

**Curriculum Book**  
and  
**Assessment and Evaluation Scheme**

based on  
**Outcome Based Education (OBE)**  
and  
**Choice-Based Credit System (CBCS)**  
in  
**Bachelor of Pharmacy**  
**(B Pharm)**  
**4 Year Degree Program**

Revised as on 01 August 2023  
Applicable w.e.f. Academic Session 2023-24



**AKS University**

Satna 485001, Madhya Pradesh, India

**Faculty of Pharmaceutical Science & Technology**  
**Rajiv Gandhi Institute of Pharmacy**



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**FORWARDING**

I am delighted to observe the updated curriculum of the Rajiv Gandhi institute of Pharmacy, for Bachelor Program, which seamlessly integrates the most recent trends and corporate affairs in the field of Pharmaceutical industry and adheres to the guidelines set forth by PCI and UGC. The revised curriculum also thoughtfully incorporates the directives of NEP-2020.

The alignment of course outcomes (COs), Programme Outcome (POs) and Programme specific outcomes (PSOs) has been intricately executed, aligning perfectly with the requisites of NEP-2020 and NAAC standards. I hold the belief that this revised syllabus will significantly enhance the skills and employability of our students.

With immense satisfaction, I hereby present the revised curriculum for the B Pharmacy program for implementation in the upcoming session.

**Date: 01Aug 2023**

**Er. Anant Kumar Soni**

Pro Chancellor & Chairman  
AKS University, Satna





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**FROM THE DESK OF THE VICE-CHANCELLOR**



*AKS University is currently undergoing a process to revamp its curriculum into an outcome-based approach, with the aim of enhancing the teaching and learning process. The foundation of quality of quality education lies in the implementation of a curriculum that aligns with both societal and industrial needs, focusing on relevant outcomes. This entails dedicated and inspired*

***Faculty members, as well as impactful industry internships***

*Hence, it is of utmost importance to begin this endeavor by crafting an outcome-based curriculum in collaboration with academia and industry experts. This curriculum design should be informed by the latest technological advancements, market demands, the guidelines outlined in the National Education Policy (NEP) of 2020, and sustainable goals.*

*I'm delighted to learn that the revised curriculum has been meticulously crafted by the Rajiv Gandhi Institute of Pharmacy, in consultation with an array of experts from the industry, research institutes, and academia. This curriculum effectively integrates the principles outlined in the NEP-2020 guidelines, as well as sustainable goals. It also adeptly incorporates the latest advancements in the field of business management.*

*Furthermore, the curriculum takes into account the specific needs of the Indian Industries, focusing on the creation of effective and efficient managers as well as entrepreneurs. This curriculum will not only impart knowledge but also encourages students' independent thinking for potential enhancements in the area of Pharmaceutical science.*

*The curriculum goes beyond theoretical learning and embraces practical applications. To enhance students' skills, the curriculum integrates industrial visits, and On-Job Training experiences, research projects. This well-rounded approach ensures that students receive a comprehensive education, fostering their skill development and preparing them for success in the field of Pharmaceutical Science.*

*I am confident that the updated curriculum for Rajiv Gandhi Institute of Pharmacy will not only enhance students' managerial skills but also contribute significantly to their employability. During the process of revising the curriculum, I am pleased to observe that the Rajiv Gandhi Institute of Pharmacy has diligently adhered to the guidelines provided by the PCI& UGC. Additionally, they have maintained a total credit requirement of 210 for the B program.*

*It's worth noting that curriculum revision is an ongoing and dynamic process, designed to address the continuous evolution of managerial and technological advancements and both local*



*and global concerns. This ensures that the curriculum remains responsive and attuned to the changing landscape of education and industry.*

*AKS University warmly invites input and suggestions from industry experts and technocrats and Alumni students to enhance the curriculum and make it more student-centric. Your valuable insights will greatly contribute to shaping an education that best serves the needs and aspirations of our students.*

**01-Aug-2023**

**PROFESSOR B.A. CHOPADE**  
*Vice-Chancellor*





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## PREFACE

As part of our commitment to ongoing enhancement, the Rajiv Gandhi Institute Pharmacy consistently reviews and updates its B Pharmacy program curriculum every four years. Through this process, we ensure that the curriculum remains aligned with the latest managerial developments, as well as local and global industrial and social demands.

During this procedure, the existing curriculum for the B Pharmacy Program undergoes evaluation by a panel of industry specialists, and academicians. Following meticulous scrutiny, the revised curriculum has been formulated and is set to be implemented starting from August 01, 2023. This implementation is contingent upon the endorsement of the curriculum by the University's Board of Studies and Governing Body.

This curriculum closely adheres to the PCI model syllabus distributed in 2016. It seamlessly integrates the guidelines set forth by the Ministry of Higher Education, Government of India, through NEP- 2020, as well as the principles of Sustainable Development Goals. In order to foster the holistic skill development of students, a range of practical activities, including Industrial Visits, Project planning and execution, Report Writing, Seminars, and Industrial On-Job Training, have been incorporated. Furthermore, in alignment with PCI directives, the total credit allocation for the B Pharmacy program is capped at 209/211/212 credits.

The Bachelor of Pharmacy program typically follows a credit-based system where each subject is assigned a certain number of credits. These credits reflect the workload and importance of the subject in the curriculum. The credit system is designed to ensure that students receive a balanced education that covers all the necessary areas of pharmaceutical science and practice.

Theory Courses include lectures, practical's and tutorials on subjects like Pharmacology, Medicinal Chemistry, Pharmaceutical Analysis, etc. Each theory course may carry around 3 to 4 credits. Practical Courses: Laboratory sessions where students apply their theoretical knowledge. Practical courses usually carry fewer credits than theory courses, often around 1 to 2 credits. Core Subjects: Subjects that are fundamental to the field, such as Human Anatomy and Physiology, Pharmaceutical Chemistry, Pharmaceutics, etc., may have higher credit values. Elective Subjects: These allow students to specialize



in areas of interest and may vary in credit value. The importance of these subjects in the pharmaceutical industry cannot be overstated. They provide the foundational knowledge and skills necessary for various roles within the industry, such as:

**Research and Development:** Understanding the principles of drug action, formulation, and analysis is crucial for developing new medications. **Quality Control and Assurance:** Knowledge of analytical techniques and standards is essential for ensuring the safety and efficacy of pharmaceutical products.

**Regulatory Affairs:** Familiarity with pharmaceutical laws and regulations is important for compliance in the industry. **Sales and Marketing:** A strong grasp of pharmacology and therapeutics helps in effectively promoting pharmaceutical products. The total number of credits required to earn a B.Pharm degree may vary by institution but is typically around 209/211/212 credits.

In terms of career prospects, B.Pharm graduates can find opportunities in: **Pharmaceutical Companies:** In roles such as product development, production, quality control, and marketing. **Regulatory Bodies:** As drug inspectors or regulatory affairs specialists. **Research Institutes:** Engaging in cutting-edge research to develop new drugs and therapies. **Healthcare Settings:** As pharmacists in hospitals, clinics, and community pharmacies.

The subjects studied in the B.Pharm program are directly linked to the practical needs of the pharmaceutical industry, ensuring that graduates are well-prepared for Pharmaceutical industry expectations. For each course, a thorough mapping of Course Outcomes, Program Outcomes, and Program Specific Outcomes has been undertaken. As the course syllabus is being meticulously developed, various elements such as session outcomes, laboratory instruction, classroom instruction, self-learning activities, assignments, and mini projects are meticulously outlined.

We hold the belief that this dynamic curriculum will undoubtedly enhance independent thinking, skills, and overall employability of the students.

**01-August-2023**

**Professor (Dr.) G.P. Richariya**  
Dean(I/C), Faculty of Pharmaceutical Science & technology  
Rajiv Gandhi Institute of Pharmacy  
AKS University, Satna



## **Introduction**

Rajiv Gandhi Institute of Pharmacy was established in 2006, with the aim of providing quality education in pharmaceutical sciences. The college started with, Bachelor in Pharmacy 2006. The institution became a constituent unit of AKS University Satna, in 2012 and later on other some another courses were added like D. Pharm (2015), M. Pharm (2020), the Ph. D Programmes (2021). All courses at the institute are recognized by the Pharmacy Council of India (PCI). The institute has a strong alumni association with over 1100 active members, who are placed globally at various positions in Pharma Marketing, Industrial, Regulatory and Entrepreneurial services.

## **Vision**

**To be established as globally recognized academic & research excellence to sustain the needs of pharmacy profession and the society.**

## **Mission**

**M1:** To promote & trained as per global requirement of social and pharmaceutical needs in pharmaceutical education and research through prescribed training programmes like B. Pharm., M. Pharm. and PhD with professional pharmaceutical education and effective competency.

**M2:** Achieve academic excellence in Pharmaceutical science through the innovative teaching learning process.

**M3:** To establish recognized research center for needs of pharmacy profession and the society.

**M4:** To Promote Skills through **experimental knowledge** as per global requirement of social and pharmaceutical industry.

## **Program Educational Objectives**

**PE01:** To trained with sound knowledge of fundamental principles and their applications in the area of Pharmaceutical Sciences and Technology

**PE02:** To develop pharmacy graduates with strong fundamental concepts in pharmaceutical sciences with innovative approaches.



**PE03:** To introduce regulation, professionalism, team spirit, communication skills, social and ethical commitment in the graduates in order to embellish leadership roles facilitating improvement in healthcare sector with a distinct professional identity, business acumen, global recognition and sustainable development.

**PE04:** To develop the skills for contribute in health care system by counseling for prophylaxis and prevention of diseases and creating awareness about healthcare issues.

**PE05:** To understand the concept of drug discovery and design, drug delivery, drug action and clinical sciences, drug analysis, drug regulatory affairs etc.

### **Program outcome**

- 1. Pharmacy Knowledge:** Possess knowledge and comprehension of the core and basic knowledge associated with the profession of pharmacy, including biomedical sciences; pharmaceutical sciences; behavioral, social, and administrative pharmacy sciences; and manufacturing practices.
- 2. Planning Abilities:** Demonstrate effective planning abilities including time management, resource management, delegation skills and organizational skills. Develop and implement plans and organize work to meet deadlines.
- 3. Problem analysis:** Utilize the principles of scientific enquiry, thinking analytically, clearly and critically, while solving problems and making decisions during daily practice. Find, analyze, evaluate and apply information systematically and shall make defensible decisions.
- 4. Modern tool usage:** Learn, select, and apply appropriate methods and procedures, resources, and modern pharmacy-related computing tools with an understanding of the limitations.
- 5. Leadership skills:** Understand and consider the human reaction to change, motivation issues, leadership and team-building when planning changes required for fulfillment of practice, professional and societal responsibilities. Assume participatory roles as responsible citizens or leadership roles when appropriate to facilitate improvement in health and wellbeing.



- 6. Professional Identity:** Understand, analyze and communicate the value of their professional roles in society (e.g. health care professionals, promoters of health, educators, managers, employers, employees).
- 7. Pharmaceutical Ethics:** Honour personal values and apply ethical principles in professional and social contexts. Demonstrate behavior that recognizes cultural and personal variability in values, communication and lifestyles. Use ethical frameworks; apply ethical principles while making decisions and take responsibility for the outcomes associated with the decisions.
- 8. Communication:** Communicate effectively with the pharmacy community and with society at large, such as, being able to comprehend and write effective reports, make effective presentations and documentation, and give and receive clear instructions.
- 9. The Pharmacist and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety and legal issues and the consequent responsibilities relevant to the professional pharmacy practice.
- 10. Environment and sustainability:** Understand the impact of the professional pharmacy solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
- 11. Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change. Self access and use feedback effectively from others to identify learning needs and to satisfy these needs on an ongoing basis.

### **Program Specific outcome**

#### **For B Pharmacy**

The Graduate shall be able to:

**PSO1. (Knowledge of drug discovery):** Apply the knowledge of pharmaceutical and allied sciences in design, manufacture and evaluation of drug delivery systems.

**PSO2.(Quality Analysis of API's):** To understand the concept for classification and modern analysis of APIs and formulations in their quality control and enforce quality assurance standards.

**PSO3.( MOA of Drug):** To understand about complete the mechanism of action of drugs including their kinetics and adverse actions.

**PSO4: (Biological evaluation of drug):** Ability to do basic evaluation of bioactivity of drugs in *in-silico* models.



### Consistence/Mapping of PEOs with Mission of Department

PEO	M1	M2	M3	M4
PEO1	2	1	3	2
PEO2	1	3	2	2
PEO3	3	2	1	1
PEO4	2	2	3	2
PEO5	3	2	2	3

Correlation Indices: 1 – Low, 2 – Medium, 3 – High

### GENERAL COURSE STRUCTURE & THEME

#### 1. Definition of Credit:

1 Hr. Lecture (L) per week	1 Credit
1 Hr. Tutorial (T) per week	1 Credit
2 Hours Practical (P) per week	1 Credit

#### 2. Range of Credits:

In the light of the fact that a typical Model Four-year Graduate degree program in Pharmacy has about 216 credits, the total number of credits proposed for the four year Bachelor of Pharmacy is kept as 216 considering NEP-20 and NAAC guideline.

#### 3. Structure of UG Program in Bachelor of Pharmacy (B Pharm):

The structure of UG Program in Bachelor of business administration shall have essentially the following categories of courses with the breakup of credits as given:





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**COMPONENTS OF CURRICULUM**

(Program curriculum grouping based on course components)

Sr. No.	Course components	% of total numbers of credits of the program	Total number of credits
1	Pharmacy Core course (PCC)	74.43	161
2	Computer Application (CA)	1.85	4
3	Soft Skill development (SSD)	0.92	3
4	Environmental Science (EVS)	1.38	3
5	Indian Knowledge system (IKS)	0.92	2
6	Sustainable Development Goals(SDG)	0.92	2
7	Basic Science(BSC)	7.40	16
8	Life Science(LS)	4.60	10
9	Management Skills (MS)	1.85	4
10	Practice School(PS)	3.10	6
11	Project work(PJT)	3.10	6
<b>Total</b>		<b>100%</b>	<b>216</b>

**COURSE LEVEL CODING SCHEME**

Three-digit number (odd numbers are for the odd semester courses and even numbers are for even semester courses) used as suffix with the Course Code for identifying the level of the course. Digit at hundred's place signifies the year in which course is offered. *e.g.*

101, 102---for first semester	201, 202---for second semester	301, 302---for third semester
401, 402---for fourth semester	501, 502---for fifth semester	601, 602---for sixth semester
701, 702---for seventh semester	801, 802---for eighth semester	-





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**Course code and definition**

L T P C	Lecture Tutorial Practical Credit
PCC	Pharmacy Core course
CA	Computer Application
SSD	Soft Skill development
EVS	Environmental Science
IKS	Indian Knowledge system
SDG	Sustainable Development Goals
BSC	Basic Science
LS	Life Science
MS	Management Skills
PS	Practice School
PJT	Projects





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**Category wise course structure & Distributions'**

**1. No of Pharmacy Core Courses(PCC):51,Credits:106**

Sr. No.	Course code	Name of Course	Semester	Credits
1	BP101T	Human Anatomy and physiology I–Theory	I	4
2	BP102T	Pharmaceutical Analysis I –	I	4
3	BP103T	Pharmaceutics I – Theory	I	4
4	BP104T	Pharmaceutical Inorganic Chemistry –Theory	I	4
5	BP107P	Human Anatomy and Physiology –Practical	I	2
6	BP108P	Pharmaceutical Analysis I – Practical	I	2
7	BP109P	Pharmaceutics I – Practical	I	2
8	BP110P	Pharmaceutical Inorganic Chemistry –Practical	I	2
9	BP201T	Human Anatomy and Physiology II – Theory	II	4
10	BP202T	Pharmaceutical Organic Chemistry I – Theory	II	4
11	BP203T	Biochemistry – Theory	II	4
12	BP204T	Pathophysiology – Theory	II	4
13	BP207P	Human Anatomy and Physiology II – Practical	II	2
14	BP208P	Pharmaceutical Organic Chemistry I – Practical	II	2
15	BP209P	Biochemistry – Practical	II	2
16	BP302T	Physical Pharmaceutics I – Theory	III	4
17	BP304T	Pharmaceutical Engineering – Theory	III	4
18	BP306P	Physical Pharmaceutics I Practical	III	2
19	BP 308P	Pharmaceutical Engineering Practical	III	2
20	BP402T	Medicinal Chemistry I – Theory	IV	4



21	BP403T	Physical Pharmaceutics II – Theory	IV	4
22	BP404T	Pharmacology I – Theory	IV	4
23	BP405T	Pharmacognosy and Phytochemistry I– Theory	IV	4
24	BP406P	Medicinal Chemistry I – Practical	IV	2
25	BP407P	Physical Pharmaceutics II – Practical	IV	2
26	BP408P	Pharmacology I – Practical	IV	2
27	BP409P	Pharmacognosy and Phytochemistry I – Practical	IV	2
28	BP501T	Medicinal Chemistry II – Theory	V	4
29	BP502T	Industrial PharmacyI– Theory	V	4
30	BP503T	Pharmacology II – Theory	V	4
31	BP504T	Pharmacognosy and Phytochemistry II– Theory	V	4
32	BP505T	Pharmaceutical Jurisprudence – Theory	V	4
33	BP506P	Industrial PharmacyI – Practical	V	2
34	BP507P	Pharmacology II – Practical	V	2
35	BP508	Pharmacognosy and Phytochemistry II –Practical	V	2
36	BP601T	Medicinal Chemistry III – Theory	VI	4
37	BP602T	Pharmacology III – Theory	VI	4
38	BP603T	Herbal Drug Technology – Theory	VI	4
39	BP604T	Biopharmaceutics and Pharmacokinetics –	VI	4
40	BP605T	Pharmaceutical Biotechnology – Theory	VI	4
41	BP606T	Quality Assurance –Theory	VI	4
42	BP607T	Medicinal chemistry III – Practical	VI	2
43	BP608T	Pharmacology III – Practical	VI	2
44	BP609T	Herbal Drug Technology – Practical	VI	2
45	BP701T	Instrumental Methods of Analysis	VII	4
46	BP702T	Industrial PharmacyII – Theory	VII	4
47	BP703T	Pharmacy Practice – Theory	VII	4
48	BP704T	Novel Drug Delivery System – Theory	VII	4
49	BP705P	Instrumental Methods of Analysis	VII	2
50	BP801T	Biostatistics and Research Methodology	VIII	4
51	BP802T	Social and Preventive Pharmacy	VIII	4
<b>Total Credits</b>				<b>161</b>



**2. Number of Computer Skill Course (CSC):**

Sr. No	Code No	Subject	Semester	Credits
1	BP205T	Computer Applications in Pharmacy – Theory *	II	3
2.	BP210P	Computer Applications in Pharmacy – Practical*	II	1
<b>Total Credits</b>				<b>4</b>

**3. Number of Soft Skills Development (SSD):**

Sr. No	Code No	Subject	Semester	Credits
1	BP105T	Communication Skills	II	2
2	BP111P	Communication Skills (Practical)	II	1
<b>Total Credits</b>				<b>3</b>

**4. Number of Environmental Studies (EVS): 01, Credits: 3**

Sr. No	Code No	Subject	Semester	Credits
1	BP206T	Environmental Studies	II	3
<b>Total Credits</b>				<b>3</b>

**5. Number of Indian Knowledge Systems (IKS): 01, Credits: 2**

Sr. No	Code No	Subject	Semester	Credits
1	0IKS02	Indian knowledge Systems	II	2
<b>Total Credits</b>				<b>2</b>

**6. Number of Sustainable Development Goal (SDG): 01, Credits: 2**

Sr. No	Code No	Subject	Semester	Credits
1	0SDG01	Sustainable Development Goal	I	2
<b>Total Credits</b>				<b>2</b>

**7. Number of Life science Studies:3, Credits:10**

Sr. No.	Course code	Name of Course	Semester	Credits
1	BP303T	Pharmaceutical Microbiology (Theory)	III	4
2	BP307P	Pharmaceutical Microbiology – Practical	III	2
3	BP605T	Pharmaceutical Biotechnology – Theory	VI	4
<b>Total Credits</b>				<b>10</b>

**8. Number of Basic Science (BSC): 08, Credits: 19**

Sr. No.	Course code	Name of Course	Semester	Credits
1	BP106RBT	Remedial Biology/	I	2



	BP106RMT	Remedial Mathematics – Theory		
2	BP112RBP	Remedial Biology – Practical	I	1
3	BP202T	Pharmaceutical Organic Chemistry I – Theory	II	4
4	BP208P	Pharmaceutical Organic Chemistry I– Practical	II	2
5	BP301T	Pharmaceutical Organic Chemistry II – Theory	III	4
6	BP305P	Pharmaceutical Organic Chemistry II – Practical	III	2
7	BP401T	Pharmaceutical Organic Chemistry III– Theory	IV	4
<b>Total Credits</b>				<b>19</b>

#### 9. Major Project/Minor Projects/Internship:2, Credits: 12

Sr. No.	Course code	Name of Course	Semester	Credits
1	BP706PS	Practice School*	VII	6
2	BP813PW	Project Work	VIII	6
<b>Total Credits</b>				<b>12</b>

#### Pharmacy Elective Courses

A student would be free to choose any two papers from below, these courses offers in VIII Sem. with 8 credit courses.

Sr. No.	Course code	Name of Course	Semester	Credits
1	BP803ET	Pharma Marketing Management	VIII	4
2	BP804ET	Pharmaceutical Regulatory Science	VIII	4
3	BP805ET	Pharmacovigilance	VIII	4
4	BP806ET	Quality Control and Standardization of Herbals	VIII	4
5	BP807ET	Computer Aided Drug Design	VIII	4
6	BP808ET	Cell and Molecular Biology	VIII	4
7	BP809ET	Cosmetic Science	VIII	4
8	BP810ET	Experimental Pharmacology	VIII	4
9	BP811ET	Advanced Instrumentation Techniques	VIII	4
10	BP812ET	Dietary Supplements and Nutraceuticals	VIII	4



## GENERAL COURSE STRUCTURE AND CREDIT DISTRIBUTION

### A Credit assignment

1. Theory and Laboratory courses Courses are broadly classified as Theory and Practical. Theory courses consist of lecture (L) and /or tutorial (T) hours, and Practical (P) courses consist of hours spent in the laboratory. Credits (C) for a course is dependent on the number of hours of instruction per week in that course, and is obtained by using a multiplier of one (1) for lecture and tutorial hours, and a multiplier of half (1/2) for practical (laboratory) hours. Thus, for example, a theory course having three lectures and one tutorial per week throughout the semester carries a credit of 4. Similarly, a practical having four laboratory hours per week throughout semester carries a credit of 2.

2. Minimum credit requirements The minimum credit points required for award of a B. Pharm. degree is 209. These credits are divided into Theory courses, Tutorials, Practical, Practice School and Project over the duration of eight semesters. The credits are distributed semester-wise as shown in Table IX. Courses generally progress in sequences, building competencies and their positioning indicates certain academic maturity on the part of the learners. Learners are expected to follow the semester-wise schedule of courses given in the syllabus. The lateral entry students shall get 52 credit points transferred from their D. Pharm program. Such students shall take up additional remedial courses of 'Communication Skills' (Theory and Practical) and 'Computer Applications in Pharmacy' (Theory and Practical) equivalent to 3 and 4 credit points respectively, a total of 7 credit points to attain 59 credit points, the maximum of I and II semesters.

### Semester wise credits distribution

Table-

Semester	Credit Points
I	27/29 \$ /30 #
II	29
III	26
IV	28
V	26
VI	26
VII	24
VIII	22
Extracurricular/ Co curricular activities	01*
total credit points for the program	209/211\$ /212 #

\*The credit points assigned for extracurricular and or co-curricular activities shall be given by the Principals of the colleges and the same shall be submitted to the University. The criteria to



acquire this credit point shall be defined by the colleges from time to time. \$Applicable ONLY for the students studied Physics / Chemistry / Botany / Zoology at HSC and appearing for Remedial Mathematics course. #Applicable ONLY for the students studied Mathematics / Physics / Chemistry at HSC and appearing for Remedial Biology course.

### **INDUCTION PROGRAM**

Induction program for students to be offered right at the start of the first year. It is mandatory. AKS University has designed an induction program for 1<sup>st</sup> year student, details are below:

1. Physical activity
2. Creative Arts
3. Universal Human Values
4. Literary
5. Proficiency Modules
6. Lectures by Eminent speakers
7. Visits to local Areas
8. Familiarization to Dept./Branch & Innovations

### **MANDATORY VISITS/WORKSHOP/EXPERT LECTURES**

1. It is mandatory to arrange one industrial visit every semester for the students.
2. It is mandatory to conduct a One week work shop during the winter break after third semester on professional /industry /entrepreneurial orientation.
3. It is mandatory to organize at least one expert lecture per semester for each branch by expert resource persons from industry.



## EVALUATION SCHEME

### 1. For Theory Courses:

- ☐ The weightage of Internal assessment is 50% and;
- ☐ End Semester Exam is 50% the student has to obtain at least 50% marks individually both in internal assessment and end semester Exams to pass.

### 2. For Practical Courses:

- ☐ The weightage of Internal assessment is 50%
- ☐ End Semester Exam is 50%. The student has to obtain at least 50% marks individually both in internal assessment and end semester exams to pass.

**3. For Summer Internship/Projects/Seminar etc.:** Evaluation is based on work done, quality of report, performance in viva-voce, presentation etc.

Semester	L	T	P	Total Hour	No of Hours Per Sem.	Total Credit
Semester – I	20	4	20	44	44 x 15 = 660	34
Semester – II	18	04	14	36	36 x 15 = 540	29
Semester – III	12	04	16	32	32 x 15 = 480	24
Semester – IV	15	5	16	36	36 x 15 = 540	28
Semester – V	15	5	12	32	32 x 15 = 480	25
Semester – VI	18	6	12	36	36 x 15 = 540	30
Semester – VII	12	4	16	32	32 x 15 = 480	24
Semester - VIII	12	4	12	30	30 x 15 = 450	22
<b>Total</b>	<b>114</b>	<b>36</b>	<b>118</b>	<b>278</b>	<b>4170</b>	216



**Semester wise course structure:****Table-I: Course of study for semester I**

Course code	Name of the course	No. of hours	Tutorial	Credit points
BP101T	Human Anatomy and Physiology I– Theory	3	1	4
BP102T	Pharmaceutical Analysis I – Theory	3	1	4
BP103T	Pharmaceutics I – Theory	3	1	4
BP104T	Pharmaceutical Inorganic Chemistry – Theory	3	1	4
BP105T	Communication skills – Theory *	2	-	2
BP106RBT BP106RMT	Remedial Biology/ Remedial Mathematics – Theory*	2	-	2
BP107P	Human Anatomy and Physiology – Practical	4	-	2
BP108P	Pharmaceutical Analysis I – Practical	4	-	2
BP109P	Pharmaceutics I – Practical	4	-	2
BP110P	Pharmaceutical Inorganic Chemistry – Practical	4	-	2
BP111P	Communication skills – Practical*	2	-	1
BP112RBP	Remedial Biology – Practical*	2	-	1
<b>Total</b>		<b>32/34<sup>§</sup>/36<sup>#</sup></b>	<b>4</b>	<b>27/29<sup>§</sup>/30<sup>#</sup></b>

<sup>#</sup>Applicable ONLY for the students who have studied Mathematics / Physics / Chemistry at HSC and appearing for Remedial Biology (RB)course.

<sup>§</sup>Applicable ONLY for the students who have studied Physics / Chemistry / Botany / Zoology at HSC and appearing for Remedial Mathematics (RM)course.

\* Non University Examination (NUE)

**Table-II: Course of study for semester II**

Course Code	Name of the course	No. of hours	Tutorial	Credit points
BP201T	Human Anatomy and Physiology II – Theory	3	1	4
BP202T	Pharmaceutical Organic Chemistry I – Theory	3	1	4
BP203T	Biochemistry – Theory	3	1	4
BP204T	Pathophysiology – Theory	3	1	4
BP205T	Computer Applications in Pharmacy – Theory *	3	-	3
BP206T	Environmental sciences – Theory *	3	-	3
BP207P	Human Anatomy and Physiology II –Practical	4	-	2
BP208P	Pharmaceutical Organic Chemistry I– Practical	4	-	2
BP209P	Biochemistry – Practical	4	-	2
BP210P	Computer Applications in Pharmacy – Practical*	2	-	1
<b>Total</b>		<b>32</b>	<b>4</b>	<b>29</b>

\*Non University Examination (NUE)



**Table-III: Course of study for semester III**

<b>Course code</b>	<b>Name of the course</b>	<b>No. of hours</b>	<b>Tutorial</b>	<b>Credit points</b>
BP301T	Pharmaceutical Organic Chemistry II – Theory	3	1	4
BP302T	Physical Pharmaceutics I – Theory	3	1	4
BP303T	Pharmaceutical Microbiology – Theory	3	1	4
BP304T	Pharmaceutical Engineering – Theory	3	1	4
BP305P	Pharmaceutical Organic Chemistry II – Practical	4	-	2
BP306P	Physical Pharmaceutics I – Practical	4	-	2
BP307P	Pharmaceutical Microbiology – Practical	4	-	2
BP 308P	Pharmaceutical Engineering –Practical	4	-	2
<b>Total</b>		<b>28</b>	<b>4</b>	<b>24</b>

**Table-IV: Course of study for semester IV**

<b>Course code</b>	<b>Name of the course</b>	<b>No. of hours</b>	<b>Tutorial</b>	<b>Credit points</b>
BP401T	Pharmaceutical Organic Chemistry III– Theory	3	1	4
BP402T	Medicinal Chemistry I – Theory	3	1	4
BP403T	Physical Pharmaceutics II – Theory	3	1	4
BP404T	Pharmacology I – Theory	3	1	4
BP405T	Pharmacognosy and Phytochemistry I– Theory	3	1	4
BP406P	Medicinal Chemistry I – Practical	4	-	2
BP407P	Physical Pharmaceutics II – Practical	4		2
BP408P	Pharmacology I – Practical	4	-	2
BP409P	Pharmacognosy and Phytochemistry I – Practical	4	-	2
<b>Total</b>		<b>31</b>	<b>5</b>	<b>28</b>

**Table-V: Course of study for semester V**

<b>Course code</b>	<b>Name of the course</b>	<b>No. of hours</b>	<b>Tutorial</b>	<b>Credit points</b>
BP501T	Medicinal Chemistry II – Theory	3	1	4
BP502T	Industrial Pharmacy I– Theory	3	1	4
BP503T	Pharmacology II – Theory	3	1	4
BP504T	Pharmacognosy and Phytochemistry II– Theory	3	1	4
BP505T	Pharmaceutical Jurisprudence – Theory	3	1	4
BP506P	Industrial PharmacyI – Practical	4	-	2
BP507P	Pharmacology II – Practical	4	-	2
BP508P	Pharmacognosy and Phytochemistry II – Practical	4	-	2
<b>Total</b>		<b>27</b>	<b>5</b>	<b>26</b>



**Table-VI: Course of study for semester VI**

<b>Course code</b>	<b>Name of the course</b>	<b>No. of hours</b>	<b>Tutorial</b>	<b>Credit points</b>
BP601T	Medicinal Chemistry III – Theory	3	1	4
BP602T	Pharmacology III – Theory	3	1	4
BP603T	Herbal Drug Technology – Theory	3	1	4
BP604T	Biopharmaceutics and Pharmacokinetics – Theory	3	1	4
BP605T	Pharmaceutical Biotechnology – Theory	3	1	4
BP606T	Quality Assurance –Theory	3	1	4
BP607P	Medicinal chemistry III – Practical	4	-	2
BP608P	Pharmacology III – Practical	4	-	2
BP609P	Herbal Drug Technology – Practical	4	-	2
<b>Total</b>		<b>30</b>	<b>6</b>	<b>30</b>

**Table-VII: Course of study for semester VII**

<b>Course code</b>	<b>Name of the course</b>	<b>No. of hours</b>	<b>Tutorial</b>	<b>Credit points</b>
BP701T	Instrumental Methods of Analysis – Theory	3	1	4
BP702T	Industrial PharmacyII – Theory	3	1	4
BP703T	Pharmacy Practice – Theory	3	1	4
BP704T	Novel Drug Delivery System – Theory	3	1	4
BP705P	Instrumental Methods of Analysis – Practical	4	-	2
BP706PS	Practice School* (* Non University Examination (NUE)	12	-	6
<b>Total</b>		<b>28</b>	<b>5</b>	<b>24</b>

**Table-VIII: Course of study for semester VIII**

Course code	Name of the course	No. of hours	Tutorial	Credit points
BP801T	Biostatistics and Research Methodology	3	1	4
BP802T	Social and Preventive Pharmacy	3	1	4
BP803ET	Pharma Marketing Management	3 + 3 = 6	1 + 1 = 2	4 + 4 = 8
BP804ET	Pharmaceutical Regulatory Science			
BP805ET	Pharmacovigilance			
BP806ET	Quality Control and Standardization of Herbals			
BP807ET	Computer Aided Drug Design			
BP808ET	Cell and Molecular Biology			
BP809ET	Cosmetic Science			
BP810ET	Experimental Pharmacology			
BP811ET	Advanced Instrumentation Techniques			
BP812ET	Dietary Supplements and Nutraceuticals			
BP813PW	Project Work	12	-	6
Total		24	4	22





AKS University  
Faculty of Pharmaceutical Science & Technology  
Rajiv Gandhi Institute of Pharmacy  
Curriculum of B. Pharmacy (HAP-I) Program  
(Revised as on 01 August 2023)

**Semester -I**

**Course Code: BP101T/& BP107P**

**Course Title:** Human Anatomy and Physiology -I

**Prerequisite** - The Student should have fundamental knowledge of the human body & its structures and functions of cell & tissues.

**Scope**

- This subject is designed to impart fundamental Knowledge on the structure and functions Of various systems of the human body.
- It also helps in understanding both homeostatic mechanisms.
- The subject provides the basic knowledge required to understand the various disciplines of Pharmacy.

**Rationale/Objectives:** Upon completion of this course the student should be able to

1. Explain the gross morphology, structure and functions of various organs of the human body.
2. Describe the various homeostatic mechanisms and their imbalances.
3. Identify the various tissues and organs of different systems of human body.
4. Perform the various experiments related to special senses and nervous system.
5. Appreciate coordinated working pattern of different organs of each system

**Course outcomes:**

**CO-BP101.1:** To recognize the various homeostatic mechanisms, basic anatomical Term, cellular level organization & characteristics of different types of tissues and their locations in various organs.

**CO-BP101.2:** To organize the structure and functions of skin, bones and joints of human body.

**CO-BP101.3:** To analyze the importance of blood, lymphatic system and immunity in humanbody.

**CO-BP101.4:** To relate the physiology of sympathetic, parasympathetic, spinal/cranial nerves and organization of special senses.

**CO-BP101.5:** To adapt the anatomy and physiology of heart and blood vessels, cardiac cycle & their disorders.



## Curriculum of B Pharm (Human Anatomy & Physiology-I) Program

### Scheme of Studies

:Coursecode	Title of thecourse	Program Name	TOTAL Number of contact hours/Week						Credit
			Classroom Instruction (A)		Practical (P)	SW	SL	Total Hours (H)	
			Lecture	Tutorial					
BP101T	Human Anatomy & Physiology-I	B. Pharmacy	3	1	4	1	1	10	6

#### Legend:

**CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others),

**LI:** Laboratory Instruction (Includes Practical performances in laboratory workshop, field or Other locations using different instructional strategies)

**SW:** Sessional Work (includes assignment, seminar, mini project etc.),

**SL:** Self Learning,

**C:** Credits

**Note:** SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

#### Scheme of Assessment

##### Theory Assessment

Board of Study	Course Code	Course Title	Scheme of Assessment ( Marks )						
			Progressive Assessment ( PRA)						
			Academic activity, Any three (Quiz/ Assignment, open book test, filed and work seminar)	Student teacher interaction	Class Attendance(A T)	(A) Total Marks	Sessional Exam (B)	End Semester Assessment (C)	Total Marks(A+B+C)
Pharmacy	BP101T	Human anatomy & physiology -II	3	3	4	10	15	75	100



## Practical Assessment

Board of Study	Course Code	Course Title	Scheme of Assessment ( Marks )						
			Internal Assessment (A)			End Semester Examination(B)			Total Marks (A+B)
			Attendance	Record	Sessional I Exam.	Synopsis	Experiments	Viva	
Pharmacy	BP-107P	Human Anatomy & Physiology-I	2	3	10	5	25	5	50

### Guidelines for the allotment of marks for attendance

Percentage of Attendance

Theory /Practical

Sr. No	Percentage of Attendance	Theory	Practical
1	95 – 100	4	2
2	90 – 94	3	1.5
3	85 – 89	2	1
4	80 – 84	1	0.5
5	Less than 80	0	0



**Course-Curriculum Detailing:**

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

**CO-BP101. 1: To recognize the various homeostatic mechanisms, basic anatomical term and cellular level organization & characteristics of different types of tissues and their locations in various organs.**

Item	Approx Hrs
Lecture & Tutorial	10+3=13
Practical(P)	12
SW	1
SL	1
Total:	27

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction(CI)	Self Learning (SL)
<b>Theory</b> SO1.1-Scope of anatomy&physiology SO1.2-understand homeostasis& their mechanism SO1.3-structure & function of cell. SO1.4-celldivision SO1.5-cellsignaling SO1.6-Tissue & their classification <b>Practical SO1.1</b> Study of compound microscope <b>SO1.2</b> study of microscopic structures of epithelial & connective tissue <b>SO1.3</b> Study of microscopic structures of muscular & nervous tissue	1.1 Study of compound microscope. 1.2 Microscopic study of epithelial and connective tissue 1.3 Microscopic study of muscular and nervous tissue	<b>Unit I-</b> <b>Introduction to human body</b> <b>1.1</b> Definition and scope of anatomy and physiology. <b>1.2</b> levels of structural organization and body systems & basic life processes, homeostasis & their mechanism 1.3 basic anatomical terminologies & Cellular level of organization 1.4 Structure and functions of cell <b>T1</b> -Tutorial I 1.5 transport across cell membrane, 1.6 cell division –mitosis & meiosis 1.7 cell junctions. 1.8 a) General principles of cell communication, intracellular signaling pathway activation by extracellular signal molecule, b) Forms of intracellular signaling: a) Contact-dependent b) Paracrine c) Synaptic d) Endocrine <b>T 2</b> -Tutorial II <b>Tissue level of organization</b> 1.9 Classification of tissues, structure, location and functions of epithelial tissue. 1.10(a) Structure, location and functions of muscular and nervous (b) Structure, location and functions of connective tissues <b>T3</b> . Tutorial III	1.1 Study & preparation of signaling pathway. 1.2 Types of cell junction & their mechanism



**Suggested Sessional work****A) Assignments: 1.Cell division & their types.**

2. Tissue & their classification
3. Cell signaling & their forms
4. Structure & functions of cell
5. Homeostasis & their mechanism
6. cell junction

**CO2- To organize the structure and functions of skin, bones and joints of human body.**

Item	Approx hrs
Lecture & tutorial	10+3=13
practical	8
SW	2
SL	1
Total	24

Session outcomes(SOs)	Laboratory Instructions (LI)	Class room Instruction(CI)	Self Learning(SL)
<b>Theory</b> SO2.1. understand the structure & functions of skin. SO2.2. skeletal system & their classification SO2.3.microscopic structure of skeletal muscle. SO2.4.joint & their classification SO2.5.physiology of muscle contraction <b>Practical</b> <b>SO-P2.1</b> Identify name & numbers of axial bones <b>SO-P2.2</b> Identify name & numbers of appendicular bones	2.1 Identification of axial bones 2.2 Identification of appendicular bones	<b>Unit II</b> Integumentary system 2.1 Structure and functions of skin. Skeletal system 2 Divisions of skeletal system, types of bone <b>T1-Tutorial I</b> 2.4 Organization of skeletal muscle 2.5 physiology of muscle contraction, 2.6 neuromuscular junction <b>T2- Tutorial II Joints</b> 2.7 Structural and functional classification of joint 2.8 Fibrous & cartilaginous joint 2.9 Synovial joint 2.10 Types of movements & its articulation <b>T3- Tutorial III</b>	1.1 Types of bone 1.2 Joint & their classification.

**Suggested Sessional work**

## Assignments –

1. Neuromuscular junction
2. Synovial joint & their classification
3. Structure & functions of skeletal muscle
4. Types of movement of joint
5. Description of axial & app



### Suggested Sessional work A) Assignments:

1. Autonomic nervous system
2. cranial & spinal nerves
3. structure & functions of eye
4. structure & functions of ear
5. structure & functions of nose

### CO-BP101.5 To adapt the anatomy and physiology of heart and blood vessels, cardiac cycle & their disorders

Item	Approx Hrs
Lecture & Tutorial	7+3=10
Practical(P)	8
<b>SW</b>	<b>1</b>
SL	1
Total:	20

Session Outcomes(SOs)	Laboratory Instruction (LI)	Room Instruction(CI)	Self Learning (SL)
<b>Theory</b> <b>SO5.1:</b> SO5.1 Structure & functions of heart <b>SO5.2.</b> introduction of blood vessels <b>SO5.3.</b> study of blood pressure & their regulation <b>SO5.4.</b> Cardiac cycle <b>SO5.5.</b> Electrocardiogram <b>Practical</b> <b>SO-P5.1</b> Determine the heart rate & pulse rate <b>SO-P5.2</b> understand the process of blood pressure recording	<b>5.1</b> Determination of heart rate and pulse rate. <b>5.2</b> Recording of blood pressure	<b>Unit V</b> <b>Cardiovascular system</b> <b>5.1</b> Heart – anatomy of heart & blood circulation, <b>5.2</b> blood vessels, structure and functions of artery, vein and capillaries <b>T1-</b> Tutorial I <b>5.3</b> elements of conduction system of heart and heart beat, its regulation by autonomic nervous system, <b>5.4</b> cardiac output, <b>5.5</b> cardiac cycle. <b>T2-</b> Tutorial II <b>5.6</b> Regulation of blood pressure, & pulse, <b>5.7</b> Electrocardiogram and disorders of heart. <b>T3-</b> Tutorial III	1. Structure & function of blood vessels

### Suggested Sessional work

#### A) Assignments:

1. Structure & functions of heart
2. Cardiac cycle
3. Blood pressure & their regulation
4. Electrocardiogram
5. Conduction system of heart



### Brief of Hours suggested for the Course Outcome

Course Out comes	Class Lecture(CI)	(LI)	Session al Work (SW)	Self Learning (SI)	Total Hour (CI+SW+ SI+LI)
CO-BP101.1: To recognize the various homeostatic mechanisms, basic anatomical term and cellular level organization & characteristics of different types of tissues and their location in variousorgans.	13	12	1	1	27
CO-BP101.2: To organize the structure and functions of skin,bones and joints of human body.	13	8	2	1	24
CO-BP101.3: To analyze the importance of blood,lymphatic system and immunity in human body.	13	32	1	1	47
CO-BP101.4: To relate the physiology of sympathetic, parasympathetic, spinal/cranial nerves and organization of special senses.	11	0	1	1	13
CO-BP101.5: To adapt the anatomy and physiology of heart and blood vessels, cardiaccycle & their disorders	10	8	1	1	20
<b>Total Hours</b>	60	60	6	5	131



## Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		A	C	I	
CO-1	To recognize the various homeostatic mechanisms, basic anatomical term and cellular level organization & characteristics of different types of tissues and their location in various organs.	08	06	01	15
CO-2	To organize the structure and functions of skin, bones and joints of human body.	06	08	01	15
CO-3	To analyze the importance of blood, lymphatic system and immunity in human body.	06	07	02	15
CO-4	To relate the physiology of sympathetic, parasympathetic, spinal/cranial nerves and organization of special senses.	05	10	-	15
CO-5	To adapt the anatomy and physiology of heart and blood vessels, cardiac cycle & their disorders	05	07	3	15
Total		11	26	13	75

**Legend: A: Analyze, C: Create, I: Interpret**

The end of semester assessment for Human Anatomy & Physiology-I will be held with written examination of 75 marks

**Note.** Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks. Teachers can also design different tasks as per requirement, for end semester assessment.

### **Suggested Instructional/Implementation Strategies:**

1. Improved Lecture
2. Tutorial
3. Case Method
4. Group Discussion
5. Role Play
6. Demonstration
7. ICT Based Teaching Learning (Video Demonstration/Tutorials CBT, Blog, Face book, Twitter, Whats app, Mobile, Online sources)
8. Brainstorming



**Suggested Learning Resources:**

S. No.	Title	Author	Publisher	Edition & Year
1	Essentials of Medical Physiology	K. Sembulingam and P. Sembulingam	Jaypee brothers medical publishers, New Delhi	8 <sup>th</sup> edition, 2019
2	Anatomy and Physiology in Health and Illness	Kathleen J.W. Wilson	Churchill Livingstone, New York	14 <sup>th</sup> edition 2022
3	Physiological basis of Medical Practice	Best and Taylor	Williams & Wilkins Co, Riverview, MI USA	13 <sup>th</sup> edition 2011
4	Text book of Medical Physiology	Arthur C. Guyton and John E. Hall	Miamisburg, OH, U.S.A.	14 <sup>th</sup> edition 2020
5	Principles of Anatomy and Physiology	Tortora Grabowski	Palmetto, GA, U.S.A.	16 <sup>th</sup> edition 2023
6	Textbook of Human Histology	Inderbir singh	Jaypee brother's medical publishers, New Delhi.	7 <sup>th</sup> edition 2014
7	Textbook of Practical Physiology,	C.L. Ghai	Jaypee brother's medical publishers, New Delhi.	9th edition 2018
8	Practical workbook of Human Physiology	K. Srinageswari and Rajeev Sharma	Jaypee brother's medical publishers, New Delhi.	1 <sup>st</sup> edition 2006
9	Human Physiology (vol 1 and 2)	Dr. C.C. Chatterjee	Academic Publishers Kolkata	14 <sup>th</sup> edition 2022

**Curriculum Development Team:**

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**Course Outcome, Program Specific Outcome & Program Outcome Mapping**

**Course Code: BP101T**

**Course Name: Human Anatomy & physiology I**

Course Outcome	Program Outcome											Program Specific outcome			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
	Pharmacy knowledge	Planning Abilities	Problem analysis	Modern tool usage	Leadership skills	Professional Identity	Pharmaceutical Ethics	Communication	The pharmacist and society	Environment and sustainability	Life-long learning	Knowledge of drug discovery	Quality Analysis of API's	MOA of Drug	Biological evaluation of drug
<b>CO-1:</b> Different types of tissues and their location in various organs	3	2	3	1	3	2	1	2	3	2	3	1	3	1	2
<b>CO-2:</b> structure and function of skin, bones and joints of human body	2	3	1	3	0	2	0	1	2	3	3	3	2	1	3
<b>CO-3:</b> Importance of blood, lymphatic system and immunity in human body.	3	2	3	2		1	2	1	2	2	3	3	2	1	3
<b>CO-4:</b> sympathetic, parasympathetic, spinal/cranial nerves and organization of special senses	2	3	2	3	1	3	2	2	3	3	3	3	2	1	3
<b>CO-5:</b> To adapt the anatomy and physiology of heart and blood vessels, cardiac cycle & their disorders	3	3	1	1	1	3	0	3	1	2	3	2	2	2	2

**Legend: 1–Low, 2–Medium, 3–High**



### Course Curriculum Mapping

Pos& PSOs No	Cos No&	Title	SOs No	Class Room Instructions	Laboratory Instructions	Self learning
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	CO-1	To recognize the various homeostatic mechanisms, basic anatomical term and cellular level organization & characteristics of different types of tissues and their location in various organs.	SO1.1 SO1.2 SO1.3 SO1.4 SO1.5	1.1,1.2,1.3,1.4,1.5,1.6,1.7,1.8,1.9,1.10 T1,T2,T3	LI-1.1 LI-1.2 LI-1.3	SI-1.1 SI-1.2
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	CO-2	To organize the structure and functions of skin, bones and joints of human body.	SO-2.1 SO-2.2 SO-2.3 SO-2.4 SO-2.5	2.1,2.2,2.3,2.4,2.5,2.6,2.7,2.8,2.9,2.10 T1,T2,T3	LI-2.1 LI-2.2	SI-2.1 SI-2.2
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	CO-3	To analyze the importance of blood, lymphatic system and immunity in human body.	SO-3.1 SO-3.2 SO-3.3 SO-3.4 SO-3.5	3.1,3.2,3.3,3.4,3.5,3.6,3.7,3.8,3.9,3.10 T1,T2,T3	LI-3.1 LI-3.2 LI-3.3 LI-3.4 LI-3.5 LI-3.6 LI-3.7 LI-3.8	SI-3.1 SI-3.2
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	CO-4	To relate the physiology of sympathetic, parasympathetic, spinal/cranial nerves and organization of special senses.	SO-4.1 SO-4.2 SO-4.3 SO-4.4 SO-4.5	4.1,4.2,4.3,4.4,4.5,4.6,4.7,4.8. T1,T2,T3	-	SI-4.1 SI-4.2 SI-4.3
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	CO-5	To adapt the anatomy and physiology of heart and blood vessels, cardiac cycle & their disorders	SO-5.1 SO-5.2	5.1,5.2,5.3,5.4,5.5,5.6,5.7,	LI-5.1 LI-5.2	SI-5.1





AKS University  
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Curriculum of B. Pharmacy Program  
(Revised as on 01 August 2023)  
Semester-I

**Course Code: BP102 T&BP108P**

**Course Title: Pharmaceutical Analysis-I**

**Pre-requisite:** Student should have basic knowledge about analytical chemistry.

**Rationale/Objectives:-**

- Upon completion of the course student shall be able to
- Understand the principles of volumetric and electro chemical analysis
- Carry out various volumetric and electrochemical titrations develop analytical skills

**Course Outcomes:**

**CO-BP-102.1.** To explain about accuracy, precision, error, sources of errors & minimizing techniques & significant figure

**CO-BP-102.2.** To compute analytical results and understand the physiochemical concepts of analysis, theories of acids and bases, stoichiometry etc

**CO-BP-102.3.** To understand the principles of volumetric/gravimetric and gasometric analytical techniques

**CO-BP-102.4.** To analyze the technique of redox titration

**CO-BP-102.5.** To analyze various electro chemical titrations.

**Scheme of Studies:**

Board Of Study	Course Code	Course Title	Scheme of studies(Hours/Week)					Total Credit (C)
			CI (L&T)	LI	SW	SL	Total Study Hours (CI+LI+SW+S L)	
Pharmacy	BP 102T	Pharmaceutical Analysis-I	4	4	1	1	10	4

**Legend: CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others),

**LI:** Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)

**SW:** Sessional Work (includes assignment, seminar, mini project etc.),

**SL:** Self Learning,

**C:** Credits.

**Note:** SW & SL has to be planned and performed under the continuous guidance & feedback of teacher to ensure outcome of Learning.



**Scheme of Assessment:**

Theory Assessment

Board of Study	Course Code	Course Title	Scheme of Assessment ( Marks )						
			Progressive Assessment ( PRA )					End Semester Assessment (ESA)	Total Marks (PRA+ESA)
			Academic activity, Any three (Quiz/ Assignment, open book test, filed work and seminar)	Student teacher interaction	Class Attendance	Sessional exam	Total Marks		
Pharmacy	BP102T	Pharmaceutical Analysis-I	3	3	4	15	25	75	100

**Practical Assessment**

Board of Study	Course Code	Course Title	Scheme of Assessment ( Marks )						
			Internal Assessment (A)			End Semester Examination(B)			Total Marks (A+B)
			Attendance	Practical Record	Sessional Exam.	Synopsis	Experiments	Viva	
Pharmacy	BP108P	Pharmaceutical Analysis-I	2	3	10	5	25	5	50



### Guidelines for the allotment of marks for attendance

#### Percentage of Attendance Theory

#### /Practical

Sr. No	Percentage of Attendance	Theory	Practicals
1.	95 – 100	4	2
2	90 – 94	3	1.5
3.	85 – 89	2	1
4	80 – 84	1	0.5
5.	Less than 80	0	0

### Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

**CO102.1.** To explain about accuracy, precision, error, sources of errors & minimizing techniques & significant figure

### Approximate Hours

Item	Appx Hrs
CI (L&T)	10+3
LI	36
SW	1
SL	1
Total	51

Session Outcomes (SOs)	Laboratory Instruction(LI)	Class room Instruction (CI)	Self Learning(SL)
<b>Theory</b>  <b>SO1.1</b> Understand different techniques of analysis <b>SO1.2</b> Understand various Methods of expressing concentration	<b>1.1</b> Limit test of the following Chloride Sulphate Iron Arsenic  <b>1.2</b> Preparation and standardization of Sodium hydroxide	<b>UNIT-I</b> <b>1.1 Pharmaceutical analysis-</b> Definition and scope <b>1.2</b> Different techniques of analysis <b>1.3</b> Methods of expressing concentration	<b>1</b> Methods of expressing concentration  <b>1.2</b> Primary and secondary standards



<p><b>SO1.3</b> learn about various sources of impurities in medicinal agents</p> <p><b>SO1.4</b> understand about Preparation and standardization of various molar and normal solutions</p> <p><b>SO1.5</b> Study of Pharmacopoeia <b>Practical</b></p> <p><b>SO1.1</b> Understand about the Limit test of the following compounds like Chloride, Sulphate, Iron, Arsenic</p> <p><b>SO1.2</b> Learn about the Preparation and standardization of Sodium hydroxide, Sulphuric acid, Sodium thiosulphate, Potassium permanganate, Ceric ammonium sulphate.</p>	<p>Sulphuric acid Sodium thiosulphate Potassium permanganate Ceric ammonium sulphate</p>	<p><b>1.4</b> Primary and secondary standards. <b>Tutorial-01</b> <b>1.5</b> (a) Preparation and standardization of various molar and normal solutions- Oxalic acid, sodium hydroxide, hydrochloric acid. (b) Preparation and standardization of various molar and normal solutions- Sodium thiosulphate, sulphuric acid, potassium permanganate and ceric ammonium sulphate <b>Tutorial-02</b> <b>1.6 Errors:</b> Sources of errors, types of errors, methods of minimizing errors, <b>1.7</b> accuracy, precision and significant figures <b>1.8</b> Pharmacopoeia, <b>1.9</b> Sources of impurities in medicinal agents, <b>1.10</b> limit tests <b>Tutorial-03</b></p>	
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SW-1 Suggested Sessional Work (SW)

**a. Assignments:**

1. Discuss about various ways of expressing concentration.
2. Differentiate between primary & secondary standard solutions
3. Write about various sources of impurities of medicinal agent
4. Write in detail about pharmacopoeia
5. Describe in detail about limit tests.

**CO102.2 To compute analytical results and understand the physiochemical concepts of analysis, theories of acids and bases, stoichiometry etc**

Item	Appx Hrs
CI	13
LI	8
SW	1
SL	1
Total	23



Session Outcomes (SOs)	Laboratory Instruction(LI)	Class room Instruction(CI)	Self Learning (SL)
<b>Theory</b> <b>SO2.1</b> Understand about the concept of acid base titration <b>SO2.2</b> Understand about the concept of non aqueous titration <b>Practical</b> <b>SO2.1</b> Understand about the Assay of the following compounds along with standardization of titrant Ammonium chloride by acid base titration <b>SO2.2</b> Assay of the following compounds along with standardization of titrant Sodium benzoate by non-aqueous titration	<b>2.1</b> Assay of the following compounds along with standardization of titrant Ammonium chloride by acid base titration  <b>2.2</b> Assay of the following compounds along with standardization of titrant Sodium benzoate by non-aqueous titration	UNIT-II <b>Acid base titration:</b> <b>2.1</b> Theories of acid base indicators <b>2.2</b> Concept of acid base titration <b>Tutorial-01</b> <b>2.3</b> classification of acid base titrations <b>2.4</b> theory involved in titrations of strong, weak, and very weak acids and bases <b>2.5</b> neutralization curves <b>Tutorial-02</b> <b>2.6 Non aqueous titration:</b> <b>2.7</b> Solvents, acidimetry and alkalimetry titration and estimation of Sodium benzoate <b>2.8</b> Solvents, acidimetry and alkalimetry titration and estimation of Ephedrine HCl <b>2.9</b> Solvents, acidimetry and alkalimetry titration and estimation of Sodium benzoate and Ephedrine HCl continue... <b>2.10.</b> Solvents, acidimetry and alkalimetry titration and estimation of Sodium benzoate and Ephedrine HCl continue... <b>Tutorial-03</b>	<b>1</b> Theories of acid base titration  <b>2.2</b> Non aqueous titration

SW-1 Suggested Sessional Work (SW):

A. Assignments:

1. Discuss about various theories of acid base indicators.
2. Write in detail about acid base titrations.
3. Differentiate between acid base titrations & non aqueous titrations.
4. Describe about the various neutralizations curves with suitable examples.



**CO102.3. To understand the principles of volumetric/gravimetric and gasometric analytical techniques**

Item	Appx Hrs
CI	13
LI	8
SW	1
SL	1
Total	23

Session Outcomes(SOs)	Laboratory Instruction (LI)	Class room Instruction(CI)	Self Learning (SL)
<p><b>THEORY</b>  <b>SO3.1</b> Understand about the complexometric titrations &amp; their classification  <b>SO3.2</b> Understand about the mohl's method &amp; volhard's method.  <b>SO3.3</b> Principle and steps involved in gravimetric analysis.  <b>SO3.4</b> Differentiate between masking &amp; demasking agents</p> <p><b>PRACTICAL</b>  <b>SO3.1</b> Learn about the assayof the following compoundsalong with standardization of titrant Sodium chloride by precipitation titration</p> <p><b>SO3.2</b> Assay of the following compoundsalong with standardization of titrant Calcium gluconate by complexometry</p>	<p><b>3.1</b> Assay of the following compounds alongwith standardization of titrant Sodium chloride by precipitation titration</p> <p><b>3.2</b> Assayof the following compoundsalong with standardization of titrant Calcium gluconate by complexometry</p>	<p>UNIT-III  <b>Precipitation titrations:</b>  <b>3.1</b> Fundamentals of precipitation titration  <b>3.2</b> Mohr's method &amp; Volhard's Method  <b>3.3</b> Modified Volhard's,Fajans method,  <b>3.4</b> estimation of sodium chloride.  <b>Tutorial-01</b>  <b>Complexometric titration:</b>  <b>3.5</b> Classification, metal ion indicators, masking &amp; demasking reagents  <b>3.6</b> Estimation of Magnesium sulphate, and calcium gluconate.  <b>Tutorial-02</b>  <b>Gravimetry:</b>  <b>3.7</b> Principle and steps involved in gravimetric analysis.  <b>3.8</b> Purity of the precipitate: co- precipitation and post precipitation,  <b>3.9</b> Estimation of barium sulphate.  <b>3.10</b> Basic principle methods &amp; application of diazotization titration  <b>Tutorial-03</b></p>	<p><b>1</b> Mohr's method  <b>2</b> Gravimetr ictitration.</p>

SW-1 Suggested Sessional Work (SW)&Assignments:

1. Discuss about theComplexometric titrations & their classifications
2. Describe about the mohl's method & volhard's method.
3. Write about the principle and steps involved in gravimetric analysis.



**CO102.4. To analyze the technique of redox titration.**

Item	Appx Hrs
CI	10
LI	12
SW	1
SL	1
Total	24

Session Outcomes(SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
<p><b>THEORY</b>  <b>SO4.1</b> Understand Concepts of oxidation and reduction  <b>SO4.2</b> Understand about the principles and applications of Iodimetry  <b>SO4.3</b> Understand about the principles and applications of Iodometry.  <b>SO4.4</b> Differentiate between iodimetry &amp; iodometry  <b>SO4.5</b> Understand about the Principles and applications of Bromatometry &amp; Dichrometry</p> <p><b>PRACTICAL</b>  <b>SO4.1.</b> Learn about the assay of the following compounds along with standardization of titrant Hydrogen peroxide by Permanganometry titration  <b>SO4.2</b> Ferrous sulphate by cerimetry  <b>SO4.3</b> Copper sulphate by iodometry</p>	<p><b>4.1</b> Assay of the following compounds along with standardization of titrant Hydrogen peroxide by Permanganometry titration  <b>4.2</b> Ferrous sulphate by cerimetry  <b>4.3</b> Copper sulphate by iodometry</p>	<p><b>Redox titrations</b>  <b>4.1</b> Concepts of oxidation and reduction  <b>4.2</b> Types of redox titrations  <b>4.3</b> Principles and applications of Cerimetry  <b>Tutorial-01</b>  <b>4.4</b> Principles and applications of Iodimetry  <b>4.5</b> Principles and applications of Iodometry  <b>Tutorial-02</b>  <b>4.6</b> Principles and applications of Bromatometry  <b>4.7</b> Principles and applications of Dichrometry  <b>4.8</b> Titration with potassium iodate  <b>Tutorial-03</b></p>	<p><b>4.1</b> Concepts of oxidation and reduction  <b>4.2</b> Types of redox titrations</p>

SW-1 Suggested Sessional Work (SW):

**a. Assignments:**

1. Discuss about the concepts of oxidation and reduction
2. Discuss the principles and applications of Iodimetry
3. Write about the principles and applications of Iodometry.
4. Differentiate between iodimetry & iodometry
5. Describe about the Principles and applications of Bromatometry & Dichrometry.



**CO102.5. To analyze various electro chemical titrations.**

Item	Appx Hrs
CI	10
LI	12
SW	1
SL	1
Total	24

Learning Outcomes(SOs)	Laboratory Instruction (LI)	Class room Instruction(CI)	Self-Learning (SL)
<p><b>THEORY</b></p> <p>5.1 Understand about the construction and working of dropping mercury electrode</p> <p>5.2 Understand about the construction and working of reference electrode</p> <p><b>SO5.3</b> Learn about the conductometric titration</p> <p><b>SO5.4</b> Understand about the construction and working of dropping mercury electrode</p> <p><b>PRACTICAL</b></p> <p><b>SO5.1.</b> Determination of Normality by electro-analytical methods</p> <p>Conductometric titration of strong acid against strong base</p> <p><b>SO-5.2</b> Conductometric titration of strong acid and weak acid against strong base</p> <p><b>SO-5.3</b> Potentiometric titration of strong acid against strong base</p>	<p><b>5.1</b> Determination of Normality by electro-analytical methods</p> <p>Conductometric titration of strong acid against strong base</p> <p><b>5.2</b> Conductometric titration of strong acid and weak acid against strong base</p> <p><b>5.3</b> Potentiometric titration of strong acid against strong base</p>	<p>5.1 Electrochemical methods of analysis</p> <p><b>Conductometry-</b> Introduction, Conductivity cell, Conductometric titrations, applications.</p> <p><b>Tutorial-01</b></p> <p><b>Potentiometry –</b></p> <p>5.2 Electrochemical cell,</p> <p>5.3 construction and working of reference (Standard hydrogen, silver chloride electrode and calomel electrode) and indicator electrodes (metal electrodes and glass electrode),</p> <p>5.4 Methods to determine end point of potentiometric titration and applications.</p> <p><b>Tutorial-02</b></p> <p><b>Polarography</b></p> <p>5.5 Principle, Ilkovic equation,</p> <p>5.6 construction and working of dropping mercury electrode</p> <p>5.7 rotating platinum electrode, &amp; applications</p> <p><b>Tutorial-03</b></p>	<p>5.1 Construction and working of dropping mercury electrode</p> <p>5.2 Conductometric titrations</p>

SW-1 Suggested Sessional Work (SW):

**a. Assignments:**

1. Describe about the construction and working of dropping mercury electrode .
2. Write about the construction and working of reference electrode.
3. Discuss about the conductometric titration.



**Brief of Hours suggested for the Course Outcome**

Course Outcomes	Class Lecture (Cl)	Sessional Work (SW)	Self Learning (Sl)	Total hour (Cl+SW+Sl)
CO 102.1: To explain about accuracy, precision, error, sources of errors & minimizing techniques and significant figure	13	1	1	15
CO 102.2: To compute analytical results and understand the physiochemical concepts of analysis, theories of acids and bases, stoichiometry etc	13	1	1	15
CO 102.3: To understand the principles of volumetric/gravimetric and gasometric analytical techniques.	13	1	1	15
CO 102.4: To analyze the technique Of redox titration.	11	1	1	13
CO 102.5: To analyze various electro chemical titrations.	10	1	1	12
<b>Total Hours</b>	<b>60</b>	<b>05</b>	<b>05</b>	<b>70</b>



### Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		A	C	I	
CO-1	To explain about accuracy, precision, error, sources of errors & minimizing techniques and significant figure	08	06	01	15
CO-2	To compute analytical results and understand the physiochemical concepts of analysis, theories of acids and bases, stoichiometry etc	06	08	01	15
CO-3	To understand the principles of volumetric/gravimetric and gasometric analytical techniques.	07	06	02	15
CO-4	To analyze the technique of redox titration.	10	02	03	15
CO-5	To analyze various electro chemical titrations.	05	07	03	15
<b>Total</b>		<b>36</b>	<b>29</b>	<b>10</b>	<b>75</b>

**Legend: A: Analyze, C: Create, I: Interpret**

The end of semester assessment for Pharmaceutical analysis-I will be held withwritten examination of 75 marks

**Note.** Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks.

Teachers can also design different tasks as per requirement, for end semesterassessment.

#### Suggested Instructional/Implementation Strategies:

1. Improved Lecture
2. Tutorial
3. Case Method
4. Group Discussion
5. Role Play
6. Demonstration
7. ICT Based Teaching Learning (Video Demonstration/Tutorials CBT,Blog, Facebook,Twitter, Whatsapp, Mobile, Online sources)
8. Brainstorming



**Recommended Books: (Latest Editions)**

S.No.	Title	Author	Publisher	Edition & Year
1	Practical Pharmaceutical Chemistry Vol I & II	A.H. Beckett & J.B. Stenlake's	StahlonePress of University of London	4 <sup>th</sup> edition 2005
2	Text Book of Quantitative Inorganic analysis	A.I. Vogel	Pearson education India	7 <sup>th</sup> edition 2023
3	Inorganic Pharmaceutical Chemistry	P. Gundu Rao	Vallabh prakashan	2023
4	Bentley and Driver's Textbook of Pharmaceutical Chemistry	L.M. ATHERDEN	oxford University Press	8 <sup>th</sup> edition 2020
5	Analytical chemistry principles	John H. Kennedy	Cengage	2011
6	Indian Pharmacopoeia		Govt of india	9 <sup>th</sup> edition 2022

**Curriculum Development Team:**

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**Course Outcome, Program Specific Outcome& Program Outcome Mapping**

**Course Code: BP102T**

**Course Name: Pharmaceutical Analysis I**

Course Outcome	Program Outcome											Program Specific outcome			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
	Pharmacy knowledge	Planning Abilities	Problem analysis	Modern tool usage	Leadership skills	Professional Identity	Pharmaceutical Ethics	Communication	The pharmacist and society	Environment and sustainability	Life-long learning	Knowledge of drug discovery	Quality Analysis of API's	MOA of Drug	Biological evaluation of drug
<b>CO-1:</b> About accuracy, precision, error, sources of errors & minimizing techniques	3	2	3	1	3	2	1	2	3	2	3	1	3	1	2
<b>CO-2:</b> Theories of acids and bases, stoichiometry	2	3	1	3	0	2	0	1	2	3	3	3	2	1	3
<b>CO-3:</b> volumetric/gravimetric and gasometric Analytical techniques.	3	2	3	2		1	2	1	2	2	3	3	2	1	3
<b>CO-4:</b> Redox titration.	2	3	2	3	1	3	2	2	3	3	3	3	2	1	3
<b>CO-5:</b> Electro chemical titrations	3	3	1	1	1	3	0	3	1	2	3	2	2	2	2

**Legend: 1- Low, 2-Medium, 3-High**



### Course Curriculum Mapping

Pos& PSOs No	Cos No&	Title	SOs No	Class Room Instructions	Laboratory Instructions	Self learning
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	CO-1	To explain about accuracy, precision, error, sources of errors & minimizing techniques and significant figure.	SO1.1 SO1.2 SO1.3 SO1.4 SO1.5	1.1,1.2,1.3,1.4,1.5,1.6,1.7,1.8,1.9,1.10 T1, T2, T3	LI-1.1 LI-1.2	SL-1.1 SL-1.2
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	CO-2	To compute analytical results and understand the physiochemical concepts of analysis, theories of acids and bases, stoichiometry etc.	SO-2.1 SO-2.2	2.1,2.2,2.3,2.4,2.5,2.6,2.7,2.8,2.9,2.10 T1, T2, T3	LI-2.1 LI-2.2	SL-2.1 SL-2.2
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	CO-3	To understand the principles of volumetric/gravimetric and gasometric Analytical techniques.	SO-3.1 SO-3.2 SO-3.3 SO-3.4	3.1,3.2,3.3,3.4,3.5,3.6,3.7,3.8,3.9,3.10 T1, T2, T3	LI-3.1 LI-3.2	SL-3.1 SL-3.2
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	CO-4	To analyze the technique Of redox titration.	SO-4.1 SO-4.2 SO-4.3 SO-4.4 SO-4.5	4.1,4.2,4.3,4.4,4.5,4.6,4.7,4.8 T1, T2, T3	LI-4.1 LI-4.2 LI-4.3	SL-4.1 SL-4.2
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	CO-5	To analyze various electro chemical titrations	SO-5.1 SO-5.2 SO-5.3 SO-5.4	5.1,5.2,5.3,5.4,5.5,5.6,5.7, T1, T2, T3	LI-5.1 LI-5.2 LI-5.3	SL-5.1 SL-5.2





AKS University  
Faculty of Pharmaceutical Science & Technology  
Rajiv Gandhi Institute of Pharmacy  
Curriculum of B. Pharmacy (Pharmaceutics I) Program

(Revised as on 01 August 2023)**Semester-I**

**Course Code:** BP-103T & BP-109P

**Course Title :** Pharmaceutics I

**Pre- requisite:** Student should have basic knowledge about state of matter, Known about dosage form like tablet capsule and syrup etc.

**Rationale:** Understand the history of profession of pharmacy. Understand the basics of different dosage forms, pharmaceutical incompatibilities and pharmaceutical calculations. Understand the professional way of handling the prescription. Preparation of various conventional dosage forms.

**Course Outcomes:**

**C0-BP103T&109P.1:** Understand Historical background and development of profession of pharmacy, dosage form, prescription and posology.

**C0-BP103T&109P.2:** Learn about pharmaceutical calculation and preparation of powder dosage form and liquid dosage form and their preparation.

**C0-BP103T&109P.3:** Understand monophasic, biphasic liquid dosage form and learn about suspension and emulsion and preparation of above dosage form.

**C0-BP103T&109P.4:** Understand suppositories and evaluation of suppositories and pharmaceutical Incompatibilities.

**C0-BP103T&109P.5:** Learn about Semisolid dosage forms, penetration of drugs. Preparation of ointments, pastes, creams and gels. Evaluation of semi solid dosages forms.



### Scheme of Studies:

Board of Study	Course Code	Course Title				Scheme of studies(Hours/Week)			Total Credits (C)
			CI		LI	SW	SL	Total Study Hours (CI+LI+SW+S)	
			L	T					
Pharmacy	BP 103T & BP09P	Pharmaceutics-I	4		4	1	1	10	6

**Legend:** **CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others),

**LI:** Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)

**SW:** Sessional Work (includes assignment, seminar, mini project etc.),

**SL:** Self Learning,

**C:** Credits.

**Note:** SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

### Scheme of Assessment:

#### Theory

Board of Study	Course Code	Course Title	Scheme of Assessment ( Marks )						End Semester Assessment	Total Marks
			Progressive Assessment ( PRA )							
			Academic activity, Any three (Quiz/ Assignment, open book test, filed work and seminar)	Student teacher interaction	Class Attendance	Sessional exam	Total Marks			
Pharmacy	BP103T	Pharmaceutics I	3	3	4	15	25	75	100	



## Practical Assessment

Board of Study	Course Code	Course Title	Scheme of Assessment ( Marks )						
			Internal Assessment (A)			End Semester Examination(B)			Total Marks (A+B)
			Attendance	Record	Sessional Exam	Synopsis	Experiment	Viva	
Pharmacy	BP109P	Pharmaceutics- I practical	2	3	10	5	25	5	50

## Guidelines for the allotment of marks for attendance

Percentage of Attendance	Theory	Practical
95 – 100	4	2
90 – 94	3	1.5
85 – 89	2	1
80 – 84	1	0.5
Less than 80	0	0



**Course-Curriculum Detailing:**

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

**C0-BP103T&109P.1:** Understand Historical background and development of profession of pharmacy, dosage form, prescription and posology.

**Approximate Hours**

Item	AppX Hrs
CI	13
LI	0
SW	1
SL	1
<b>Total</b>	<b>15</b>

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
<b>SO1.1</b> Understand General Research Methodology: Research, objective, requirements, practical difficulties  <b>SO1.2</b> Understand review of literature, study design, types of studies,  <b>SO1.3</b> To Learn dosage strategies to eliminate errors/bias, controls, randomization,  <b>SO1.4</b> Understands crossover design, placebo, blinding techniques.		<b>Unit1</b> 1.1 General Research Methodology: Research, objective, requirements, practical difficulties. <b>1T1. Tutorial class.</b> 1.4 review of literature, study design, types of studies, 1.6 Strategies to eliminate. <b>1T2. Tutorial class.</b> 1.7 errors/bias, controls, randomization, 1.9 Crossover design. <b>1T3. Tutorial class.</b> Placebo, blinding techniques.	1. Different dosage form available in market  2. Different types of dose and their calculation

**Assignments:**

- 1 Different dosage form and different dose available in market.
- 2 Classification of dosage form



**C0-BP103T&109P.2:** Learn about pharmaceutical calculation and preparation of powder dosage form and liquid dosage form and their preparation.

**Approximate Hours**

Item	Appx Hrs
CI	13
LI	4
SW	1
SL	1
Total	19

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
<p><b>SO2.1</b> To Understand pharmaceutical liquid dosage</p> <p><b>SO2.2</b> Understand various preparations of conventional dosage forms.</p> <p><b>SO2.3</b> To learn about pharmaceutical calculation and excipients use in dosage form.</p> <p><b>SO2.4</b> To understand about effervescent, efflorescent and hygroscopic powder and eutectic mixture in pharmaceutical preparation.</p> <p><b>SO2.5</b> To learn about merit and demerit of liquid dosage form and pharmaceutical preparation.</p>	<p>2.1 To prepare and submit Powders and Granules</p> <p>a) ORS powder (WHO)</p> <p>b) Effervescent granules</p> <p>c) Dusting powder</p> <p>d) Divided powder</p>	<p><b>Unit-2 Pharmaceutical calculations, Powders, Liquid dosage forms:</b></p> <p>2.1 Weights and measures –Imperial &amp; Metric system.</p> <p>2.2 Calculations involving percentage solutions,</p> <p>2.3 Allegation, proof spirit and isotonic solutions based on freezing point and molecular weight.</p> <p><b>2T1. Tutorial class</b></p> <p>2.4 Definition, classification, advantages and disadvantages of powder.</p> <p>2.5 Simple &amp; compound powders, official preparations, dusting powders,</p> <p>2.6 Effervescent, efflorescent and hygroscopic powders, eutectic mixtures. Geometric dilutions.</p> <p><b>2T2. Tutorial class</b></p> <p>2.7 Advantages and disadvantages of liquid dosage forms.</p> <p>2.8 Excipients used in formulation of liquid dosage forms.</p> <p>2.9 Solubility enhancement techniques</p> <p><b>2T3. Tutorial class</b></p>	<p>2.1 Pharmaceutical dosage form prepared in industry.</p> <p>2.2 Problem solve</p>



**C0-BP103T&109P.3:** Understand monophasic and biphasic liquid dosage form and learn about suspension and emulsion and preparation of above dosage form.

**Approximate Hours**

Item	Appx Hrs
CI	13
LI	28
SW	1
SL	1
Total	43

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
<p><b>SO3.1</b> Understand monophasic liquid dosage form.</p> <p><b>SO3.2</b> To understand about different dosage form and use of gargle, ear drops, nasal drops, enemas, syrup elixirs, liniments and lotion.</p> <p><b>SO3.3</b> To learn about biphasic liquid dosage form.</p> <p><b>SO3.4</b> To understand types of emulsion and suspension and their preparation.</p> <p><b>SO3.5</b> To evaluation Stability problems and methods to overcome</p>	<p>3.1 a) Syrup IP'66 b) Compound syrup of Ferrous Phosphate BPC'68 3.2 Elixirs a) Piperazine citrate elixir b) Paracetamol pediatric elixir 3.3 Linctus a) Terpin Hydrate Linctus IP'66 4 b) Iodine Throat Paint (Mandles Paint) 3.4 Solution a) Strong solution of ammonium acetate b) Cresol with soap solution c) Lugol's solution 3.5 To prepare and submit Suspensions a) Calamine lotion b) Magnesium Hydroxide mixture c) Aluminum Hydroxide gel 3.6 Emulsions a) Turpentine Liniment b) Liquid paraffin emulsion. 3.7 .To prepare and submit Gargles and Mouthwashes a) Iodine gargle b)Chlorhexidine mouthwash</p>	<p><b>Unit 3</b> Monophasic liquids: Monophasic liquids: Definitions and preparations of Gargles, mouthwashes, throat paint. Eardrops, nasal drops and enemas. Syrups, elixirs, liniments and lotions. <b>3T1. Tutorial class</b> Biphasic liquids: Suspensions Definition, advantages and disadvantages, classifications Preparation of suspensions; Flocculated and Deflocculated suspension. <b>3T2. Tutorial class</b> Stability problems and methods to overcome. Emulsions: Definition and classification. Emulsifying agent and test for the identification of type of Emulsion. <b>3T3. Tutorial class</b> Methods of preparation &amp; Stability problems and methods to overcome. <b>3T4. Tutorial class</b></p>	<p>3.1 Conventional dosage form. 3.2 Factor affecting Solubility. 3.3 Preservative use in pharmaceutical</p>



**C0-BP103T&109P.4:** Understand suppositories and evaluation of suppositories and pharmaceutical incompatibilities.

**Approximate Hours**

Item	Appx Hrs
CI	10
LI	0
SW	1
SL	1
Total	15

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
<p><b>SO4.1</b> Understanding Suppositories and types of bases of Suppositories.</p> <p><b>SO4.2</b> Evaluation of suppositories.</p> <p><b>SO4.3</b> Understanding Methods of preparations. Displacement value &amp; its calculations.</p> <p><b>SO4.4</b> Understand Pharmaceutical incompatibilities.</p> <p><b>SO4.5</b> Learn about Physical, chemical and therapeutic incompatibility.</p>	<p>4.1 To prepare and submit Suppositories</p> <p>a) Glycero gelatin suppository</p> <p>b) Coca butter suppository</p> <p>c) Zinc Oxide suppository</p>	<p><b>Unit-4</b> Suppositories and incompatibilities:</p> <p>Suppositories: Definition, types.</p> <p>4.1 Advantages and disadvantages, types of bases. Methods of preparations. Displacement value &amp; its calculations.</p> <p><b>4T1. Tutorial class</b></p> <p>4.2 Evaluation of suppositories.</p> <p>4.3 Pharmaceutical incompatibilities: Definition, classification.</p> <p><b>4T2. Tutorial class</b></p> <p>4.4 Physical incompatibilities</p> <p>4.5 chemical incompatibilities</p> <p>4.6 Therapeutic incompatibilities with examples.</p> <p><b>4T3. Tutorial class</b></p>	<p>4.1 Food drug interaction list.</p> <p>4.2 Drug-drug interaction list.</p>

**4.1.Assignments:** Pharmaceutical incompatibilities



**C0-BP103T&109P.5:** Learn about Semisolid dosage forms, penetration of drugs. Preparation of ointments, pastes, creams and gels. Evaluation of semi solid dosages forms.

**Approximate Hours**

Item	Appx Hrs
CI	10
LI	4
SW	1
SL	1
Total	16

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
<p><b>SO5.1</b> Understand about Semisolid dosage forms.</p> <p><b>SO5.2</b> Learn about mechanisms and factors influencing dermal penetration of drugs</p> <p><b>SO5.3</b> Understands Preparation of ointments, paste, cream and gels.</p> <p><b>SO5.4</b> To understand about excipients used in semi solid dosage forms.</p> <p><b>SO5.5</b> Evaluation of semi solid dosages forms</p>	<p>5.1 To prepare and submit Semisolids</p> <p>a) Sulphur ointment</p> <p>b) Non staining-iodine ointment with methyl salicylate</p> <p>c) Carbopal gel</p>	<p><b>Unit 5:</b> Semisolid dosage forms:</p> <p>5.1 Semisolid dosage forms: Definitions and classification.</p> <p>5.2 Mechanisms and factors influencing dermal penetration of drugs.</p> <p>5.3 Preparation of ointments.</p> <p><b>5T1. Tutorial class</b></p> <p>5.4 Preparation of paste.</p> <p>5.5 Creams and gels.</p> <p><b>5T2. Tutorial class</b></p> <p>5.6 Excipients used in semi solid dosage forms.</p> <p>5.7 Evaluation of semi solid dosages forms.</p> <p><b>5T3. Tutorial class</b></p>	<p>5.1: Different between ointment and paste, cream and gel.</p>

**A. Assignments:** Mechanisms and factors influencing dermal penetration of drugs.



**Brief of Hours suggested for the Course Outcome**

<b>Course Outcomes</b>	<b>Class Lecture (CI)</b>	<b>LI</b>	<b>Sessional Work (SW)</b>	<b>Self Learning (SI)</b>	<b>Total hour (CI+SW+SI+L I)</b>
<b>C0-BP103T&amp;109P.1:</b> Understand Historical background and development of profession of pharmacy, dosage form, prescription and posology	13	0	1	1	15
<b>C0-BP103T&amp;109P.2:</b> Learn about pharmaceutical calculation and preparation of powder dosage form and liquid dosage form and their preparation.	13	4	1	1	19
<b>C0-BP103T&amp;109P.3:</b> Understand monophasic and biphasic liquid dosage form and learn about suspension and Emulsion and preparation of above dosage form.	13	28	1	1	43
<b>C0-BP103T&amp;109P.4:</b> Understand suppositories and evaluation of suppositories and pharmaceutical incompatibilities.	11	4	1	1	17
<b>C0-BP103T&amp;109P.5:</b> Learn about Semisolid dosage forms, penetration of drugs. Preparation of ointments.	10	4	1	1	16
<b>Total Hours</b>	<b>60</b>	<b>40</b>	<b>5</b>	<b>5</b>	<b>110</b>



## Suggestion for End Semester Assessment

**Suggested Specification Table (For ESA)**

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
<b>C0-BP103T&amp;109P.1</b>	Historical background and development of profession of pharmacy, dosage form, prescription and posology.	07	05	03	15
<b>C0-BP103T&amp;109P.2</b>	Pharmaceutical calculations, Powders, Liquid dosage forms	06	06	03	15
<b>C0-BP103T&amp;109P.3</b>	Monophasic liquids and biphasic liquid dosage form.	03	07	05	15
<b>C0-BP103T&amp;109P.4</b>	Suppositories and incompatibilities	02	10	03	15
<b>C0-BP103T&amp;109P.5</b>	Semisolid dosage forms	03	02	10	15
<b>Total</b>		<b>19</b>	<b>30</b>	<b>26</b>	<b>75</b>

**Legend: R: Remember, U: Understand, A: Apply**

The end of semester assessment for Pharmaceutics I will be held with written examination of 75 marks

**Note.** Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks.

Teachers can also design different tasks as per requirement, for end semester assessment.

### **Suggested Instructional/Implementation Strategies:**

1. Improved Lecture
2. Tutorial
3. Case Method
4. Group Discussion
5. Role Play
6. Demonstration
7. ICT Based Teaching Learning (Video, Demonstration/Tutorials CBT, Blog, Facebook, Twitter, Whatsapp, Mobile, Online sources)
8. Brainstorming



**Suggested Learning Resources:**

<b>S. No.</b>	<b>Title</b>	<b>Author</b>	<b>Publisher</b>	<b>Edition &amp; Year</b>
1	Pharmaceutical Dosage Form and Drug Delivery System	H.C. Ansel et al	Lippincott Williams and Walkins	South Asia edition; India; Elsevier; 2014
2	Cooper and Gunn's-Dispensing for Pharmaceutical Students	Carter S.J.	CBS publishers	11 th edition; New York;
3	Pharmaceutics, The Science& Dosage Form Design	M.E. Aulton	Churchill Livingstone, Edinburgh	3 rd edition; 2003
4	Indian pharmacopoeia	Indian pharmacopoeia commission	Govt of india	18 th edition
5	British pharmacopoeia	The Health Ministers of the United Kingdom	Govt of UK	NEW EDITION 2023

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**Course Code: BP103T/BP107P**

**Course Name: Pharmaceutics-I**

Course Outcome	Program Outcome											Program Specific outcome			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
	Pharmacy knowledge	Planning Abilities	Problem analysis	Modern tool usage	Leadership skills	Professional Identity	Pharmaceutical Ethics	Communication	The pharmacist and society	Environment and sustainability	Life-long learning	Knowledge of drug discovery	Quality Analysis of API's	MOA of Drug	Biological evaluation of drug
<b>CO-1:</b> Historical background and development, dosage form, prescription and posology.	3	2	3	1	3	2	1	2	3	2	3	1	3	1	2
<b>CO-2:</b> Pharmaceutical calculations, Powders, Liquid dosage forms	2	3	1	3	1	2	1	1	2	3	3	3	2	1	3
<b>CO-3:</b> Monophasic liquids and biphasic liquid dosage form	3	2	3	2	1	1	2	1	2	2	3	3	2	1	3
<b>CO-4:</b> Suppositories and incompatibilities	2	3	2	3	1	3	2	2	3	3	3	3	2	1	3
<b>CO-5:</b> Semisolid dosage forms	3	3	1	1	1	3	0	3	1	2	3	2	2	2	2

**Legend:1–Low,2–Medium,3–High**



### Course Curriculum Mapping

Pos& PSOs No	COs No	Title	SOs No	Class Room Instructions	Laboratory Instructions	Self learning
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	<b>C0-BP10 3T&amp;1 09P-1</b>	Understand Historical background and development of profession of pharmacy, dosage form, prescription and posology.	<b>SO1.1 SO1.2 SO1.3 SO1.4</b>	1.1,1.2,1.3,1.4,1.5,1.6,1.7,1.8,1.9,1.10	LI-1.1 LI-1.2 LI-1.3 LI-1.4	SI-1.1
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	<b>C0-BP10 3T&amp;1 09P-2</b>	Learn about pharmaceutical calculation and preparation of powder dosage.	<b>SO-2.1 SO-2.2 SO-2.3 SO-2.4 SO-2.5</b>	2.1,2.2,2.3,2.4,2.5,2.6,2.7,2.8,2.9.	LI-2.1 LI-2.2	SI-2.1 SI-2.2
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	<b>C0-BP10 3T&amp;1 09P-3</b>	Understand monophasic, biphasic liquid dosage form and learn about suspension and emulsion and preparation of above dosage form.	<b>SO-3.1 SO-3.2 SO-3.3 SO-3.4 SO-3.5</b>	3.1,3.2,3.3,3.4,3.5,3.6,3.7,3.8,3.9,3.10	LI-3.1 LI-3.2 LI-3.3 LI-3.4 LI-3.5 LI-3.6 LI-3.7	SI3.1 SI3.2 SI3.13
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	<b>C0-BP10 3T&amp;1 09P-4</b>	Understand suppositories and evaluation of suppositories and pharmaceutical incompatibilities.	<b>SO-4.1 SO-4.2 SO-4.3 SO-4.4 SO-4.5</b>	4.1,4.2,4.3,4.4,4.5,4.6,4.7,4.8.	LI-4.1 LI-4.2 LI-4.3 LI-4.4	SI-4.1 SI-4.2
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	<b>C0-BP10 3T&amp;1 09P-5</b>	Learn about Semisolid dosage forms, penetration of drugs. Preparation of ointments, pastes, creams and gels. Evaluation of semi solid dosages forms.	<b>SO-5.1 SO-5.2 SO-5.3 SO-5.4 SO-5.5</b>	5.1,5.2,5.3,5.4,5.5,5.6,5.7.	LI-5.1	SI-5.1





AKS University  
Faculty of Pharmaceutical Science & Technology  
Rajiv Gandhi Institute of Pharmacy  
Curriculum of B. Pharmacy (Pharmaceutical Inorganic chemistry) Program  
(Revised as on 01 August 2023)  
Semester-I

**Course Code:** BP104T/BP110P

**Course Title:** Pharmaceutical Inorganic chemistry

**Pre-requisite:** The Student should have basic knowledge of Inorganic substance with their importance and Uses.

**Rationale/Objective s:** Up on completion of the course student shall be able to

- To understand the sources of impurities and methods to determine the impurities in drugs.
- To Use different chemical methods to prepare inorganic pharmaceuticals.
- Understand the medicinal and pharmaceutical importance of inorganic compounds

**Course Out comes:**

**CO-BP104-1:** To understand the sources of impurities and methods to determine the impurities in drugs and pharmaceuticals.

**CO-BP104-2:** TO determine the level of specific impurities in the given inorganic compounds by performing different limit tests.

**CO-BP104-3:** To Use different chemical methods to prepare inorganic pharmaceuticals.

**CO-BP104-4:** To perform identification tests as per Indian Pharmacopoeia.

**CO-BP104-5:** Understand the medicinal and pharmaceutical importance of radiopharmaceuticals.



### Scheme of Studies

Course code	Title of the course	Program Name	TOTAL Number of contact hours/Week						Credit
			Classroom Instruction (A)		Practical (P)	S W	SL	Total Hours (H)	
			Lecture	Tutorial					
BP104T	Pharmaceutical Inorganic Chemistry-Theory	B. Pharmacy	3	1	4	1	1	10	6

**Legend: I:** Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others),

**LI:** Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)

**SW:** Sessional Work (includes assignment, seminar, mini project etc.),

**SL:** Self Learning, Credits.

**Note:** SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning

### Theory Assessment

Board of Study	Course Code	Course Title	Scheme of Assessment ( Marks )					End Semester Assessment(C)	Total Marks(A+B+C
			Progressive Assessment ( PRA)						
			Academic activity, Any three (Quiz/ Assignment, open book test, filed work and seminar)	Student teacher interaction	Class Attendance(AT	(A) Total Marks	Sessional Exam (B)		
Pharmacy	BP-104T	Pharmaceutical Inorganic Chemistry	3	3	4	10	15	75	100



## Practical Assessment

Board of Study	Course Code	Course Title	Scheme of Assessment ( Marks )						
			Internal Assessment (A)			End Semester Examination(B)			Total Marks (A+B)
			Attendance	Record	Sessional Exam.	Synopsi s	Experiment	Viva	
Pharmacy	BP-104P	Pharmaceutical Inorganic Chemistry	2	3	10	5	25	5	50

## Guidelines for the allotment of marks for attendance

Percentage of Attendance	Theory	Practical
95 – 100	4	2
90 – 94	3	1.5
85 – 89	2	1
80 – 84	1	0.5
Less than 80	0	0



## Curriculum of B. Pharmacy (Inorganic chemistry I)

### Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

**CO-BP104-1: To understand the sources of impurities and methods to determine the impurities in drugs and pharmaceuticals.**

Item	Approx Hrs
Lecture & Tutorial	10+3=13
Practical(P)	16
SW	1
SL	1
Total:	31

Session Outcomes(SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
<b>Theory</b> <b>SO1.1:</b> Impurities in pharmaceutical substances <b>SO1.2:</b> General methods of preparation  <b>Practical</b> <b>SO-P- 1.1:</b> Test sample would be conform with standard solution for limit test of chloride & test sample may be pass or fail. <b>SO-P- 1.2:</b> Test sample would be conform with standard solution for limit test of Sulphate & test sample may be pass or fail. <b>SO-P- 1.3:</b> Test sample would be conforming with standard solution for limit test of Heavy metal & test sample may be pass or fail. <b>SO-P- 1.4:</b> Test sample	<b>1.1:</b> To perform the limit test of Sulphate <b>1.2:</b> To perform the limit test of Chloride <b>1.3:</b> To perform the limit test of Iron <b>1.4:</b> To perform the limit test of Heavy metal.	<b>1.1:</b> History of Pharmacopoeia, Sources and types of impurities <b>1.2:</b> principle involved in the limit <b>1.3:</b> Limit test for Chloride. <b>1.4:</b> , Limit test for Sulphate, <b>1T.1:</b> Tutorial 1.5: Limit test for Heavy metals <b>1.6:</b> Limit test for Iron, Arsenic, <b>1.7:</b> Limit test for Heavy metals <b>1.8:</b> Modified limit test <b>1T.2:</b> Tutorial class  for Chloride and Sulphate <b>1.9:</b> Various assay	<b>1.1:</b> Advanced analytical methods for Conformation of limit test for inorganic salts. <b>1.2:</b> Development of National Formulary & role of WHO



would be conforming to standard solution for limit test of Iron & test sample may be pass or fail.		methods for compounds <b>1.10:</b> Medicinal uses of inorganic compounds <b>1T3:</b> Tutorial class	
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**Suggested Assignments:** History of Pharmacopoeia, Sources and types of impurities & various limit tests

## Unit II

**CO-BP104-2:** TO determine the level of specific impurities in the given inorganic compounds by performing different limit tests.

Item	Approx Hrs
Lecture & Tutorial	10+3=13
Practical(P)	8
SW	1
SL	1
Total:	23



Session Outcomes(SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
<p><b>Theory</b>  <b>SO2.1:</b> Acids, Bases and Buffers  <b>SO2.2:</b> Major extra and intracellular electrolyte  SO1.3: Dental products</p> <p><b>Practical</b>  <b>SO-P- 2.1:</b> Preparation of WHO ORS salt Powder</p> <p><b>SO-P- 2.2:</b> To perform the Measurement of pH of some inorganic solutions</p>	<p><b>2.1</b>To Prepare WHO ORS salt Powder  <b>2.2:</b> To perform the Measurement of pH of some inorganic solutions.</p>	<p><b>2.1:</b> Buffer equations and buffer capacity in general, buffers in pharmaceutical systems  <b>2.2:</b> preparation, stability, buffered isotonic solutions,  <b>2.3:</b> measurements of tonicity, calculations and methods of adjusting isotonicity.  <b>2.4:</b> Theories of Acid, base &amp; Buffer  <b>2T.1:</b> Tutorial Class  <b>2.5:</b> Functions of major physiological ions, Electrolytes used in the replacement therapy:  <b>2.6:</b> Functions of major physiological ions, Electrolytes used in the replacement therapy:  <b>2.7:</b> Calcium gluconate* and Oral Rehydration Salt (ORS), Physiological acid base balance  <b>2.8: Dental products:</b> Dentifrices, role of fluoride in the treatment of dental caries,  <b>2T.2:</b> Tutorial class  <b>2.9:</b> Desensitizing agents  <b>2.10:</b> Calcium carbonate, Sodium fluoride, and Zinc eugenol cement.  <b>2T3:</b> Tutorial class</p>	<p>2.1:Study the role of some newer inorganic salt in preparation of dental products</p>

**Suggested Assignments:** Acids, Bases and Buffers, Major extra and intracellular electrolytes, Dental products:



### Unit III

**CO-BP104-3: To Use different chemical methods to prepare inorganic pharmaceuticals.**

Item	Approx Hrs
Lecture & Tutorial	10+3=13
Practical(P)	12
SW	1
SL	1
Total:	27

Session Outcomes(SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
<b>Theory</b> <b>SO3.1:</b> Gastrointestinal agents; Acidifiers <b>SO3.2:</b> Gastrointestinal agents: antacid <b>SO3.3:</b> Gastrointestinal agents, Cathartics <b>SO3.4:</b> Antimicrobials agent  <b>Practical</b> <b>SO-P- 3.1:</b> Prepare & Submit Aluminum hydroxide gel  <b>SO-P- 3.2:</b> Prepare Submit & inorganic pharmaceutical boric acid & Potash alum <b>SO-P- 3.3:</b> Prepare Submit & inorganic pharmaceutical Potash alum	<b>3.1</b> TO prepare & Submit Aluminum hydroxide gel <b>3.2:</b> To prepare & inorganic pharmaceuticals Boric acid & Potash alum  <b>3.3.</b> Prepare Submit & inorganic pharmaceutical Potash alum	<b>3.1:</b> Acidifiers, Ammonium chloride* and Dil. HCl <b>3.2:</b> Antacid, Ideal properties of antacids, <b>3.3:</b> combinations of antacids <b>3.4:</b> Sodium Bicarbonate*, <b>3T.1:</b> Tutorial Class <b>3.5:</b> Aluminum hydroxide gel, Magnesium hydroxide mixture <b>3.6:</b> Cathartics: Magnesium sulphate, <b>3.7:</b> Sodium orthophosphate, <b>3.8:</b> Kaolin and Bentonite <b>3T.2:</b> Tutorial class <b>3.9:</b> Antimicrobials, classification, Potassium permanganate <b>3.10:</b> Boric acid, Hydrogen peroxide*, Chlorinated lime*, Iodine and its preparations <b>3T3:</b> Tutorial class	<b>3.1:</b> Study the various inorganic salts used in treatment of Ulcers.

**Suggested Assignments:** Antacid, Gastrointestinal agents Acidifiers, Antimicrobials: Mechanism, classification, Potassium permanganate, Boric acid, Hydrogen peroxide.



**Unit IV: CO-BP104-4: To perform identification tests as per Indian Pharmacopoeia.**

Item	Approx Hrs
Lecture & Tutorial	10
Practical(P)	8
SW	1
SL	1
Total:	20

Session Outcomes(SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
<b>Theory</b> <b>SO4.1: Expectorants:</b> <b>SO4.2: Emetics:</b> <b>SO4.3: Haematinics</b> <b>SO4.4: Poison and Antidote:</b>  <b>Practical</b> <b>SO-P- 4.1:</b> Student would be find out the Ferrous sulphate & Conform with identification test <b>SO-P- 4.2:</b> Student would be find out the Copper sulphate & Conform with identification test	<b>4.1</b> To prepare & Identified the Ferrous sulphate <b>4.2:</b> To prepare & Identified the Copper sulphate	<b>4.1: Expectorants:</b> Potassium iodide, Ammonium chloride*. <b>4.2:</b> Emetics: Copper sulphate*, Sodium potassium tartarate <b>4.3:</b> Haematinics: Ferrous sulphate*, <b>4.4:</b> Ferrous gluconate <b>4T1:</b> Tutorial Class <b>4.5:</b> Poison and Antidote: Sodium thiosulphate <b>4.6:</b> Activated charcoal, Sodium nitrite333  <b>4..7: Astringents:</b> Properties & Classes <b>4.8:</b> Zinc Sulphate, Potash Alum <b>3T.2:</b> Tutorial class	<b>4.1:</b> Study the various agents used in treatment as poisoning& emetinices .

**Suggested Assignments:** Expectorants, Emetics, Haematinics, Poison and Antidote



## **Unit V**

CO-BP104-5: Understand the medicinal and pharmaceutical importance of radiopharmaceuticals.

Item	Approx Hrs
Lecture & Tutorial	8+2=10
Practical(P)	0
SW	1
SL	1
Total:	20

Session Outcomes(SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
<b>Theory</b> <b>SO5.1:</b> To Know the radio pharmaceuticals <b>SO5.2:</b> precautions & pharmaceutical application of radioactive substances	NA	<b>5.1:</b> Radio activity <b>5.2:</b> Measurement of radioactivity & Properties of $\alpha$ , $\beta$ , $\gamma$ radiations <b>5.3:</b> Half life, <b>5.4:</b> Radio isotopes <b>5T1:</b> Tutorial Class <b>5.5:</b> Study of radio isotopes - Sodium iodide I131, <b>5.6:</b> Storage conditions & precautions radio pharmaceuticals <b>5.7:</b> Pharmaceutical application of radioactive substances. <b>5T.2:</b> Tutorial class	<b>5.1:</b> Various radiation techniques with their applications.



### Brief of Hours suggested for the Course Outcome

Course Out comes	Class Lecture (Cl)	(LI)	Session a I Work (SW)	Self Learning (SI)	Total Hour (Cl+SW+ SI+LI)
<b>CO-BP104-1:</b> To understand the sources of impurities and methods to determine the impurities in drugs and pharmaceuticals.	13	16	1	1	31
<b>CO-BP104-2:</b> To determine the level of specific impurities in the given inorganic compounds by performing different limit tests	13	8	1	1	23
<b>CO-BP104-3:</b> To Use different chemical methods to prepare inorganic pharmaceuticals.	13	12	1	1	27
<b>CO-BP104-4:</b> To perform identification tests as per Indian Pharmacopoeia.	10	8	1	1	20
<b>CO-BP104-5:</b> Understand the medicinal and pharmaceutical importance of radiopharmaceuticals.	10	0	1	1	12
<b>Total Hours</b>	59	44	5	5	113



## Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

Course Outcome	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
<b>CO-BP104-1:</b>	To understand the sources of impurities and methods to determine the impurities in drugs and pharmaceuticals.	08	06	01	15
<b>CO-BP104-2:</b>	To determine the level of specific impurities in the given inorganic compounds by performing different limit tests	12	07	01	20
<b>CO-BP104-3:</b>	To Use different chemical methods to prepare inorganic pharmaceuticals.	02	06	02	10
<b>CO-BP104-4:</b>	To perform identification tests as per Indian Pharmacopoeia	10	02	03	15
<b>CO-BP104-5:</b>	Understand the medicinal and pharmaceutical importance of radiopharmaceuticals.	05	07	03	15
<b>Total</b>		<b>37</b>	<b>28</b>	<b>10</b>	<b>75</b>

**Legend: R: Remember, U: Understand, A: Apply**

The end of semester assessment for Pharmaceutical Inorganic chemistry will be held with written examination of 75 marks

**Note.** Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks. Teachers can also design different tasks as per requirement, for end semester assessment.

### Suggested Instructional/Implementation Strategies:

1. Improved Lecture
2. Tutorial
3. Case Method
4. Group Discussion
5. Role Play
6. Demonstration
7. ICT Based Teaching Learning (Video Demonstration/Tutorials CBT, Blog, Face book, Twitter, What's app, Mobile, Online sources)
8. Brainstorming



**Suggested Learning Resources:**

S. No.	Title	Author	Publisher	Edition & Year
1	Indian Pharmacopoeia	Indian Pharmacopoeia Commission (IPC), Govt. of India	Govt. of India	Eighth edition, 2018
2	Inorganic Pharmaceutical Chemistry	Anand & Chatwal	Himalayan publishing House Pvt Ltd	Fifth edition 2022
3	Bentley and Driver's Textbook of Pharmaceutical Chemistry	Atherden LM	Oxford / BSP Books	Eighth Edition 2020
4	Inorganic Pharmaceutical Chemistry	M.L Schroff,	National Book Centre, Calcutta	10 <sup>th</sup> edition 2012
5	Inorganic Pharmaceutical Chemistry, 3rd Edition	P. Gundu Rao	Wiley publication	2021
6	Text Book of Quantitative Inorganic analysis	A.I. Vogel	Oxford publication	Eleventh edition 2018
7	Practical Pharmaceutical Chemistry Vol I & II,	A.H. Beckett & J.B. Stenlake's	Stahlone Press of University of London -	4th edition.

**Curriculum Development Team:**

1. **Prof. SP Gupta**, Director, RGIP, AKS University
2. **Mr. Satyendra Garg**, Assistant professor, RGIP, AKS University



### Course Outcome, Program Specific Outcome & Program Outcome Mapping

**Course Code: BP104T /BP110P**

**Course Name: Pharmaceutical Inorganic chemistry**

Course Outcome	Program Outcome											Program Specific outcome			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
	Pharmacy knowledge	Planning Abilities	Problem analysis	Modern tool usage	Leadership skills	Professional Identity	Pharmaceutical Ethics	Communication	The pharmacist and society	Environment and sustainability	Life-long learning	Knowledge of drug discovery	Quality Analysis of APIs	MOA of Drug	Biological evaluation of drug
<b>CO-1:</b> Sources of impurities and methods to determine the impurities in drugs	3	2	3	1	3	2	1	2	3	2	3	1	3	1	2
<b>CO-2:</b> Determine the level of specific impurities in the given inorganic compounds	2	3	1	3	0	2	0	1	2	3	3	3	2	1	3
<b>CO-3:</b> To Use different chemical methods to prepare inorganic pharmaceuticals.	3	2	3	2		1	2	1	2	2	3	3	2	1	3
<b>CO-4:</b> To perform identification tests as per Indian Pharmacopoeia	2	3	2	3	1	3	2	2	3	3	3	3	2	1	3
<b>CO-5:</b> Medicinal and pharmaceutical importance of radiopharmaceuticals	3	3	1	1	1	3	0	3	1	2	3	2	2	2	2

**Legend: 1–Low, 2–Medium, 3–High**



## Course Curriculum Mapping

Pos& PSOs No	Cos No&	Title	SOs No	Class Room Instructions	Laboratory Instructions	Self learning
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	CO-BP104-1:	To understand the sources of impurities and methods to determine the impurities in drugs and pharmaceuticals.	SO1.1 SO1.2	1.1,1.2,1.3,1.4,1.5,1.6,1.7,1.8,1.9,1.10	LI-1.1 LI-1.2 LI-1.3 LI-1.4	SI-1.1 SI-1.2
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	CO-BP104-2:	To determine the level of specific impurities in the given inorganic compounds by performing different limit tests	<b>SO-2.1</b> <b>SO-2.2</b>	2.1,2.2,2.3,2.4,2.5,2.6,2.7,2.8,2.9,2.10	LI-2.1 LI-2.2	SI-2.1
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	CO-BP104-3:	To Use different chemical methods to prepare inorganic Pharmaceuticals.	<b>SO-3.1</b> <b>SO-3.2</b> <b>SO-3.3</b>	3.1,3.2,3.3,3.4,3.5,3.6,3.7,3.8,3.9,3.10	LI-4.1 LI-4.2 LI-4.3 LI-4.4	SI3.1
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	CO-BP104-4:	To perform identification tests as per Indian Pharmacopoeia	<b>SO-4.1</b> <b>SO-4.2</b>	4.1,4.2,4.3,4.4,4.5,4.6,4.7,4.8.	LI-4.1,LI-4.2,LI-4.3,LI-4.4	SI-4.1
<b>Pos:1,2,3,4,5,6,7,8,9,10,11</b> <b>PSOs:1,2,3,4,5,6</b>	CO-BP104-5:	Understand the medicinal and pharmaceutical importance of radiopharmaceuticals.	SO-5.1 SO-5.2	5.1,5.2,5.3,5.4,5.5,5.6,5.7,5.8	-	SI-5.1





AKS University  
Faculty of Pharmaceutical Science & Technology  
Rajiv Gandhi Institute of Pharmacy  
Curriculum of B. Pharmacy (Communication Skills) Program  
(Revised as on 01August2023)

**Course Code:** BP 105T/BP111P

**Course Title:** Communication Skills

**Pre-requisite:** Students must have basic knowledge of English language.

**Rationale:** In order to compete in this fast growing world, LSWR skills of the students should be well developed and enhanced. Besides, they must have effective communication skills as it plays a vital role in shaping individual's personality and career. It also boosts the confidence and prepares them to face the audience fearlessly.

**Course Outcomes:**

**After completion of the course:**

1. Students will be able to summarize and explain an expanded world perspective that demonstrates an appreciation of a diverse range of individuals, communities, and viewpoints.
2. Students will demonstrate an understanding of human communication styles and events related to culture, self-concept, perception, listening, verbal communication and non-verbal communication.
3. Students will paraphrase information from outside sources effectively and accurately therefore Strengthen their ability to write academic papers, essays and summaries using the process approach.
4. Students will earn any job they want both in the near future and later in their lives as well as it will enhance their professional profile by showcasing top-notch presentation skills that set them apart in their field.
5. Students will develop critical thinking skills, improve communication skills, increase self-confidence, and build teamwork.



### Scheme of Studies:

Board of Study	Course Code	Course Title	Scheme of studies (Hours/Week)					Total Credits(C)
			CI	LI	SW	SL	Total Study Hours(CI+LI+SW+SL)	
Program Core(PCC)	BP111P	Communication Skills	2	2	1	1	6	3

#### Legend:

**CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) And others),

**LI:** Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)

**SW:** Sessional Work (includes assignment, seminar, mini project etc.),

**SL:** Self Learning,

**C:** Credits.

**Note:** SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

### Scheme of Assessment:

#### Theory

Board of Study	Course Code	Course Title	Scheme of Assessment(Marks )							
			Progressive Assessment(PRA)						End Semester Assessment	Total Marks
			Class/Home Assignment 5 number 3marks each (CA)	Class Test 2 (2 best out Of 3) 10 marks each (CT)	Seminar one (Presentation) (SA)	Class Activity any one (CAT )	Class Attendance (AT)	Total Marks (CA+CT+SA+CAT+AT)		
PCC	BP105T	Communication Skills	15	20	5	5	5	50	50	100



### Guidelines for the allotment of marks for attendance

Percentage of Attendance	Theory	Practical
95 – 100	4	2
90 – 94	3	1.5
85 – 89	2	1
80 – 84	1	0.5
Less than 80	0	0



**Course-Curriculum Detailing:**

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

**CT101.1: Students will be able to summarize and explain an expanded world perspective that demonstrates an appreciation of a diverse range of individuals, communities, and viewpoints.**

**Approximate Hours**

Item	AproX Hrs
CI	5
LI	2
SW	1
SL	1
Total	9

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self Learning (SL)
SO1.1 Students will get familiar with the concept of communication. SO1.2 Students will learn the process to be followed for effective communication. SO1.3 Students will learn the barriers that hinder the communication. SO1.4 Students will learn the different perspectives that affect communication.	1. Ways to eradicate semantic barriers. 2. 7c's of communication	<b>UNIT – 1 Communication Skills</b> ..1 Communication -Introduction, Definition, The importance of communication. ..2 The communication process. <b>1T.1:</b> Tutorial class ..3 Barriers to communication ..4 Perspectives in communication. <b>1T.2:</b> Tutorial class	1 Prepare a presentation on communication and its importance. 2 prepare a presentation on barriers to communication.



**CT101.2: Students will demonstrate an understanding of human communication styles and events related to culture, self-concept, perception, listening, verbal communication and non-verbal communication.**

**Approximate Hours**

Item	AppX Hrs
CI	5
LI	2
SW	1
SL	1
Total	9

<b>Session Outcomes (SOs)</b>	<b>Laboratory Instruction (LI)</b>	<b>Classroom Instruction (CI)</b>	<b>Self Learning (SL)</b>
<p><b>SO2.1</b> Understand the techniques of communication.</p> <p><b>SO2.2</b> students will get familiar with the types of communication.</p> <p><b>SO2.3</b> Students will know about different styles of communication matrix</p>	<p>1. Non verbal communication oral skills</p>	<p><b>UNIT 2 – Elements of communication</b></p> <p><b>2T.2:</b> Tutorial class 2.1- Introduction, face to face communication, tone of voice.</p> <p><b>2T.2:</b> Tutorial class 2.2 – verbal and non verbal communication</p> <p>2.3-Communication style, Introduction, communication style matrix with examples.</p>	<p>1. Prepare the chart to show the difference between verbal and non - verbal communication</p> <p>2 prepare notes on several communication styles</p>



**CT101.3: Students will paraphrase information from outside sources effectively and accurately therefore strengthen their ability to write academic papers, essays and summaries using the process approach.**

**Approximate Hours**

Item	Appx Hrs
CI	5
LI	2
SW	1
SL	1
Total	9

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self Learning (S)
<b>SO3.1</b> Students will be able to listen actively.  <b>SO3.2</b> Students will be able to write according to the need.  <b>SO3.3</b> students will learn to organize the content effectively.	1. Active listening session. 2. Methods of Note taking and note making	<b>UNIT-3 :Basic listening skills</b>  3.1 Introduction, Self – Awareness, Active Listening, Listening In Difficult Situations. 3.2 Effective written communication. 3.3 Writing effectively.	1 Prepare a presentation on listening process.  2 Prepare notes on types of listening.  3 write an article on recent development in medical science.

**CT101.4: Students will earn any job they want both in the near future and later in their lives as well as it will enhance their professional profile by showcasing top-notch presentation skills that set them apart in their field.**

**Approximate Hours**

Item	Approx. Hrs
CI	3
LI	2
SW	1
SL	1
Total	7



Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self Learning (SL)
<b>SO4.1</b> Understanding about the purpose of interview. <b>SO4.2</b> Students will be able to deal with the stage fear. <b>SO4.</b> Students will be able to deliver presentation effectively.	1. Mock interview session 2. Presentation session	4.1.1. Purpose of interview, Do's and don'ts of interview. 4.2.2. Giving presentation, dealing with fears, planning your presentation, structuring your presentation. 4.3.3. Delivering your presentation, techniques of delivery.	1. Prepare a presentation on interview and its types. 2. Prepare notes on oral presentation and its features.

**CT101.5: Students will develop critical thinking skills, improve communication skills, increase self-confidence, and build teamwork.**

#### Approximate Hours

Item	Appx Hrs
CI	2
LI	2
SW	1
SL	1
Total	6

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self Learning (S)
<b>SO5.1</b> Students will get familiar with the concept of group discussion. <b>SO5.2</b> Students will be able to follow the rules of group discussion.	1. Debate session. 2. Group discussion session	<b>Unit 5-Group Discussion</b> .1 Introduction, communication skills in group discussion. .2 Dos and don'ts of groups discussion	1 Write 10 difference between Do and Don't of Group Discussion.



### Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (CL)	Sessional Work (SW)	Self Learning (SL)	Total hour (CL+SW+SL)
<b>CT101.1:</b> Students will be able to summarize and explain an expanded world perspective that demonstrates an appreciation of a diverse range of individuals, communities, and viewpoints.	5	1	1	7
<b>CT101.2:</b> Students will demonstrate an understanding of human communication styles and events related to culture, self-concept, perception, listening, verbal communication and non-verbal communication.	5	1	1	7
<b>CT101.3</b> Students will paraphrase information from outside sources effectively and accurately therefore Strengthen their ability to write academic papers, essays and summaries using the process approach.	5	1	1	7
<b>CT101.4</b> Students will earn any job they want both in the near future and later in their lives as well as it will enhance their professional profile by showcasing top-notch presentation skills that set them apart in their field.	3	1	1	5
<b>CT101.5:</b> Students will develop critical thinking skills, improve communication skills, increase self-confidence, and build teamwork.	2	1	1	4
<b>Total Hours</b>	<b>20</b>	<b>5</b>	<b>5</b>	<b>30</b>



## Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	Communication skills.	03	01	01	05
CO-2	Elements and style of communication.	02	06	02	10
CO-3	Listening and writing skills.	03	07	05	15
CO-4	Interview and presentation skills.	-	10	05	15
CO-5	Group Discussion.	03	02	-	05
Total		11	26	13	50

**Legend: R: Remember, U: Understand, A: Apply**

**Note:** Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks. Teachers can also design different tasks as per requirement, for end semester assessment.

### Suggested Instructional/Implementation Strategies:

1. Improved Lecture
2. Tutorial
3. Group Discussion
4. Presentations
5. writings
6. Speeches
7. Brainstorming



## Suggested Learning Resources:

### (a)Books:

S. No.	Title	Author	Publisher	Edition &Year
1	Communication Skills	Sanjay Kumar	Oxford press.	2nd edition,2015
2	Brilliant communication skills	Gill Hasson	Pearson life.	1st edition,2015
3	Living English personality Development and soft skill	Barun k mitra	Oxford press	2 <sup>nd</sup> edition,2023
4	Communication Skills for professionals	Konar nira	New arrivals - PHI	3 <sup>rd</sup> edition 2022
5.	Soft skill and professional communication	Francis peters SJ	Mc Graw Hill	1st edition 2011.

### Curriculum Development Team:

1. **Prof. SP Gupta**, Director, RGIP, AKS University
2. **Mr. Amarpreet Saluja**, Assistant professor, RGIP,AKS University
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**Course Outcome, Program Specific Outcome& Program Outcome Mapping**

**Course Code: BP105T**

**Course Name: Communication Skill**

Course Outcome	Program Outcome											Program Specific outcome			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
	Pharmacy knowledge	Planning Abilities	Problem analysis	Modern tool usage	Leadership skills	Professional Identity	Pharmaceutical Ethics	Communication	The pharmacist and society	Environment and sustainability	Life-long learning	Knowledge of drug discovery	Quality Analysis of API's	MOA of Drug	Biological evaluation of drug
<b>CO-1:</b> Diverse range of individuals, communities, and viewpoints.	3	2	3	1	3	2	1	2	3	2	3	1	3	1	2
<b>CO-2:</b> Human communication styles and events related to culture, verbal communication	2	3	1	3	1	2	1	1	2	3	3	1	2	1	1
<b>CO-3:</b> Living English personality Development and soft skill	3	2	3	2	1	1	2	1	2	2	3	1	2	1	1
<b>CO-4:</b> Communication Skills for professionals	2	3	2	3	1	3	2	2	3	3	3	1	2	1	1
<b>CO-5:</b> Soft skill and professional Communication	3	3	1	1	1	3	1	3	1	2	3	1	2	2	2



## Course Curriculum Map:

Pos & PSOs No.	Cos No. &Titles	SOs No.	Laboratory Instruction (LI)	Classroom Instruction(CI)	Self Learning (SL)
PO1,2,3,4,5,6 7,8,9,10,11,12 PSO1,2,3,4,5	CO-1: Communication skills.	SO1.1 SO1.2 SO1.3 SO1.4 SO1.5		1.1,1.2,1.3,1.4,1.5	1.1,1.1
PO1,2,3,4,5,6 7,8,9,10,11,12 PSO1,2,3,4,5	Brilliant communication skills	SO2.1 SO2.2 SO2.3		2.1,2.2,2.3	2.1,2.2
PO1,2,3,4,5,6 7,8,9,10,11 PSO1,2,3,4,5	CO3: Living English personality Development and soft skill	SO3.1 SO3.2 SO3.3		3.1,3.2,3.3	3.1,3.2
PO1,2,3,4,5,6 7,8,9,10,11,12 PSO1,2,3,4,5	CO 4: Communication Skills for professionals	SO4.1 SO4.2 SO4.3 SO4.4 SO4.5		4.1,4.2,4.3	4.1,4.2
PO1,2,3,4,5,6 7,8,9,10,11,12 PSO1,2,3,4,5	CO 5: Soft skill and professional communication	SO5.1 SO5.2 SO5.3 SO5.4 SO5.5		5.1,5.2,5.3	5.1,5.2





AKS University  
Faculty of Pharmaceutical Science & Technology  
Rajiv Gandhi Institute of Pharmacy  
Curriculum of B. Pharmacy Program  
(Revised as on 01 August 2023)  
**Semester-I**

**Course Code:** BP106T/BP112RBP

**Course Title:** Remedial biology theory

**Pre-requisite:** The Students should have a basic knowledge body parts and their primary functions as well as some knowledge of animal kingdom and plants.

**Rationale/Objectives:** Upon completion of the course student shall be able to

- Know the classification and salient features of five kingdoms
- Understand the basic components of anatomy & physiology of plant.
- Know understand the basic components of anatomy & physiology animal with special reference to humans.

**Course Outcomes:**

**CO-BP106-1:** To understand about diversity in living world, five kingdom classification and morphology of different plants.

**CO-BP106-2:** To know the composition of blood, digestion and respiration in humans.

**CO- BP106-3:** To understand excretory products and their elimination, neural control in human as well as reproductive systems of humans.

**CO-BP106-4:** To understand about plants with essential minerals and their related different cycles including photosynthesis.

**CO-BP106-5:** Understand the overall development of the plants.



## Scheme of Studies

Course code	Title of the course	Program Name	TOTAL Number of contact hours/Week						Credit
			Class room Instruction (A)		Practical(P)	SW	SL	Total Hours (H)	
			Lecture	Tutorial					
BP106T	Remedial biology Theory	B. Pharmacy	2	0	2	1	1	6	3

### Legend:

**CI:** Class room Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others),

**LI: Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)** SW: Sessional Work (includes assignment, seminar, mini project etc.),

**SL:** Self Learning, Credits.

**Note:** SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

### Theory Assessment

Board of Study	Course Code	Course Title	Scheme of Assessment (Marks)						
			Progressive Assessment(PRA)						
			ademic activity, Any three (Quiz/Assignment, open book test, filed work and seminar)	Student teacher interaction	Class Attendance(AT)	(A) Total Marks	Sessional Exam(B)		
Pharmacy	BP-106T	Remedial biology theory	3	3	4	10	15	75	100



## Practical Assessment

Board Of Study	Course Code	Course Title	Scheme of Assessment(Marks)						
			Internal Assessment(A)			End Semester Examination (B)			Total Marks (A+B)
			Attendance	Record	Sessional Exam.	Synopsi s	Experimen t	Viva	
Pharmacy	BP112P	Remedial Biology	2	3	10	5	25	5	50

### Guidelines for the allotment of marks for attendance

Percentage of Attendance	Theory	Practical
95 – 100	4	2
90 – 94	3	1.5
85 – 89	2	1
80 – 84	1	0.5
Less than 80	0	0



## Course-Curriculum

### Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

**CO-BP104-1:** To understand about diversity in living world, five kingdom classification and morphology of different plants.

Item	Approx Hrs
Lecture & Tutorial	7
Practical(P)	20
SW	1
SL	1
Total:	29

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self Learning(SL)
<b>Theory</b> <b>SO1.1:</b> Introduction Definition and characters Of living organisms <b>SO1.2:</b> Binomial nomenclature. <b>SO1.3:</b> Five kingdoms of life. <b>SO1.4:</b> General anatomy of root, stem, leaf of monocotyledons and dicotyledons <b>Practical-</b> <b>SO-P-1:</b> Introduction to experiments in biology Study of Microscope Section cutting techniques Mounting and staining Permanent slide preparation. <b>SO-P-1.2:</b> Study of stem, root, leaf, seed, fruit, flower & their modification. <b>SO-P-1.3:</b> Microscope and identification of different tissue of plant.	<b>1.1:</b> Understand The microscope functioning  <b>1.2:</b> Perform The staining techniques <b>1.3:</b> Study about the cell and its inclusions. <b>1.4:</b> Permanent slide was prepared.	<b>1.1:</b> Introduction Definition And characters of Living organisms <b>1.2:</b> Diversity in living world. <b>1.3:</b> Binomial nomenclature <b>1.4:</b> Five kingdoms of life. <b>1.5:</b> Morphology of different parts of flowering plants root stem, inflorescence. <b>1.6:</b> Flower, leaf, fruit, seed <b>1.7:</b> General anatomy of root stem, leaf of monocotyledons and di-cotyledons.	<b>1.1</b> Student can read about some More special characters of five kingdoms. <b>1.2:</b> Understand and divide cereal plants, fruit plants and commercial purpose plants on the basis of monocotyledons and dicotyledons.



**Suggested Assignments:** Definition and characters of living organisms

## Unit-II

**CO-BP106-2:** To know the composition of blood, digestion and respiration in humans.

Item	Approx Hrs
Lecture & Tutorial	7
Practical(P)	6
SW	2
SL	1
Total:	16

Session Outcomes(SOs)	Laboratory Instruction (LI)	Classroom Instruction ( CI)	Self Learning(SL)
<b>Theory</b> SO2.1: Composition of blood , blood groups, & Coagulation of blood. SO2.2: Structure of heart and blood vessel. SO2.3: Digestion , absorption and assimilation of digested food. SO2.4: Exchange of gases. <b>Practicals</b> SO-P-2.1: Determination of blood groups. SO-P-2.2- Determination of blood pressure . SO-P-2.3- Determination of tidal volume.	2.1: Blood sample collected Carefully. 2.2: To study about blood groups. <b>2.3:</b> To study about the working of sphygmomanometer. <b>2.4:</b> Blood pressure was determined. <b>2.5:</b> To study about the tidal volume.	2.1: Composition of blood, blood groups, coagulation of blood. 2.2: Composition and functions of lymph , Human circulatory system 2.3: Structure of human heart and blood vessels Cardiac cycle, cardiac output and ECG 2.4: Human alimentary canal and digestive glands, Role of digestive enzymes. 2.5: Digestion, absorption and assimilation of digested food. 2.6: Human respiration, mechanism. 2.7: Exchange of gases	<b>2.1:</b> What effects can occur if unmatched blood. Group is given to a patient. 2.2: Can read about how respiration occurs in different species.

**Suggested Assignments:** Body fluids and circulation

## Unit-III

**CO-BP106-3:** To understand excretory products and their elimination, neural control in human as well as reproductive systems of humans.

Item	Approx Hrs
Lecture & Tutorial	7
Practical(P)	6
SW	2
SL	1
Total:	16



Session Outcomes(SOs)	Laboratory Instruction (LI)	Classroom Instruction ( CI)	Self Learning(SL)
<b>Theory</b> <b>SO3.1:</b> Modes of excretion, Human excretory system, structure and function <b>SO3.2:</b> Modes of excretion, Human excretory system structure and function, generation and conduction of nerve impulse. <b>SO3.3:</b> Partsof female reproductive system, Parts of male reproductive system. <b>SO3.4</b> Spermatogenesis and Oogenesis, Menstrual. <b>Practical</b> <b>SO-P-3.1:</b> Detailed study of frog by using computer models.	3.1: Study about the frog by model.	<b>3.1:</b> Modes of excretion ,Human excretory,system. ,structure and function. 3.2. Urine Formation Rennin Angiotensin system 3.3Definition and classification of nervous system ,Structure of a neuron, Generation And conduction of nerve impulse. 3.4. Structure of brain and spinal cord, functions of cerebrum, cerebellum, hypothalamus and medulla oblongata. 3.5. Functions of hormones secreted by endocrine glands, Endocrine glands and their secretions 3.6. Parts of female reproductive system, Parts of male reproductive system. 3.7 Menstrual cycle, Spermatogenesis and Oogenesis	<b>3.1:</b> List the Different excretory Products that living organisms excrete.  3.2: Study about brain disease and Understand their mechanism



**Suggested Assignments:** Modes of excretion, Human excretory system

Unit-IV:

CO-BP106-4: To understand about plants with essential minerals and their related different cycles including photosynthesis

Item	Approx Hrs
Lecture & Tutorial	5
Practical(P)	2
SW	1
SL	1
Total:	9

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self Learning(SL)
Theory SO4.1: Essential mineral, micro nutrients. mineral, macro SO4.2 Nitrogen metabolism. Nitrogen cycle, biological nitrogen fixation. SO4.3 Photosynthesis pigments. PRACTICALS- SO-P-4.1. Study of cell and its inclusion.	4.1: Understand And read about the cell	4.1: Essential mineral, macro and micro nutrients. 4.2: Nitrogen metabolism, Nitrogen cycle, biological nitrogen fixation 4.3: Autotrophic nutrition. 4.4: photosynthesis, Photosynthetic pigments 4.5: Factors affecting photosynthesis.	4.1: Determine the effect the of the factor affecting photosynthesis.

**Suggested Assignments:** Essential mineral, macro and micro nutrients.



**Unit-V****CO-BP104-5: Understand the overall development of the plants.**

Item	Approx Hrs
Lecture & Tutorial	4
Practical(P)	0
SW	1
SL	1
Total:	6

Session outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self Learning (SL)
Theory SO5.1: Plant respiration. SO5.2: Plant growth and development. SO5.3: Cell the unit of life SO5.4: Tissues.	NA	5.1: Respiration, glycolysis, fermentation (anaerobic). 5.2: Phases and rate of plant growth, Condition of growth, Introduction to plant growth regulators 5.3: Structure and functions of cell and cell organelles & Cell division. 5.4: Definition, types of tissues, location and functions.	5.1: Read the names of diseases occurring in plants & their causes.

**Assignments:** Respiration & glycolysis



**Brief of Hours suggested for the Course Outcome**

<b>Course Outcomes</b>	<b>Class Lecture( CI)</b>	<b>(LI)</b>	<b>Sessional Work ( SW)</b>	<b>Self Learning (SI)</b>	<b>Total Hour (CI+SW+SI+ LI)</b>
CO-BP106-1: To understand about diversity in living world, five kingdom classification and morphology of different plants.	7	20	1	1	29
CO-BP106-2: To know the composition of blood, digestion and respiration in humans	7	6	2	1	16
CO-BP106-3: To understand excretory products and their elimination, neural control in human as well as reproductive systems of humans	7	2	1	1	11
CO-BP106-4: To understand about plants with essential minerals and their related different cycles including photosynthesis.	5	2	1	1	9
CO-BP106-5: Understand the overall development of the plants.	4	0	1	1	6
<b>Total Hours</b>	<b>30</b>	<b>30</b>	<b>6</b>	<b>5</b>	<b>71</b>



**Suggestion for End Semester Assessment  
Suggested Specification Table (For ESA)**

Course Outcome	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-BP106-1	: To understand about diversity in living world, five kingdom classification and morphology of different plants	08	06	01	15
CO-BP106-2:	To know the composition of blood, digestion and respiration in humans.	12	07	01	20
CO-BP106- 3:	To understand excretory products and their elimination, neural Control in human as well as Reproductive systems of humans.	02	06	02	10
CO-BP106- 4:	To understand about plants with essential minerals and their related different cycles including photosynthesis.	10	02	03	15
CO-BP106-5:	Understand the overall development Of the plants.	05	07	03	15
Total		37	28	10	75

Legend:

R: Remember,

U: Understand,

A: Apply

The end of semester assessment for Remedial Biology will be held with written examination of 75 marks

Note. Detailed assessment rubric need to be prepared by the course wise teachers for above tasks.

Teachers can also design different tasks as per requirement, for end semester assessment.

Suggested Instructional/Implementation Strategies:

1. Improved Lecture
2. Tutorial
3. Case Method
4. Group Discussion
5. Role Play
6. Demonstration
7. ICTBasedTeachingLearning(VideoDemonstration/TutorialsCBT,Blog,Facebook,Twitter, Whatsapp,Mobile,Onlinesources)
8. Brainstorming



### Suggested Learning resources

S.No.	Title	Author	Publisher	Edition & Year
1	Text book of Biology	S.B. Gokhale	Nirali prakashan	2019
2	A Text book of Biology	Naidu B.V. Sreenivasa	Bangalore prakashan sahitya	1988
3	A manual for pharmaceutical Biology practical	S.B.Gokhale and C.K.Kokate.	Nirali prakashan	58 Edition

### Curriculum Development Team:

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**Course Outcome, Program Specific Outcome& Program Outcome Mapping**

**Course Code: BP106RBT**

**Course Name: Remedial Biology**

Course Outcome	Program Outcome											Program Specific outcome			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
	Pharmacy knowledge	Planning Abilities	Problem analysis	Modern tool usage	Leadership skills	Professional Identity	Pharmaceutical Ethics	Communication	The pharmacist and society	Environment and sustainability	Life-long learning	Knowledge of drug discovery	Quality Analysis of API's	MOA of Drug	Biological evaluation of drug
<b>CO-1:</b> Classification and morphology of different plants	3	2	3	1	3	2	1	2	3	2	3	1	3	1	2
<b>CO-2:</b> The composition of blood, digestion and respiration in humans	2	3	1	3	1	2	1	1	2	3	3	3	2	1	3
<b>CO-3:</b> Reproductive system and elimination in humans	3	2	3	2	1	1	2	1	2	2	3	3	2	1	3
<b>CO-4:</b> Plants in their essential mineral and their different cycles.	2	3	2	3	1	3	2	2	3	3	3	3	2	1	3
<b>CO-5:</b> overall development of plants.	3	3	1	1	1	3	0	3	1	2	3	2	2	2	2



### Course Outcome & Program Outcome Mapping

#### Course Curriculum Mapping

Pos& PSOs No	Cos No&	Title	SOs No	Class Room Instructions	Laboratory Instructions	Self learning
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	<b>CO-BP10 6-1</b>	To understand about diversity in living world, five kingdom classification and morphology of different plants.	SO1.1 SO1.2 SO1.3 SO1.4	1.1,1.2,1.3,1.4,1.5,1.6,1.7	LI-1.1 LI-1.2 LI-1.3 LI-1.4	SI-1.1 SI-1.2
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	<b>CO-BP10 6-2</b>	To know the composition of blood, digestion and respiration in humans	SO-2.1 SO-2.2 SO-2.3 SO-2.4	2.1,2.2,2.3,2.4,2.5,2.6,2.7	LI-2.1 LI-2.2 LI-2.2 LI-2.4 LI-2.5	SI-2.1 SI-2.2
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	<b>CO-BP10 6-3</b>	Understand elimination, reproductive system and elimination in humans	SO-3.1 SO-3.2 SO-3.3 SO-3.4	3.1,3.2,3.3,3.4,3.5,3.6,3.7	LI-3.1	SI-3.1 SI-3.2
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	<b>CO-BP10 6-4</b>	Understand about plants in their essential mineral and their different cycles.	SO-4.1 SO-4.2 SO-4.3	4.1,4.2,4.3,4.4,4.5	LI-4.1	SI-4.1
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	<b>CO-BP10 6-5</b>	Understand the overall development of plants.	SO-5.1 SO-5.2 SO-5.3 SO-5.4	5.1,5.2,5.3,5.4		SI-5.1





AKS University  
Faculty of Pharmaceutical Science & Technology  
Rajiv Gandhi Institute of Pharmacy  
Curriculum of B. Pharmacy (Remedial Mathematics) Program  
(Revised as on 01 August 2023)

**Semester-I**

**Course Code:** BP 106RMT

**Course Title:** Remedial Mathematics

**Pre-requisite:** Students should have basic knowledge of whole numbers, counting, place value, rounding, exponents, and negative numbers; addition and subtraction; and multiplication and division.

**Rationale/Objectives:**

Upon completion of the course the student shall be able to:-

1. Know the theory and their application in Pharmacy
2. Solve the different types of problems by applying theory
3. Appreciate the important application of mathematics in Pharmacy

**Course Out comes:**

**CO1- BP 106 RMT 1:** Apply mathematical concepts and principles to perform computations for Pharmaceutical Sciences.

**CO2- BP 106RMT: 2.** Create, use and analyze mathematical representations and mathematical relationships

**CO3- BP 106RMT.3:** Communicate mathematical knowledge and understanding to help in the field of Clinic Pharmacy

**CO4- BP 106RMT.4:** Explain the relationship between the derivative of a function as a function and the notion of the derivative as the slope of the tangent line to a function at a point.

**CO5- BP106RMT.5:** Distinguish between linear, nonlinear, partial and ordinary differential equations.



## Scheme of Studies

Course code	Title of the course	Progra m Name	TOTAL Number of contact hours/Week						Credit
			Classroom Instruction		Practic al(P)	S W	S L	Total Hour s (H)	
			Lectu re	Tutori al (A)					
BP 106RMT	Remedial Mathematics	B. Pharmacy	2	0	0	1	1	6	6

**Legend: CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others),

**LI:** Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)

**SW:** Sessional Work (includes assignment, seminar, mini project etc.),

**SL:** Self Learning, Credits.

**Note:** SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.



## Theory Assessment

Board of Study	Course Code	Course Title	Scheme of Assessment ( Marks )						
			Progressive Assessment ( PRA)						
			Academic activity, Any three (Quiz/ Assignment, open book test, filed work and seminar)	Student teacher	Class Attendance	(A) Total Marks	Sessional Exam (B)		
Pharmacy	BP 106 RMT	Remedial Mathematics	3	3	4	10	15	75	100

## Guidelines for the allotment of marks for attendance

Percentage of Attendance	Theory
95 – 100	4
90 – 94	3
85 – 89	2
80 – 84	1
Less than 80	0



**Course-Curriculum Detailing:**

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

**CO1-** BP 106RMT.1. Apply mathematical concepts and principles to perform computations for Pharmaceutical Sciences.

Item	Approx Hrs
Lecture	6
SW	1
SL	1
Total:	8

Session Outcomes(SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
<b>Theory</b> <b>SO1</b> Polynomial, Rational fractions <b>SO1.2:</b> Polynomial, Rational fractions  <b>SO1.3:</b> Understand the logarithms <b>SO1.4:</b> Understand the Definition of limit of a function		<b>Unit-1.0</b> 1.1 Introduction, Polynomial, Rational fractions Proper and Improper fractions, Partial fraction 1.2 Application of PartialFraction in Chemical Kinetics and Pharmacokinetics 1.3 Introduction, Definition, Theorems/Properties of logarithms, Common logarithms 1.4 Characteristic and Mantissa, worked examples application of logarithm to solve pharmaceutical problems 1.5 Real Valued function, Classification of real valued functions,  1.6 Introduction , Limit of a function Definition of limit of a function	<b>1.1:</b> Limit of a function <b>1.2:</b> Decide whether a given Real Valued function



**Suggested Assignments:** application of logarithm to solve pharmaceutical problems, Application of Partial fraction in Chemical Kinetics and Pharmacokinetics

## Unit II

**CO2-BP-106RMT.2: Create, use and analyze mathematical representations and mathematical relationships**

Item	Approx Hrs
Lecture & Tutorial	6
SW	1
SL	1
Total:	8

Session Outcomes(SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
<b>Theory</b> <b>SO1:</b> Matrices, Types of matrices <b>SO2:</b> Solution of system of linear of equations using matrix method  <b>SO1.3:</b> To perform the Cramer's rule		<b>Unit-2</b> 2.1 Introduction matrices, Types of matrices, Operation on matrices, 2. 2 Matrix Multiplication Solution of system of linear of equations using matrix method 2.3 Cayley–Hamilton theorem Application of Matrices in solving Pharmacokinetic equations 2.4 Introduction of Determinants, Properties of determinants 2.5 Product of determinants, Minors and co-Factors 2.2.6 Cramer's rule	SL.1 Study the Application of Matrices in solving Pharmacokinetic equations. SL.2 Understand the concept Minors and co-Factors

**Suggested Assignments:** Solution of system of linear of equations using matrix method, Cayley – Hamilton theorem Application of Matrices in solving Pharmacokinetic



## Unit II

**CO3- BP 106RMT 3.** Communicate mathematical knowledge and understanding to help in the field of Clinical.

Item	Approx Hrs
Lecture & Tutorial	5
SW	1
SL	1
Total:	7

Session Outcomes(SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
<p><b>SO1:</b> Derivative of the sum or difference of two functions</p> <p><b>SO2:</b> Conditions for a function to be a maximum or a minimum at a point.</p> <p><b>SO3:</b> Derivative of <math>x^n</math> w.r.t <math>x</math>, Derivative of <math>e^x</math></p>		<p>Unit-3.0 Calculus Differentiation</p> <p>3.1 Introductions, Derivative of a function, Derivative of a constant</p> <p>3.2 Derivative of a product of a constant and a function, Derivative of the sum or difference of two functions</p> <p>3.3 Derivative of the product of two functions (product formula), Derivative of the quotient of two functions (Quotient formula)</p> <p>3.4 Derivative of <math>x^n</math> w.r.t <math>x</math>, Derivative of <math>e^x</math>, Derivative of <math>\log_e x</math> Derivative of <math>a^x</math> Derivative of trigonometric functions from first principles</p> <p>3.5 Successive Differentiation, Conditions for a function to be a maximum or a minimum at a point.</p>	<p><b>SL.1</b> Study the various Derivative of a function</p> <p><b>SL.2</b> Understand the concept of product formula</p>

**Suggested Assignments:** Derivative of  $\log_e x$  Derivative of  $a^x$  Derivative of trigonometric functions from first principles, Successive Differentiation, Conditions for a function to be a maximum or a minimum at a point



## Unit IV

**CO4-BP106RMT.** 4. Explain the relationship between the derivative of a function as a function and the notion of the derivative as the slope of the tangent line to a function at a point.

Item	Approx Hrs
Lecture & Tutorial	5
SW	1
SL	1
Total:	7

Session Outcomes(SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
<b>Theory</b> <b>SO1</b> – intercept form of a straight line. <b>SO2</b> Method of Partial fractions <b>SO3:</b> Distance formula,		4.1 Signs of the Coordinates, Distance formula, <b>4.2</b> Slope or gradient of a straight line , Conditions for parallel and perpendicularity two lines, 4.3 Slope of a line joining two points, Slope – intercept form of a straight line 4.4 Introduction, Definition of integration , Standard formulae, Rules of integration. 4.5 Method of substitution, Method of Partial fractions Integration by parts, definite integrals, application.	<b>SL.1</b> Slope or gradient of a straight line. <b>SL.2</b> Understand the Integration by parts, <b>SL.3</b> definite integrals, application.

**Suggested Assignments:** Standard formulae, Rules of integration, Slope or gradient of a straight line , Conditions for parallel and perpendicularity two lines.



## **Unit V**

**CO5- BP 106RMT 5.** Distinguish between linear, nonlinear, partial and ordinary differential equations.

Item	Approx Hrs
Lecture & Tutorial	5
SW	1
SL	1
Total:	7

Session Outcomes(SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
<b>Theory</b> <b>SO1:</b> To Know Exact equations. <b>SO2:</b> Homogeneous equations <b>SO3:</b> Equations in separable form,		5.1 Some basic definitions, Order and degree, Equations in separable form, 5.2 Homogeneous equations, linear Differential equations, 5.3 Exact equations Application in solving Pharmacokinetic equations 5.4 Introduction, Definition, Properties of Laplace Transforms of elementary Inverse Laplace transforms, Laplace transform of derivatives, 5.5 Application to solve Linear differential equations, Application in solving Chemical kinetics and Pharmacokinetics equations.	<b>SL.1</b> Understand the Order and degree, Equations in separable form. <b>SL.2</b> Understand the Laplace Transforms

**Suggested Assignments:** Application to solve Linear differential equations, Application in solving Chemical kinetics and Pharmacokinetics equations.



### Brief of Hours suggested for the Course Outcome

Course Out comes	Class Lecture (Cl)	Sessional Work (SW)	Self Learning (Sl)	Total Hour (Cl+SW+Sl+LI)
<b>CO- BP 106RMT -1:</b> Apply mathematical concepts and principles to perform computations for Pharmaceutical Sciences.	6	1	1	8
<b>CO-BP106RMT-2:</b> Communicate mathematical knowledge and understanding to help in the field of Clinical.	6	1	1	8
<b>CO- BP 106RMT -2:</b> Communicate Mathematical knowledge and understanding to help in the field of Clinical.	5	1	1	7
<b>CO- BP 106RMT- 4:</b> Explain the relationship between the derivative of a function as a function and the notion of the derivative as the slope of the tangent line to a function at a point.	5	1	1	7
<b>CO- BP 106RMT-5:</b> Distinguish between linear, nonlinear, partial and ordinary differential equations.	5	1	1	7
<b>Total Hours</b>	<b>27</b>	<b>5</b>	<b>5</b>	<b>37</b>



## Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

Course Outcome	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
<b>CO- BP 106RMT -1:</b>	<b>1. Partial fraction 2. Logarithms 3. Function: 4. Limits and continuity</b>	08	06	01	15
<b>CO-BP106RMT -2:</b>	<b>Matrices and Determinant</b>	12	07	01	20
<b>CO- BP 106RMT -3:</b>	<b>Calculus</b>	02	06	02	10
<b>CO- BP 106RMT -4:</b>	<b>Analytical Geometry</b>	10	02	03	15
<b>CO- BP 106RMT -5:</b>	<b>Differential Equations Laplace Transform</b>	05	07	03	15
Total		37	28	10	75

**Legend: R: Remember, U: Understand, A:Apply**

The end of semester assessment for Remedial Mathematics –I will be held with written examination of 75 marks

**Note.** Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks. Teachers can also design different tasks as per requirement, for end semester assessment.

### Suggested Instructional/Implementation Strategies:

1. Improved Lecture
2. Tutorial
3. Case Method
4. Group Discussion
5. Role Play
6. Demonstration
7. ICT Based Teaching Learning (Video Demonstration/Tutorials CBT, Blog, Face book, Twitter, Whats app, Mobile, Online sources)
8. Brainstorming



### Suggested Learning Resources:

S. No.	Title	Author	Publisher	Edition & Year
1	Differential Calculus	<u>Shanti Narayan</u>	S Chand;	Fifteenth edition (1 January 1942)
2	Pharmaceutical Mathematics with application to Pharmacy	<u>D H Panchaksharappa Gowda</u>	Pharmamed Press	2014
3	Higher Engineering Mathematics	Dr.B.S.Grewal	KHANNA PUBLISHERS	43rd Edition 2015
4	Integral Calculus	Shanthinarayan ,	Schand	35th Edition
5	Remedial mathematics	Kumar and goyal dr. Vinod bais	s vikas and company	2017



### Course Outcome & Program Outcome& Program Specific outcome Mapping

Course Code: **BP106RT**

Course Name: **Remedial Math's**

Course Outcome	Program Outcome											Program Specific outcome			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
	Pharmacy knowledge	Planning Abilities	Problem analysis	Modern tool usage	Leadership skills	Professional Identity	Pharmaceutical Ethics	Communication	The pharmacist and society	Environment and sustainability	Life-long learning	Knowledge of drug discovery	Quality Analysis of API's	MOA of Drug	Biological evaluation of drug
<b>CO-1:</b> Differential	3	2	3	1	3	2	1	2	3	2	3	1	3	1	2
<b>CO-2:</b> Pharmaceutical Mathematics with application to Pharmacy	2	3	1	3	1	2	1	1	2	3	3	3	2	1	3
<b>CO-3:</b> Higher Engineering Mathematics	3	2	3	2	1	1	2	1	2	2	3	3	2	1	3
<b>CO-4:</b> Integral Calculus	2	3	2	3	1	3	2	2	3	3	3	3	2	1	3
<b>CO-5:</b> mathematics	3	3	1	1	1	3	1	3	1	2	3	2	2	2	2

**Legend: 1- Low, 2-Medium, 3-High**



### Course Curriculum Mapping

Pos& PSOs No	Cos No&	Title	SOs No	Class Room Instructions	Self learning
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	CO-BP106RMT - 1:	Partial fraction 2. Logarithms 3. Function: 4. Limits and continuity	SO1.1	1.1,1.2,1.3,1.4,1.5,1.6	SI-1.1
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	CO-BP106RMT - 2:	Matrices and Determinant	SO-2.1	2.1,2.2,2.3,2.4,2.5,2.6	SI-2.1
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	CO-BP106RMT - 3	Calculus	SO-3.1	3.1,3.2,3.3,3.4,3.5	SI3.1
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	CO-BP106RMT - 4	Analytical Geometry	SO-4.1	4.1,4.2,4.3,4.4,4.5	SI-4.1
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	CO-BP106RMT - 5	Differential Equations Laplace Transform	SO-5.1	5.1,5.2,5.3,5.4,5.5	SI-5.1





AKS University  
Faculty of Pharmaceutical Science & Technology  
Rajiv Gandhi Institute of Pharmacy  
Curriculum of B. Pharmacy (HAP-II) Program  
(Revised as on 01 August 2023)

**Course Code:** BP201T/BP207P

**Course Title:** Human Anatomy & Physiology-II

**Pre- requisite:** Student should have basic knowledge about structure & functions of the various systems of human body.

**Scope:** This subject is designed to impart fundamental knowledge on the structure and functions of the various systems of the human body. It also helps in understanding both homeostatic mechanisms. The subject provides the basic knowledge required to understand the various disciplines of pharmacy.

**Rationale/Objectives:** Upon completion of this course the student should be able to

1. Explain the gross morphology, structure and functions of various organs of the human body.
2. Describe the various homeostatic mechanisms and their imbalances.
3. Identify the various tissues and organs of different systems of human body.
4. Perform the various experiments related to special senses and nervous system.
5. Appreciate coordinated working pattern of different organs of each system

**Course Outcomes:**

**CO-BP 201.1:** To relate the basic knowledge about central nervous system including nervous tissue, brain & spinal cord.

**CO-BP201.2:** To illustrate the structure & functions of gastrointestinal tract & to learn about ATP/CTP/BMR.

**CO-BP201.3:** To learn about structure and functions of respiratory system and various mechanism involved in regulation of respiration and categorize the anatomy of urinary system and physiology of urine formation / micturition

**CO-BP201.4:** To appraise the essentiality of endocrine glands, their hormones and disorders.

**CO-BP201.5:** To predict the anatomy and physiology of male and female reproductive organs, pregnancy, process of delivery and concept of genetics.



**Scheme of Studies:**

Board of Study	Course Code	Course Title	Scheme of studies (Hours/Week)					Total Credits (C)
			CI (L+T)	LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	
Pharmacy	BP 201T	Human Anatomy & Physiology-II	4	4	1	1	10	6

**Legend:**

**CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others),

**LI:** Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)

**SW:** Sessional Work (includes assignment, seminar, mini project etc.),

**SL:** Self Learning,

**C:** Credits

**Note:** SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning



## Scheme of Assessment:

### Theory Assessment

Board of Study	Course Code	Course Title	Scheme of Assessment ( Marks )						
			Progressive Assessment ( PRA)						
			Academic activity, Any three (Quiz/ Assignment, open book test, filed work and seminar)	Student teacher interaction	Class Attendance(AT)	(A) Total Mark	Sessional Exam (B)	EndSemester Assessment(C)	Total Marks(A+B+C)
Pharmacy	BP 201T	Human anatomy & physiology-II	3	3	4	10	15	75	100

### Practical Assessment

Board of Study	Course Code	Course Title	Scheme of Assessment ( Marks )						Total Marks (A+B)
			Internal Assessment (A)			End Semester Examination(B)			
			Attendance	Record	Sessional Exam.				
						Synopsiss	Experimentt	Viva	
Pharmacy	BP-201P	Human Anatomy & Physiology -II	2	3	10	5	25	5	50

### Percentage of Attendance Theory /Practical

Sr. No	Percentage of Attendance	Theory	Practicals
1.	95 – 100	4	2
2	90 – 94	3	1.5
3.	85 – 89	2	1
4	80 – 84	1	0.5
5.	Less than 80	0	0



**CO-BP201.1:** To relate the basic knowledge about central nervous system including nervous tissue, brain & spinal cord.

Item	Approx Hrs
Lecture & Tutorial	10+3=13
Practical(P)	28
SW	2
SL	1
Total:	44

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
<b>Theory</b>  <b>SO1.1-</b> study of nervous system  <b>SO1.2-</b> Describe nerve impulse & action potential <b>SO1.3-</b> structure & function of brain <b>SO1.4-</b> structure & functions of spinal cord <b>SO1.5-</b> study of meninges & cerebro-spinal fluid <b>Practical</b>  <b>SO-P1.1</b> understand the structure of nervous system  <b>SO-P1.2</b> evaluate the general neurological examination for nervous system  <b>SO-P1.3</b> Evaluate the functions of olfactory nerve	1.1 To study the nervous system using specimen, models, etc.  1.2 To demonstrate the general neurological examination  <b>1.3.</b> To demonstrate the function of olfactory nerve.  1.4. To demonstrate the reflex activity  1.5. To examine the different types of taste.  1.6 To demonstrate the visual acuity  1.7 To study the integumentary and special senses using specimen, models, etc.	<b>Unit I-</b>  <b>Nervous system</b> 1.1 Organization of nervous system, 1.2 neuron, neuroglia, 1.3 classification and properties of nerve fibre, electrophysiology, T1-Tutorial I 1.4 action potential, nerve impulse, receptors, synapse, neurotransmitters. 1.5 Central nervous system: Meninges, ventricles of brain and cerebrospinal fluid.  1.6 structure and functions of brain (cerebrum, brain stem)  T2-Tutorial II 1.7 structure and functions of brain [cerebellum and Diencephalon]  1.8 spinal cord (gross structure, functions of afferent and efferent nerve tracts)  1.9 internal structure of spinal cord	1. Study of neuron & their types. 2. Organization of nervous system



<b>SO-P1.4</b> Understand the reflexes & their activities  <b>SO-P1.5</b> evaluate different types of taste  <b>SO-P1.6</b> evaluate the visual acuity  <b>SO-P1.7</b> Study of integumentary system & special sense organs		1.10 reflex activity & pathway  T3. Tutorial III	
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### Suggested Sessional work

- (A) Assignments:
1. Nervous system
  2. Nerve impulse
  3. Major parts of brain
  4. Structure & functions of cerebrum
  5. Structure & functions of spinal cord

**CO-BP201.2:** To illustrate the structure & functions of gastrointestinal tract & to learn about ATP/CTP/BMR.

Item	Approx hrs
Lecture & tutorial	6+3=9
practical	8
SW	2
SL	1
Total	20

Session outcomes (SOs)	Laboratory Instructions (LI)	Class room Instruction (CI)	Self-Learning (SL)
<b>Theory</b> <b>SO2.1.</b> study of digestive system & their various parts <b>SO2.2.</b> Understand the structure & functions of Stomach.	<b>2.1</b> Study of digestive, systems with the help of models, charts and specimens. <b>2.2</b> Recording of basal mass index	<b>Unit II</b> <b>● Digestive system</b> <b>2.1</b> Anatomy of GI Tract with special reference to anatomy and functions of stomach, (Acid production in the stomach, regulation of acid production through	<b>2.1</b> Study of various parts of GIT <b>2.2</b> Study of BMR



<b>SO2.3.</b> structure & functions of liver <b>SO2.4.</b> understand the process of digestion & absorption <b>SO2.5.</b> Describe the formation & role of ATP <b>Practical</b> <b>SO-P2.1</b> Understand the digestive system & their parts <b>SO-P2.2</b> Evaluate the recording of BMI		parasympathetic nervous system, pepsin role in protein digestion)  <b>2.2</b> Structure & functions of small intestine and large intestine <b>T1-Tutorial I</b> <b>2.3</b> anatomy and functions of salivary glands & pancreas <b>2.4</b> anatomy & physiology of liver, movements of GIT <b>T2-Tutorial II</b>  <b>2.5</b> digestion and absorption of nutrients and disorders of GIT.  • <b>Energetics</b> <b>2.6</b> Formation and role of ATP, Creatinine Phosphate and BMR.  <b>T3-Tutorial III</b>	
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### Suggested Sessional work

- (A) Assignments: 1. Digestive system  
 2. Structure & functions of liver  
 3. Structure & functions of pancreas  
 4. Digestion & absorption of nutrients  
 5. Formation & role of ATP

**CO-BP201.3. To learn about structure and functions of respiratory system and various mechanism involved in regulation of respiration and categorize the anatomy of urinary system and physiology of urine formation / micturition.**

Item	Approx hrs
Lecture & tutorial	10+3=13
practical	20
SW	2
SL	1
Total	36



Session outcomes (SOs)	Laboratory instruction (LI)	Class room instruction (CI)	Self Learning (SL)
<b>Theory</b> <b>SO3.1.</b> Introduction of respiratory system <b>SO3.2.</b> study of lung volume & capacities <b>SO3.3.</b> Description of mechanism of artificial respiration. <b>SO3.4.</b> study of urinary system <b>SO3.5.</b> Description of mechanism of urine formation <b>Practical</b> <b>SO-P3.1</b> Determine the tidal volume & vital capacity of lungs <b>SO-P3.2</b> understand the respiratory system & their functions <b>SO-P3.3</b> Study of vital organs & gonads <b>SO-P3.4</b> to evaluate body temperature <b>SO-P3.5</b> To understand the urinary system & their functions	3.1 Determination of tidal volume and vital capacity 3.2 Study of respiratory systems with the help of models, charts and specimens. 3.3 Permanent slides of vital organs and gonads 3.4 Recording of body temperature 3.5 Study of Urinary systems with the help of models, charts and specimens.	<b>Unit III</b> <b>Respiratory system</b> 3.1 Anatomy of respiratory system with special reference to anatomy of lungs 3.2 Mechanism of respiration, regulation of respiration 3.3 Lung Volumes and capacities & transport of respiratory gases, 3.4 Artificial respiration, and resuscitation methods. <b>T1-Tutorial I</b> <b>Urinary system</b> 3.5 Anatomy of urinary tract with special reference to anatomy of kidney & functions of kidney and urinary tract, 3.6 physiology of urine formation, 3.7 micturition reflex and role of kidneys in acid base balance, <b>T2-Tutorial II</b> 3.8 role of RAS in kidney 3.9 disorders of kidney. 3.10 structure of nephron <b>T3 –Tutorial III</b>	1. Study of respiratory system 2. study of structure of nephron

### Suggested Sessional work

- (A) Assignments:
1. structure of nephron
  2. Respiratory system
  3. Artificial respiration
  4. urinary system
  5. Physiology of urine formation



**CO-BP201.4:** To appraise the essentiality of endocrine glands, their hormones and disorders.

Item	Approx hrs
Lecture & tutorial	10+3=13
Practical	8
SW	1
SL	1
Total	23

Session outcomes(SOs )	Laboratory instruction(LI)	Class room instruction( CL)	Self Learning (SL)
<b>Theory</b> <b>SO4.1.</b> Introduction of endocrine system <b>SO4.2.</b> study of various Endocrine glands & their hormones. <b>SO4.3.</b> study of pituitary gland & their disorders <b>SO4.4</b> study of adrenal gland & their disorders <b>Practical</b> <b>SO-P4.1</b> study of endocrine system <b>SO-P4.2</b> Understand the positive & negative feedback system	<b>4.1</b> To study the endocrine system using specimen, models, etc. <b>4.2</b> To demonstrate positive and negative feedback mechanism	<b>Endocrine system</b> 4.1 Classification of hormones, mechanism of hormone action, 4.2 structure & functions of pituitary gland 4.3 disorders of pituitary gland T1-Tutorial I 4.4 structure, functions & disorders of thyroid gland 4.5 structure, functions & disorders of parathyroid gland 4.6 structure & functions of adrenal gland 4.7 disorders of Adrenal gland T2-Tutorial II 4.8 structure, functions & disorders of pancreas, 4.9 structure, functions & disorders of pineal gland 4.10 structure, functions & disorders of thymus & gonads. T3-Tutorial III	<b>4.1.</b> Study of endocrine system. <b>4.2.</b> study of structure & functions of pituitary gland

#### Suggested Sessional work

- (A) Assignments:
1. Classification of hormones
  2. Pituitary gland & their disorders
  3. Structure & functions of Adrenal gland
  4. Structure & functions of pancreas



**CO-BP201.5: To predict the anatomy and physiology of male and female reproductive organs, pregnancy, process of delivery and concept of genetics.**

Item	Approx hrs
Lecture & tutorial	9+3=12
practical	8
SW	2
SL	1
Total	23

Session outcomes (SOs)	Laboratory instruction (LI)	Class room instruction (CL)	Self-Learning(SL)
<b>Theory</b> <b>SO5.1.</b> Structure & functions of male reproductive system <b>SO5.2.</b> Structure & functions of female reproductive system <b>SO5.3.</b> Description of spermatogenesis & oogenesis <b>SO5.4.</b> Pregnancy & their mechanism <b>SO5.5.</b> introduction of Genetics <b>Practical</b> <b>SO-P5.1</b> Study of family planning devices & pregnancy diagnosis test <b>SO-P5.2</b> Study of reproductive system & their functions	<b>5.1</b> Study of family planning devices and pregnancy diagnosis test. <b>5.2</b> Study of reproductive system with the help of models, charts and specimens.	<b>Reproductive system</b> 5.1 Anatomy of male reproductive system 5.2 Anatomy of female reproductive system, 5.3 Functions of male and female reproductive system, sex hormones T1-Tutorial I 5.4 physiology of menstruation, fertilization, 5.5 Spermatogenesis & Oogenesis, 5.6 pregnancy and their maintenance T2-Tutorial II 5.7 mechanism of parturition <b>Introduction to genetics</b> 5.8 Chromosomes, genes and DNA, protein synthesis, 5.9 Genetic pattern of inheritance. T3-Tutorial III	<b>5.1.</b> study of male & female reproductive parts <b>5.2.</b> study of structure of DNA & CHROMOSOMES

**Suggested Sessional work**

- (A) Assignments:
1. Structure & functions of male reproductive system
  2. pregnancy & their maintenance
  3. Genetic pattern of inheritance
  4. Structure & functions of male reproductive system



**Brief of Hours suggested for the Course Outcome**

Course outcome	Class Lecture (CL)+ Tutorial	L1	Sessional Work (SW)	Self Learning (SL)	Total hour (CL+L1+SW+SL)
CO-BP101.1 To relate the basic knowledge about central nervous system including nervous tissue, brain & spinal cord.	13	28	2	1	44
CO-BP201.2. To illustrate the structure & functions of gastrointestinal tract & to learn about ATP/CTP/BMR.	9	8	2	1	20
CO-BP201.3. To learn about structure and functions of respiratory system and various mechanism involved in regulation of respiration and categorize the anatomy of urinary system and physiology of urine formation / micturition.	13	20	2	1	36
CO-BP201.4. To appraise the essentiality of endocrine glands, their hormones and disorders.	13	8	1	1	23
CO-BP201.5. To predict the anatomy and physiology of male and female reproductive organs, pregnancy, process of delivery and concept of genetics.	12	8	2	1	23
<b>Total hours</b>	<b>60</b>	<b>72</b>	<b>9</b>	<b>5</b>	<b>146</b>



## Suggestion for End Semester Assessment

**Suggested Specification Table (For ESA)**

CO	Unit Titles	Marks Distribution			Total Marks
		A	C	I	
COBP201-1	. To relate the basic knowledge about central nervous system including nervous tissue, brain & spinal cord.	08	06	01	15
COBP201-2	To illustrate the structure & functions of gastrointestinal tract & to learn about ATP/CTP/BMR.	06	08	01	15
COBP201-3	To learn about structure and functions of respiratory system and various mechanism involved in regulation of respiration and categorize the anatomy of urinary system and physiology of urine formation / micturition.	06	07	02	15
COBP201-4	To appraise the essentiality of endocrine glands, their hormones and disorders.	10	2	3	15
COBP201-5	To predict the anatomy and physiology of male and female reproductive organs, pregnancy, process of delivery and concept of genetics	05	07	3	15
Total		35	30	10	75

**Legend:**     *A: Analyze,*                      *C: Create,*                      *I: Interpret*

The end of semester assessment for Human Anatomy & Physiology-II will be held with written examination of 75 marks

**Note.** Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks. Teachers can also design different tasks as per requirement, for end semester assessment.

### **Suggested Instructional/Implementation Strategies:**

1. Improved Lecture
2. Tutorial
3. Case Method
4. Group Discussion
5. Role Play
6. Demonstration
7. ICT Based Teaching Learning (Video Demonstration/Tutorials CBT, Blog, Facebook, Twitter, WhatsApp, Mobile, Online sources)
8. Brainstorming



**Suggested Learning Resources:**

<b>S. No.</b>	<b>Title</b>	<b>Author</b>	<b>Publisher</b>	<b>Edition &amp; Year</b>
1	Essentials of Medical Physiology	K. Sembulingam and P. Sembulingam	Jaypee brothers medical publishers, New Delhi	8 <sup>th</sup> edition, 2019
2	Anatomy and Physiology in Health and Illness	Kathleen J.W. Wilson	Churchill Livingstone, New York	14 <sup>th</sup> edition 2022
3	Physiological basis of Medical Practice	Best and Taylor	Williams & Wilkins Co, Riverview, MI USA	13 <sup>th</sup> edition 2011
4	Text book of Medical Physiology	Arthur C, Guyton and John E. Hall	Miamisburg, OH, U.S.A.	14 <sup>th</sup> edition 2020
5	Principles of Anatomy and Physiology	Tortora Grabowski	Palmetto, GA, U.S.A.	16 <sup>th</sup> edition 2023
6	Textbook of Human Histology	Inderbir singh	Jaypee brother's medical publishers, New Delhi.	7 <sup>th</sup> edition 2014
7	Textbook of Practical Physiology,	C.L. Ghai	Jaypee brother's medical publishers, New Delhi.	9 <sup>th</sup> edition 2018
8	Practical workbook of Human Physiology	K. Srinageswari and Rajeev Sharma	Jaypee brother's medical publishers, New Delhi.	1 <sup>st</sup> edition 2006
9	Human Physiology (vol 1 and 2)	Dr. C.C. Chatterjee	Academic Publishers Kolkata	14 <sup>th</sup> edition 2022

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**Course Outcome, Program Specific Outcome& Program Outcome Mapping**

Course Code: BP201T/BP207P

Course Name Human Anatomy & Physiology-II

Course Outcome	Program Outcome											Program Specific outcome			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
	Pharmacy knowledge	Planning Abilities	Problem analysis	Modern tool usage	Leadership skills	Professional Identity	Pharmaceutical Ethics	Communication	The pharmacist and society	Environment and sustainability	Life-long learning	Knowledge of drug discovery	Quality Analysis of API's	MOA of Drug	Biological evaluation of drug
<b>CO-1:</b> central nervous system including nervous tissue, brain & spinal cord.	3	2	1	1	3	2	1	2	3	2	3	1	3	1	2
<b>CO-2:</b> structure & functions of gastrointestinal tract & to learn ATP/CTP/BMR	2	3	1	3	2	2	1	1	2	3	2	3	2	1	3
<b>CO-3:</b> respiratory system, urinary system and physiology of urine formation / micturition	3	2	1	2	2	1	2	1	2	2	2	3	2	1	3
<b>CO-4:</b> Essentiality of endocrine glands, their hormones and disorders	2	1	2	3	1	3	2	2	3	3	2	3	2	1	3
<b>CO-5:</b> anatomy and physiology of male and female reproductive organs, pregnancy,	3	1	1	1	1	3	1	3	1	2	3	2	2	1	1

**Legend: 1- Low, 2-Medium, 3-High**



### Course Curriculum Mapping

Pos& PSOs No	Cos No&	Title	SOs No	Class Room Instructions	Laboratory Instructions	Self learning
Pos:1,2,3,4,5,6,7, 8,9,10,11 PSOs:1,2,3,4,5,6	CO-1	To relate the basic knowledge about central nervous system including nervous tissue, brain & spinal cord.	SO1.1 SO1.2 SO1.3 SO1.4 SO1.5	1.1,1.2,1.3,1.4,1.5,1.6,1.7,1.8,1.9,1.10 T1, T2, T3	LI-1.1 LI-1.2 LI-1.3 LI-1.4 LI-1.5 LI-1.6 LI-1.7	SI-1.1 SI-1.2
Pos:1,2,3,4,5,6,7, 8,9,10,11 PSOs:1,2,3,4,5,6	CO-2	To illustrate the structure & functions of gastrointestinal tract & to learn about ATP/CTP/BMR.	SO-2.1 SO-2.2 SO-2.3 SO-2.4 SO-2.5	2.1,2.2,2.3,2.4,2.5,2.6, T1, T2, T3	LI-2.1 LI-2.2	SI-2.1 SI-2.2
Pos:1,2,3,4,5,6,7, 8,9,10,11 PSOs:1,2,3,4,5,6	CO-3	To learn about structure and functions of respiratory system and various mechanism involved in regulation of respiration and categorize the anatomy of urinary system and physiology of urine formation / micturition.	SO-3.1 SO-3.2 SO-3.3 SO-3.3 SO-3.4 SO-3.5	3.1,3.2,3.3,3.4,3.5,3.6,3.7,3.8,3.9,3.10 T1, T2, T3	LI-3.1 LI-3.2 LI-3.3 LI-3.4 LI-3.5	SI-3.1 SI-3.2
Pos:1,2,3,4,5,6,7, 8,9,10,11 PSOs:1,2,3,4,5,6	CO-4	To appraise the essentiality of endocrine glands, their hormones and disorders.	SO-4.1 SO-4.2 SO-4.3 SO-4.4	4.1,4.2,4.3,4.4,4.5,4.6,4.7,4.8., 4.9, 4.10 T1, T2, T3	LI-4.1 LI-4.2	SI-4.1 SI-4.2
Pos:1,2,3,4,5,6,7, 8,9,10,11 PSOs:1,2,3,4,5,6	CO-5	To predict the anatomy and physiology of male and female reproductive organs, pregnancy, process of delivery and concept of genetics	SO-5.1 SO-5.2 SO-5.3 SO-5.4 SO-5.5	5.1,5.2,5.3,5.4,5.5,5.6,5.7,5.8, 5.9, T1, T2, T3	LI-5.1 LI-5.2	SI-5.1 SI-5.2





AKS University  
Faculty of Pharmaceutical Science & Technology  
Rajiv Gandhi Institute of Pharmacy  
Curriculum of B. Pharmacy (Pharmaceutical organic chemistry - I) Program  
**Curriculum of B. Pharmacy Program (Revised as on 01 August 2023)**  
**Semester-II**

**Course Code:** BP202T/BP208P

**Course Title:** Pharmaceutical Organic Chemistry - I

**Pre-requisite:** The Student should have basic knowledge of organic substance with their importance and Uses.

**Rationale/Objective s:** Up on completion of the course student shall be able to

- To understand the sources of impurities and methods to determine the impurities in drugs.
- To Use different chemical methods to prepare organic pharmaceuticals.
- Understand the medicinal and pharmaceutical importance of organic compounds

**Course Out comes:**

**CO- BP202T -1:** To understand the Classification, nomenclature and isomerism of organic compound

**CO- BP202T -2:** To understand the alkanes, alkenes and conjugated dienes

**CO- BP202T -3:** To use different, kinetics, order of reactivity of alkyl-halides and Alcohols

**CO- BP202T -4:** Understand the Carbonyl compounds\*(Aldehydes and ketones), Nucleophilic addition reaction.

**CO- BP202T -5:** Understand the Carboxylic acids and aliphatic amines.



## Scheme of Studies

Course code	Title of the course	ProgramName	TOTAL Number of contact hours/Week						Credit
			Classroom Instruction (A)		Practical (P)	SW	SL	Total Hours (H)	
			Lecture	Tutorial					
BP202T	Pharmaceutical Organic Chemistry-1 Theory	B. Pharmacy	3	1	4	1	1	10	6

### Legend:

**CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others,

**LI:** Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)

**SW:** Sessional Work (includes assignment, seminar, mini project etc.),

**SL:** Self Learning, Credits.

**Note:** SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.



## Theory Assessment

Board of Study	Course Code	Course Title	Scheme of Assessment ( Marks )					End semester Assessment (C)	Total Marks(A+B+C)
			Progressive Assessment ( PRA)						
			Academic activity,Any three (Quiz/ Assignment, open book test, filed work and seminar)	Student teacher interaction	Class Attendance (AT)	Total Marks	Sessional Exam (B)		
Pharmacy	BP202T	Pharmaceutical Organic Chemistry-1	3	3	4	10	15	75	100



## Practical Assessment

Board of Study	Course Code	Course Title	Scheme of Assessment ( Marks )						
			Internal Assessment (A)			End Semester Examination(B)			Total Marks (A+)
			Attendance	Record	Sessional Exam.	Synopsis	Experiment	Viva	
Pharmacy	BP202T	Pharmaceutical Organic Chemistry-I	2	3	10	5	25	5	50

### Guidelines for the allotment of marks for attendance

Percentage of Attendance	Theory	Practical
95 – 100	4	2
90 – 94	3	1.5
85 – 89	2	1
80 – 84	1	0.5
Less than 80	0	0



**Course Curriculum Detailing:**

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

CO-BP202-1: to understand the reaction of benzene for synthesis of product in medical field.

Item	Approx Hrs
Lecture & Tutorial	10+3=13
Practical(P)	16
SW	1
SL	1
Total:	31

Session Outcomes(SO)	Laboratory Instruction(LI)	Class room Instruction(CI)	Self Learg (SL)
<b>Theory</b> <b>SO1.1:</b> Understand Classification of Organic Compounds <b>SO1.2:</b> Explain Common and IUPAC systems of nomenclature of organic compounds SO1.3 Structural isomerism's in organic compounds <b>Practical</b> <b>SO-P- 1.1:</b> To Systematic qualitative analysis of unknown organic compounds <b>SO-P- 1.2:</b> To Preliminary test: Color, odour, aliphatic/aromatic compounds, saturation and unsaturation, etc.	<b>1.1:</b> Explain hemicyclic compound.  <b>1.2</b> Explain cyclic compound	Unit- 1 1.1 what is organic compound. 1.2 Classification of organic compound. 1.3 saturated hydrocarbon 1.4 un-saturated hydrocarbon 1.5 IUPAC Nomenclature of organic compound. 1.6 what is Isomerism 1.7 classification of Isomerism 1.8 Structural Isomerism 1.9 classification of Structural Isomerism. 1.10 Tautomerism  1T.1: to study of alkane, alkene, alkynes	Classification of Organic Compounds



<b>1.3:</b> Explain homo-cyclic compound.  <b>1.4</b> Explain cyclic compound		<b>1T.2:</b> study of open chain compound and closed chain compound.  <b>1T3:</b> Chain and Ring chain Isomerism	
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**Suggested Assignments:** Discuss Common and IUPAC systems of nomenclature of organic compounds

## Unit II

**CO-BP202-2: To understand the alkenes, alkenes and conjugated dines**

Item	Approx Hrs
Lecture & Tutorial	10+3=13
Practical(P)	8
SW	1
SL	1
Total:	23



Session Outcomes(SO)	Laboratory Instruction(LI)	Class room Instruction(CI)	Self Learning(SL)
<b>Theory</b> <b>SO2.1:</b> Understand the $sp^3$ hybridization in alkanes, Halogenations of alkenes, uses of paraffin's. <b>SO2.2:</b> Stabilities of alkenes, $sp^2$ hybridization in alkenes <b>SO2.3:</b> Explain $E_1$ and $E_2$ reactions – kinetics, order of reactivity of alkyl halides. <b>SO2.4:</b> rearrangement of carbocations, Saytzeffs orientation. <b>SO2.5:</b> Understand and explain of Markownikoff's orientation, Anti Markownikoff's orientation.  <b>Practical</b> <b>SO-P- 2.1:</b> Detection of elements like Nitrogen, Sulphur and Halogen, by Lassaigne's test  <b>SO-P-2.2:</b> Solubility test	Detection of elements  like Nitrogen, Sulphur and Halogen, by Lassaigne's test.  Solubility test	Unit-2 <b>2.1</b> $sp^3$ hybridization in alkanes, Halogenation of alkanes, uses of paraffins.  <b>2.2</b> Stabilities of alkenes, Stabilities of alkenes,  <b>2.3</b> $sp^2$ hybridization in alkenes. $E_1$ and $E_2$ reactions  <b>2.4</b> kinetics, order of reactivity of alkyl halides,  <b>2.5</b> rearrangements of carbocations, Saytzeffs orientation and evidences.  <b>2.6</b> $E_1$ verses $E_2$ reactions, Factors affecting $E_1$ and $E_2$ reactions.  <b>2.7</b> Ozonolysis, electrophilic addition reactions of alkenes, <b>2.8</b> Markownikoff's orientation, free radical addition reactions of alkenes, Anti Markownikoff's orientation. <b>2.9</b> Stability of conjugated dienes, Diel-Alder, electrophilic addition, <b>2.10</b> free radical addition reactions of conjugated dienes, allylic rearrangement  <b>2T.1:</b> free radical addition reactions of alkenes,  <b>2T.2:</b> Stability of conjugated dienes ,  <b>2T3</b> Diel-Alder, electrophilic addition.	2.1: Study the $E_1$ and $E_2$ reactions – kinetics, order of reactivity of alkyl halides.

**Suggested Assignments:** Discuss Mark ownik off's orientation, Anti Markownikoff's orientation



### Unit III

**CO-BP202-3: to use different, kinetics, order of reactivity of alkyl halides and alcohols.**

Item	Approx Hrs
Lecture & Tutorial	10+3=13
Practical(P)	12
SW	1
SL	1
Total:	27

Session Outcomes(SOs)	Laboratory Instruction(LI)	Hom Instruction(CI)	Self Learning (SL)
<p><b>Theory</b></p> <p>SO3.1 Understand of SN<sub>1</sub> and SN<sub>2</sub> reactions - kinetics, order of reactivity of alkyl halides.</p> <p>SO3.2 stereochemistry and rearrangement of carbo-cations.</p> <p>SO3.3 Explain SN<sub>1</sub> versus SN<sub>2</sub> reactions, Factors affecting SN<sub>1</sub> and SN<sub>2</sub> reactions.</p> <p>SO3.4 Explain Qualitative tests, Structure and uses of alcohol</p> <p>SO3.5 Structure and uses of ethyl chloride, Chloroform,</p> <p><b>Practical</b></p> <p><b>SO-P- 3.1:</b> Determination of Functional group test like Phenols, Amides/ Urea,</p> <p><b>SO-P- 3.2:</b> Determination of Melting point/Boiling point of organic compounds</p>	<p><b>3.3.</b> Determination of Functional group test like Nitro compounds and anilines.</p>	<p><b>3.1</b> SN<sub>1</sub> and SN<sub>2</sub> reactions</p> <p>3.2 kinetics, order of reactivity of alkyl halides,</p> <p>3.3 stereochemistry and rearrangement of carbocations.</p> <p>3.4 SN<sub>1</sub> versus SN<sub>2</sub> reactions, Factors affecting SN<sub>1</sub> and SN<sub>2</sub> reactions</p> <p>3.5 Structure and uses of ethyl chloride,</p> <p>3.6 Chloroform, trichloroethylene, tetra chloro ethylene,</p> <p>3.7 dichloromethane, tetra chloromethane and iodo form.</p> <p>3.8 Alcohols*- Qualitative tests, Structure and uses of Methyl alcohol,</p> <p>3.9 Qualitative tests, Structure and uses of chlorobutanol, Ceto-steryl alcohol,</p>	<p><b>3.1:</b> Structure and uses of ethyl chloride, Chloroform,</p>



<b>SO-P-3.3:</b> Determination of Functional group test like Nitro compounds and anilines.		3.10 Benzyl alcohol, Glycerol, Propylene  <b>3T.1:</b> Tutorial Class Qualitative tests, Structure and uses of Ethyl alcohol.  <b>3T.2:</b> Tutorial class Introduction of alkyl halide  <b>3T3:</b> Tutorial class Properties of alcohols.	
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**Suggested Assignments:** Discuss Qualitative tests, Structure and uses of Ethylalcohol, Methyl alcohol,

**Unit IV: CO-BP202-4: : Understand the Carbonyl compounds\*(Aldehydes and ketones), Nucleophilic addition reaction.**

Item	Approx Hrs
Lecture & Tutorial	10
Practical(P)	8
SW	1
SL	1
Total:	20



Session Outcomes (SOs)	Laboratory Instruction(LI)	Class room Instruction(CI)	Self Learning (SL)
<p><b>Theory</b>  SO4.1 Understand of Nucleophilic addition reaction . Electromeric effect, aldol condensation, Crossed aldol condensation.</p> <p>SO4.2 Explain Cannizzaro reaction, Crossed Cannizzaro reaction, Benzoin condensation.</p> <p>SO4.3 Explain Perkin condensation, qualitative tests, Structure and uses of Formaldehyde, Paraldehyde.</p> <p>SO4.4 Explain Acetone, Chloral hydrate, Hexamine.</p> <p>SO4.5 Benzaldehyde, Vanilin, Cinnamaldehyde.</p> <p><b>Practical</b>  <b>SO-P- 4.1:</b> Functional group test like Aldehydes and Ketones, Esters.  <b>SO-P- 4.2:</b> student are perform to Identification of the unknown compound from the literature using melting point/ boiling point.</p>	<p>Functional group test like aldehydes and ketones, esters.</p> <p>: Identification of the unknown compound from the literature using melting point/ boiling point.</p>	<p><b>Unit-4</b></p> <p><b>4.1 Introduction of carbonyl compound</b></p> <p><b>4.2</b> Nucleophilic addition,</p> <p><b>4.3</b> Electrometric effect</p> <p><b>4.4</b> aldol condensation, Crossed Aldol condensation,</p> <p><b>4.5</b> Cannizzaro reaction, Crossed Cannizzaro reaction,</p> <p><b>4.6</b> Benzoin condensation, Perkin condensation,</p> <p><b>4.7</b> qualitative tests, Structure and uses of Formaldehyde,</p> <p><b>4.8</b> Paraldehyde, Acetone, Chloral hydrate.</p> <p><b>4.9</b> Hexamine, Benzaldehyde,</p> <p><b>4.10</b> Vanilin, Cinnamaldehyde.</p> <p><b>4T1:</b> Properties of Aldehyde</p> <p><b>4T.2:</b> Properties of ketone</p> <p><b>4T3:</b> Properties of Acetone.</p>	<p><b>4.1</b> Perkin condensation, qualitative tests, Structure and uses of Formaldehyde, Paraldehyde</p>

**Suggested Assignments:** Discuss Nucleophilic addition, Electrometric effect.



**Unit V**

CO-BP202-5: Understand the Carboxylic acids and aliphatic amines.

Item	Approx Hrs
Lecture & Tutorial	8+2=10
Practical(P)	8
SW	1
SL	1
Total:	20

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
<p><b>Theory</b></p> <p>SO5.1 Understand Acidity of carboxylic acids, effect of substituents on acidity.</p> <p>SO5.2 Explain inductive effect and qualitative tests for carboxylic acids, amide and ester.</p> <p>SO5.3 Structure and Uses of Tartaric acid, Citric acid, Succinic acid. Oxalic acid, Salicylic acid, Benzoic acid,</p> <p>SO5.4 Explain Dimethyl phthalate, Methyl salicylate and Acetyl salicylic acid</p> <p>SO5.5 Understand and explain <b>Aliphatic amines*</b> - Basicity, effect of substituent on Basicity.</p> <p><b>Practical</b></p> <p><b>SO-P- 5.1:</b> Functional group test like amines, Nitro compounds and Anilides.</p> <p><b>SO-P- 5.2:</b> student are perform to Identification of the unknown organic compound.</p>	<p><b>5.1:</b> Functional group test like amines, Nitro compounds and Anilides.</p>	<p><b>5.1 Introduction of Carboxylic acid</b></p> <p><b>5.2</b> Acidity of carboxylic acid</p> <p><b>5.3</b> effect of substituents on acidity</p> <p><b>5.4</b> inductive effect and qualitative tests for carboxylic acid.</p> <p><b>5.5</b> amide and ester</p> <p><b>5.6</b> Structure and Uses of Acetic acid, Lactic acid.</p> <p><b>5.7</b> Tartaric acid, Citric acid, Succinic acid.</p> <p><b>5.8</b> Oxalic acid, Salicylic acid, Benzoic acid</p> <p><b>5.9</b> Benzyl benzoate, Dimethyl phthalate,</p> <p><b>5.10</b> Methyl salicylate and Acetyl salicylic acid</p> <p><b>5T1:</b> Tutorial Class Introduction of aliphatic amines.</p> <p><b>5T.2:</b> Tutorial class Basicity, effect of substituent on Basicity.</p> <p><b>5T3 :</b> Qualitative test, Structure and uses of Ethanolamine, Ethylenediamine, Amphetamine</p>	<p><b>5.1:</b> Explain Aliphatic amines - Basicity, effect of substituent on Basicity.</p>



### Brief of Hours suggested for the Course Outcome

Course Out comes	Class Lecture (Cl)	(L)	Sessional Work (SW)	Self Learning (Sl)	Total Hour (Cl+SW+Sl+LI)
<b>CO-BP202-1:</b> To understand the Classification, nomenclature and isomerism of organic compound	13	16	1	1	31
<b>CO-BP202-2:</b> To understand the alkanes, alkenes and conjugated dienes	13	8	1	1	23
<b>CO-BP202-3:</b> To use different kinetics order of reactivity alkyl halide and alcohol.	13	12	1	1	27
<b>CO-BP202-4:</b> Understand the Carbonyl compounds*(Aldehydes and ketones), Nucleophilic addition reaction.	10	8	1	1	20
<b>CO-BP202-5:</b> Understand the Carboxylic acids and Aliphatic amines.	10	0	1	1	20
<b>Total Hours</b>	59	44	5	5	121



### Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

Course Outcome	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-BP202-1:	To understand the classification, nomenclature and isomerism of organic compound	08	06	01	15
COBP202-2:	To understand the alkanes, alkenes and conjugated dienes	12	07	01	20
COBP202-3:	To use different kinetics order of reactivity alkyl halide and alcohol.	02	06	02	10
COBP202-4:	Understand the Carbonyl compounds (Aldehydes and ketones), Nucleophilic addition reaction.	10	02	03	15
COBP202-5:	Understand the Carboxylic acids and Aliphatic amines.	05	07	03	15
<b>Total</b>		<b>37</b>	<b>28</b>	<b>10</b>	<b>75</b>

**Legend: R: Remember, U: Understand, A:Apply**

The end of semester assessment for Pharmaceutical Organic chemistry I will be held with written examination of 75 marks

**Note.** Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks. Teachers can also design different tasks as per requirement, for end semester assessment.

**Suggested Instructional/Implementation Strategies:**

1. Improved Lecture
2. Tutorial
3. Case Method
4. Group Discussion
5. Role Play
6. Demonstration
7. ICT Based Teaching Learning (Video Demonstration/Tutorials CBT, Blog, Face book, Twitter, Whats app, Mobile, Online sources)
8. Brainstorming



**Suggested Learning Resources:**

<b>S. No.</b>	<b>Title</b>	<b>Author</b>	<b>Publisher</b>	<b>Edition &amp; Year</b>
1	Advanced Organic Chemistry	Morrison Boyd	Pearson education	Revised edition edition 2010
2	A Text book of Organic Chemistry	Arun Bahl , B.S Bahl	S.Chand	Revised edition, 2019
3	Organic Chemistry	P.L. Soni	Sultan Chand,	1983
4	Organic Chemistry	R. T. Morrison and R. N. Boyd	Prentice -Hall	6th Edition 2007
5	Advanced organic chemistry	Dr. Jagdamba singh, Dr. LDS Yadav	Pragati prakashan	Revised edition 2016
6	Organic Chemistry	J. Clayden	Oxford Press	Revised edition

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**Course Outcome, Program Specific Outcome & Program Outcome Mapping**

**Course Code: BP202T/BP208P**

**Course Name: Pharmaceutical Organic Chemistry - I**

Course Outcome	Program Outcome											Program Specific outcome			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
	Pharmacy knowledge	Planning Abilities	Problem analysis	Modern tool usage	Leadership skills	Professional Identity	Pharmaceutical Ethics	Communication	The pharmacist and society	Environment and sustainability	Life-long learning	Knowledge of drug discovery	Quality Analysis of API's	MOA of Drug	Biological evaluation of drug
<b>CO-1:</b> To understand the Classification, nomenclature and isomerism of organic compound	3	2	3	1	3	2	1	2	3	2	3	1	3	1	2
<b>CO-2:</b> To understand the alkanes, alkenes and conjugated dienes	2	3	1	3	0	2	0	1	2	3	3	3	2	1	3
<b>CO-3:</b> To use different, kinetics, order of reactivity of alkyl-halides and alcohols	3	2	3	2		1	2	1	2	2	3	3	2	1	3
<b>CO-4:</b> Understand the Carbonyl compounds*(Aldehydes and ketones), Nucleophilic addition reaction.	2	3	2	3	1	3	2	2	3	3	3	3	2	1	3
<b>CO-5:</b> Understand the Carboxylic acids and aliphatic amines	3	3	1	1	1	3	0	3	1	2	3	2	2	2	2

**Legend: 1- Low, 2-Medium, 3-High**



### Course Curriculum Mapping

Pos& PSOs No	Cos No	Title	SOs No	Class Room Instructions	Laboratory Instructions	Self learning
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	<b>CO-BP202T-1</b>	To understand the Classification, nomenclature and isomerism of organic compound	SO1.1 SO1.2	1.1,1.2,1.3,1.4,1.5,1.6,1.7,1.8,1.9,1.10	LI1.1 LI1.2	SI-1.1 SI-1.2
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	<b>CO-BP202T-2</b>	To understand the alkanes, alkenes and conjugated dienes	<b>SO-2.1</b>	2.1,2.2,2.3,2.4,2.5,2.6,2.7,2.8,2.9,2.10	LI2.1 LI2.2	SI-2.1
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	<b>CO-BP202T-3</b>	To use different, kinetics, order of reactivity of alkyl-halides and alcohols	SO3.1	3.1,3.2,3.3,3.4,3.5,3.6,3.7,3.8,3.9,3.10	LI3.1 LI3.2	SI3.1
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	<b>CO-BP202T-4</b>	Understand the Carbonyl compounds*(Aldehydes and ketones), Nucleophilic addition reaction.	SO-4.1 SO-4.2	4.1,4.2,4.3,4.4,4.5,4.6,4.7,4.8.	LI4.1 LI4.2	SI-4.1
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	<b>CO-BPT202T-5</b>	Understand the Carboxylic acids and aliphatic amines.	SO-5.1 SO-5.2	5.1,5.2,5.3,5.4,5.5,5.6,5.7,5.8	LI5.1 LI5.2	SI-5.1





AKS University  
Faculty of Pharmaceutical Science & Technology  
Rajiv Gandhi Institute of Pharmacy  
Curriculum of B. Pharmacy (Biochemistry) Program  
(Revised as on 01 August 2023)  
**Semester-II<sup>nd</sup>**

**Course Code:** BP203T/BP209P

**Course Title:** Biochemistry (theory)

**Pre-requisite:** Students should have a basic knowledge of Biomolecules - Introduction, classification, chemical nature and biological role of carbohydrate, lipids, nucleic acids, amino acids and proteins.

**Rationale/Objective s:** Upon completion of course student shall be able to

1. Understand the catalytic role of enzymes, importance of enzyme inhibitors in design of new drugs, therapeutic and diagnostic applications of enzymes.
2. Understand the metabolism of nutrient molecules in physiological and pathological conditions.
3. Understand the genetic organization of mammalian genome and functions of DNA in the synthesis of RNAs and proteins

**Course Outcomes:-**

- CO-BP203-1: To explain about Bio-molecules and Bioenergetics such as carbohydrate, lipids, nucleic acids, amino acids and proteins.
- CO-BP203-2: To understand about the Carbohydrate metabolism and Biological oxidation
- CO-BP203-3: To understand about the Lipid metabolism and Amino acid metabolism
- CO-BP203-4: To understand the Nucleic acid metabolism and genetic information transfer
- CO-BP203-5: To understand about the enzymes, enzyme inhibitor and coenzymes



Course code	Title of the course	Program Name	TOTAL Number of contact hours/Week						Credit	15 hr /weeks
			Classroom Instruction (A)		Practical (P)	SW	SL	Total Hours(H)		
			Lecture	Tutorial						
BP203 T	Biochemistry (Theory)	B. Pharmacy	3	1	4	1	1	10	6	120

**Legend: CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and dx

**LI:** Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)

**SW:** Sessional Work (includes assignment, seminar, mini project etc.),

**SL:** Self Learning, Credits.

**Note:** SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

### Theory Assessment

Board of Study	Cour se Code	Cours eTitle	Scheme of Assessment ( Marks )						
			Progressive Assessment ( PRA)						
			Academic activity,Any three (Quiz/ Assignment, open book test, filed work and seminar)	Student teacher interaction	Class Attend ance (AT)	(A)  Total Marks	Sessional Exam (R)	End Semester Assessment(C)	Total Marks(A+B+)
Pharmacy	BP- 203T	Biochemistry	3	3	4	10	15	75	100



## Practical Assessment

Board of Study	Course Code	Course Title	Scheme of Assessment ( Marks )						
			Internal Assessment (A)			End Semester Examination(B)			Total Marks (A+B)
			Attendance	Record	Sessional Exam.	Synopsis	Experiment	Viva	
Pharmacy	BP-203 P	Biochemist ry	2	3	10	5	25	5	50

## Guidelines for the allotment of marks for attendance

Percentage of Attendance	Theory	Practical
95 – 100	4	2
90 – 94	3	1.5
85 – 89	2	1
80 – 84	1	0.5
Less than 80	0	0



**Course-Curriculum Detailing:**

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

**CO-BP203-1: To explain about Bimolecules and Bioenergetics such as carbohydrate, lipids, nucleic acids, amino acids and proteins.**

Item	Approx Hrs
Lecture & Tutorial	9+3=12
Practical(P)	0
SW	1
SL	1
Total:	14

Session Outcomes(SOs)	Laboratory Instruction(LI)	Classroom Instruction(CI)	Self Learning (SL)
<b>Theory</b> <b>SO1.1:</b> Understand about Introduction of Bimolecules and bioenergetics <b>SO1.2:</b> Learn about Classification and chemical nature of carbohydrate and lipids. <b>SO1.3:</b> Learn about Classification and chemical nature of nucleic acids, amino acids and proteins <b>SO1.4:</b> To understand about Concept of free energy, endergonic and exergonic reaction, Relationship between free energy, enthalpy and entropy, Redox potential <b>SO1.5:</b> To study of Energy rich compounds, classification, biological significances of ATP and cyclic AMP		<b>1.1</b> To brief introduction of Bimolecules <b>1.2</b> Classification and chemical nature of carbohydrate and lipids. <b>1.3</b> Classification and chemical nature of nucleic acids, amino acids and proteins. <b>1T.1: Tutorial</b> <b>1.4</b> Introduction and defined Bioenergetics <b>1.5</b> Concept of free energy <b>1.6</b> endergonic and exergonic reaction <b>1T.2: Tutorial</b> <b>1.7</b> Relationship between free energy, enthalpy and entropy, Redox potential <b>1.8</b> Energy rich compounds <b>1.9</b> Classification and biological significances of ATP and cyclic AMP <b>1T.3: Tutorial</b>	<b>1.1</b> Classification, chemical nature and biological role of Biomolecules. <b>1.2</b> Classification and biological significances of ATP and cyclic AMP.



**Suggested Assignments:**

1. Discuss about various Biomolecules such as carbohydrate, protein, amino acid, nucleic acid and lipid.
2. General discussion of Bioenergetics

**Unit II**

**CO-BP203-2:** To understand about the Carbohydrate metabolism and Biological oxidation

Item	Approx Hrs
Lecture & Tutorial	10+3=13
Practical(P)	24
SW	1
SL	1
Total:	39

Session Outcomes(SOs)	Laboratory Instruction(LI)	Room Instruction(CI)	Self Learning(SL)
<p><b>Theory</b>  <b>SO2.1:</b> Carbohydrate metabolism:- Glycolysis Pathway, energetic and significance</p> <p><b>SO2.2:</b> Citric acid cycle- Pathway, energetic and significance HMP shunt and its significance; Glucose-6-Phosphate dehydrogenase (G6PD) deficiency</p> <p><b>SO2.3:</b> Glycogen metabolism Pathways and glycogen storage diseases (GSD) Gluconeogenesis- Pathway and its significance</p> <p><b>SO2.4:</b> Hormonal regulation of blood glucose level and Diabetes mellitus, Electron transport</p>	<p>2.1 Qualitative analysis of carbohydrates (Glucose, Fructose, Lactose, Maltose, Sucrose and starch)</p>	<p>1 Introduction of metabolism of carbohydrates Glycolysis-Pathway, energetic and significance</p> <p>2 Citric acid cycle- Pathway, energetic and significance</p> <p>3 HMP shunt and its significance</p> <p>4 Glucose-6-Phosphate dehydrogenase (G6PD) deficiency</p> <p><b>2T.1:</b> Tutorial</p> <p>5 Glycogen metabolism Pathways and glycogen storage diseases (GSD)</p> <p>6 Gluconeogenesis- Pathway and its significance</p> <p>7 Hormonal regulation</p>	<p>2.1: Carbohydrate metabolism</p> <p><b>a.</b> Glycolysis – Pathway, energetic and significance</p> <p><b>b.</b> Gluconeogenesis- Pathway and its significance</p> <p>2.2: Biological oxidation Electron transport chain (ETC) and its mechanism.</p>



<p>chain (ETC) and its mechanism  <b>SO2.5:</b> Oxidative phosphorylation &amp; its mechanism and substrate level Phosphorylation , Inhibitors ETC and oxidative phosphorylation/Uncouplers</p> <p><b>Practical</b>  <b>SO-P-2.1</b> To prepared qualitative analysis of carbohydrates (Glucose, Fructose, Lactose, Maltose, Sucrose and starch) has been done.</p>		<p>of blood glucose level and Diabetes mellitus  <b>2T.2:</b> Tutorial</p> <p>8 <b>Biological oxidation</b>  Electron transport chain (ETC) and its mechanism.</p> <p>9 Oxidative phosphorylation &amp; its mechanism and substrate level Phosphorylation</p> <p>10 Inhibitors ETC and oxidative phosphorylation/Uncouplers  <b>2T.3:</b> Tutorial</p>	
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#### Suggested Assignments:

1. **Biological oxidation** - Electron transport chain (ETC) and its mechanism.
2. **Carbohydrate metabolism** (a) Glycolysis – Pathway, energetic and significance  
(b) Gluconeogenesis- Pathway and its significance

### Unit III

**CO-BP203-3: To understand about the Lipid metabolism and Amino acid metabolism**

Item	Approx Hrs
Lecture & Tutorial	10+3=13
Practical(P)	12
SW	1
SL	1
Total:	27



Session Outcomes(SO)	Laboratory Instruction (LI)	Room Instruction (CI)	Self Learning (SL)
<p><b>Theory</b></p> <p><b>SO3.1 Lipid metabolism</b>  <math>\beta</math>-Oxidation of saturated fatty acid (Palmitic acid)</p> <p><b>SO3.2</b> Formation and utilization of ketone bodies; ketoacidosis and De novo synthesis of fatty acids (Palmitic acid)</p> <p><b>SO3.3</b> Biological significance of cholesterol and conversion of cholesterol into bile acids, steroid hormone and vitamin D.</p> <p><b>SO3.4</b> Disorders of lipid metabolism: Hypercholesterolemia, atherosclerosis, fatty liver and obesity</p> <p><b>SO3.5 Amino acid metabolism</b>  General reactions of amino acid metabolism: Transamination, deamination &amp; decarboxylation, urea cycle and its disorders</p> <p><b>SO3.5 a)</b> Catabolism of phenylalanine and tyrosine and their metabolic disorders (Phenylketonuria, Albinism, alcaptonuria,</p>	<p>3.1 Quantitative analysis of reducing sugars (DNSA method)</p> <p>3.2 Quantitative analysis of Proteins (Biuret method)</p> <p>3.3 Identification tests for Proteins (albumin and Casein)</p>	<p>3.1 Introduction of lipid metabolism  Formation and utilization of ketone bodies; ketoacidosis and De novo synthesis of fatty acids (Palmitic acid)</p> <p>3.2 Biological significance of cholesterol and conversion of cholesterol into bile acids, steroid hormone and vitamin D</p> <p>3.3 Disorders of lipid metabolism: Hypercholesterolemia, atherosclerosis, Fatty liver and obesity.</p> <p><b>3T.1:</b> Tutorial class</p> <p>3.4 <b>Introduction of Amino acid metabolism</b></p> <p>3.5 General reactions of amino acid metabolism:- Transamination, Deamination and decarboxylation, urea cycle and its disorders</p> <p>3.6 Metabolism of</p>	<p><b>3.1 Lipid metabolism</b>  <math>\beta</math>-Oxidation of saturated fatty acid (Palmitic acid)</p> <p>3.2 Disorders of lipid metabolism: Hypercholesterolemia, atherosclerosis, fatty liver and obesity</p> <p>3.3 amino acid metabolism: Transamination, deamination &amp; decarboxylation, urea cycle and its disorders</p>



tyrosinemia)  <b>SO3.5 b)</b> Synthesis and significance of biological substances; 5-HT, melatonin, dopamine, noradrenaline, adrenaline  <b>SO3.5 c)</b> Catabolism of heme; hyperbilirubinemia and jaundice  <b>Practical</b> <b>SO-P-3.1</b> to prepare and submitted reducing sugars (DNSA method)  <b>SO-P-3.2.</b> to prepare and submitted Proteins (Biuret method) <b>SO-P-3.3</b> to prepare and submitted Proteins (albumin and Casein)		phenylalanine and tyrosine and their metabolic disorders 3.7 ketonuria, Albinism, alkeptonuria, tyrosinemia <b>3T.2:</b> Tutorial class 3.8 Synthesis and significance of biological substances; 5-HT and melatonin 3.9 Synthesis and significance of biological substances:- dopamine and noradrenaline drenaline 3.10 Matabolism of heme; hyperbilirubinemia and jaundice  <b>3T.3:</b> Tutorial class	
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### Suggested Assignments:

- Lipid metabolism**  $\beta$ -Oxidation of saturated fatty acid (Palmitic acid)
- Amino acid metabolism** General reactions of amino acid metabolism: Transamination, deamination & decarboxylation, urea cycle and its disorders



## Unit IV:

**CO-203.4:** To understand the Nucleic acid metabolism and genetic information transfer

Item	Approx Hrs
Lecture & Tutorial	10+3=13
Practical(P)	08
SW	1
SL	1
Total:	23

Session Outcomes(SOs)	Laboratory Instruction(LI)	Class room Instruction(CI)	Self Learning(SL)
<b>Theory</b> <b>SO4.1:</b> Nucleic acid metabolism and genetic information transfer <b>SO4.2:</b> Biosynthesis of purine and pyrimidine nucleotides <b>SO4.3:</b> Catabolism of purine nucleotides and Hyperuricemia and Gout disease <b>SO4.4:</b> Organization of mammalian genome <b>SO4.5:</b> Structure of DNA , RNA and their functions DNA replication (semi conservative model) and Transcription or RNA synthesis  <b>Practical</b> <b>SO-P-4.1:</b> To perform Qualitative analysis of urine for abnormal constituents has been done. <b>SO-P-4.2:</b> To prepare and submitted blood creatinine	1 Qualitative analysis of urine for abnormal constituents 2 Determination of blood creatinine	<b>1</b> To brief introduction of Nucleic acid metabolism <b>2</b> Detail in genetic information transfer <b>3</b> Biosynthesis of purine and pyrimidine nucleotides <b>4T.1:</b> Tutorial class <b>4</b> Catabolism of purine nucleotides and Hyperuricemia and Gout disease <b>5</b> Organization of mammalian genome <b>6</b> Structure of DNA , RNA and their functions <b>4T.2: Tutorial class</b> <b>7</b> DNA replication (semi conservative model) <b>8</b> Transcription or RNA synthesis <b>9</b> Genetic code <b>10</b> Translation or Protein synthesis Discuss in Inhibitors. <b>4T.3: Tutorial class</b>	<b>4.1.</b> Nucleic acid metabolism and genetic information transfer  <b>4.2</b> Genetic code, Translation or Protein synthesis and inhibitors

### Suggested Assignments:

1. Nucleic acid metabolism and genetic information transfer
2. Structure of DNA and RNA and their functions
3. Genetic code, Translation or Protein synthesis and inhibitors



## Unit V

**CO-BP203-5:** To understand about the enzymes, enzyme inhibitor and coenzymes

Item	Approx Hrs
Lecture & Tutorial	8+3=11
Practical (P)	16
SW	1
SL	1
Total:	29

Session Outcomes(SOs)	Laboratory Instruction(LI)	Class room Instruction (CI)	Self Learning(SL)
<b>Theory</b> <b>SO5.1: Enzymes-</b> Introduction, properties, nomenclature and IUB classification of enzymes <b>SO5.2:</b> Enzyme kinetics (Michael is plot, Line Weaver Burke plot) <b>SO5.3:</b> Enzyme inhibitors with examples Regulation of enzymes: enzyme induction and repression, allosteric enzymes regulation <b>SO5.4:</b> Therapeutic and diagnostic applications of enzymes and isoenzymes <b>SO5.5:</b> Coenzymes – Structure and biochemical functions <b>Practical:</b> <b>SO-P-5.1</b> To perform the salivary amylase activity has been done. <b>SO-P-5.2</b> To Study the effect of Temperature on Salivary amylase activity has been done. <b>SO-P-5.3</b> To Study the effect of substrate concentration on salivary amylase	<b>5.1</b> Determination of Salivary amylase activity <b>5.2</b> Study the effect of Temperature on Salivary amylase activity. <b>5.3</b> Study the effect of substrate concentration on salivary amylase activity <b>5.4</b> Study of enzymatic hydrolysis of starch	<b>5.1</b> To brief introduction of enzymes <b>5.2</b> properties, nomenclature and IUB classification of enzymes <b>5.3</b> Enzyme kinetics (Michael is plot, Line Weaver Burke plot) <b>5T.1:</b> Tutorial class <b>5.4</b> Enzyme inhibitors with examples and Regulation of enzymes <b>5.5</b> enzyme induction and repression, allosteric enzymes regulation <b>5.6</b> Therapeutic and diagnostic applications of enzymes <b>5T.2:</b> Tutorial class <b>5.7</b> Therapeutic and diagnostic applications of isoenzymes <b>5.8</b> Coenzymes – Structure and	<b>5.1: Enzymes-</b> Introduction, properties, nomenclature and IUB classification of enzymes. <b>5.2: Coenzymes –</b> Structure and biochemical functions



activity has been done <b>SO-P-5.4</b> To Study of enzymatic hydrolysis of starch has been perform.		biochemical functions <b>5T.3:</b> Tutorial class	
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**Suggested Sessional work & Assignments:**

1. Introduction, properties, nomenclature and IUB classification of enzymes.
2. Coenzymes –Structure and biochemical functions



### Brief of Hours suggested for the Course Outcome

Course Out comes	Class Lecture (Cl)	(L)	Sessional Work (SW)	Self Learning (Sl)	Total Hour (Cl+SW+Sl+LI)
<b>CO-BP203.1:</b> To explain about Bimolecules and Bioenergetics such as carbohydrate, lipids, nucleic acids, amino acids and proteins	12	0	1	1	14
<b>CO-BP203.2:</b> To understand about the Carbohydrate metabolism and Biological oxidation	13	24	1	1	39
<b>CO-BP 203.3:</b> To understand about the Lipid metabolism and Amino acid metabolism	13	12	1	1	27
<b>CO-BP203.4:</b> To understand the Nucleic acid metabolism and genetic information transfer	13	08	1	1	23
<b>CO-BP203.5:</b> To understand about the enzymes, enzyme inhibitor and coenzyme	11	16	1	1	29
<b>Total Hours</b>	62	60	5	5	132



## Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

Course Outcome	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
<b>CO-BP203-1:</b>	To explain about Bimolecules and Bioenergetics such as carbohydrate, lipids, nucleic acids, amino acids and proteins.	08	06	01	15
<b>CO-BP203-2:</b>	To understand about the Carbohydrate metabolism and Biological oxidation	12	07	01	20
<b>CO-BP203-3:</b>	To understand about the Lipid metabolism and Amino acid metabolism	02	06	02	10
<b>CO-BP203-4:</b>	To understand the Nucleic acid metabolism and genetic information transfer	10	02	03	15
<b>CO-BP203-5:</b>	To understand about the enzymes, enzyme inhibitor and coenzymes	05	07	03	15
<b>Total</b>		<b>37</b>	<b>28</b>	<b>10</b>	<b>75</b>

**Legend: R: Remember, U: Understand, A: Apply**

The end of semester assessment for Biochemistry will be held with written examination of 75 marks  
**Note.** Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks.  
 Teachers can also design different tasks as per requirement, for end semester assessment.

### **Suggested Instructional/Implementation Strategies:**

1. Improved Lecture
2. Tutorial
3. Case Method
4. Group Discussion
5. Role Play
6. Demonstration
7. ICT Based Teaching Learning (Video Demonstration/Tutorials CBT, Blog, Face book, Twitter, Whats app, Mobile, Online sources)
8. Brainstorming



### Suggested Learning Resources:

S. No.	Title	Author	Publisher	Edition & Year
1	Principles of Biochemistry	Lehninger	W.H. freeman Publications	29 January 2021
2	Harper's Biochemistry	Robert K. Murry, Daryl K. Granner and Victor W. Rodwell	Mc Graw-Hill	32 edition 2023
3	Biochemistry	Stryer	John L.	4 <sup>th</sup> edition 2019
4	Biochemistry	D. Satyanarayan and U.Chakrapani	vier publications	2020
5	Textbook of Biochemistry	Rama Rao	USB publications	7DECEMBER 2020
6	Textbook of Biochemistry	Deb Publication .	New central book agency	10th edition 2019
7	Outlines of Biochemistry	Conn and Stump publications	Wiley publications	5 <sup>th</sup> edition 2006
8	Practical Biochemistry	C. Gupta and S. Bhargavan	CBS Publications	12 <sup>th</sup> edition 2018
9	Introduction of Practical Biochemistry	David T. Plummer	Mc-Graw-Hill education publications	3 <sup>rd</sup> edition, 2017
10	Practical Biochemistry for Medical students	Rajagopal and Ramakrishna	Jaypee brothers publications	2024
11.	Practical Biochemistry	Harold Varley	CBS Publications	1 January 2005

### Curriculum Development Team:

1. **Prof. SP Gupta**, Director, RGIP, AKS University
2. **Mr. Satyendra Garg**, Assistant professor, RGIP, AKS University



### Course Outcome, Program Outcome, Program Specific Outcome Mapping

Course Code: BP203T

Course Name: Biochemistry

Course Outcome	Program Outcome											Program Specific outcome			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
	Pharmacy knowledge	Planning Abilities	Problem analysis	Modern tool usage	Leadership skills	Professional Identity	Pharmaceutical Ethics	Communication	The pharmacist and society	Environment and sustainability	Life-long learning	Knowledge of drug discovery	Quality Analysis of API's	MOA of Drug	Biological evaluation of drug
<b>CO-1:</b> Bio molecules and Bioenergetics such as carbohydrate, lipids, nucleic acids, amino acids and proteins	3	2	3	1	3	2	1	2	3	2	3	1	3	1	2
<b>CO-2:</b> Carbohydrate metabolism and Biological oxidation	2	3	1	3	0	2	0	1	2	3	3	3	2	1	3
<b>CO-3:</b> Lipid metabolism and Amino acid metabolism	3	2	3	2		1	2	1	2	2	3	3	2	1	3
<b>CO-4:</b> Nucleic acid metabolism and genetic information transfer	2	3	2	3	1	3	2	2	3	3	3	3	2	1	3
<b>CO-5:</b> Enzymes, enzyme inhibitor and coenzymes	3	3	1	1	1	3	0	3	1	2	3	2	2	2	2

**Legend: 1- Low, 2-Medium, 3-High**



## Course Curriculum Mapping

Pos& PSOs No	Cos No&	Title	SOs No	Class Room Instructions	Laboratory Instructions	Self learning
Pos: 1,2,3,4,5,6,7,8,9,10,11 PSOs: 1,2,3,4,5,6	<b>CO-BP20 3-1:</b>	To explain about Bimolecules and Bioenergetics such as carbohydrate, lipids, nucleic acids, amino acids and proteins	SO1.1 SO1.2 SO1.3 SO1.4 SO1.5	1.1,1.2,1.3,1.4,1.5,1.6,1.7,1.8,1.9	LI-1.1 LI-1.2 LI-1.3 LI-1.4	SI-1.1 SI-1.2
Pos: 1,2,3,4,5,6,7,8,9,10,11 PSOs: 1,2,3,4,5,6	<b>CO-BP20 3-2:</b>	To understand about the Carbohydrate metabolism and Biological oxidation	SO-2.1 SO-2.2 SO-2.3 SO-2.4 SO-2.5	2.1,2.2,2.3,2.4,2.5,2.6,2.7,2.8,2.9,2.10	LI-2.1	SI-2.1 SI-2.2
Pos: 1,2,3,4,5,6,7,8,9,10,11 PSOs: 1,2,3,4,5,6	<b>CO-BP20 3-3:</b>	To understand about the Lipid metabolism and Amino acid metabolism	SO-3.1 SO-3.2 SO-3.3 SO-3.4 SO-3.5	3.1,3.2,3.3,3.4,3.5,3.6,3.7,3.8,3.9,3.10	LI-4.1 LI-4.2 LI-4.3	SI-3.1 SI-3.2 SI-3.3
Pos: 1,2,3,4,5,6,7,8,9,10,11 PSOs: 1,2,3,4,5,6	<b>CO-BP20 3-4:</b>	To understand the Nucleic acid metabolism and genetic information transfer	SO-4.1 SO-4.2 SO-4.3 SO-4.4 SO-4.5	4.1,4.2,4.3,4.4,4.5,4.6,4.7,4.8, 4.9, 4.10	LI-4.1 LI-4.2 LI-4.3 LI-4.4	SI-4.1 SI-4.2
Pos: 1,2,3,4,5,6,7,8,9,10,11 PSOs: 1,2,3,4,5,6	<b>CO-BP20 3-5:</b>	To understand about the enzymes, enzyme inhibitor and coenzymes	SO-5.1 SO-5.2 SO-5.3 SO-5.4 SO-5.5	5.1,5.2,5.3,5.4,5.5,5.6,5.7,5.8	LI-5.1 LI-5.2 LI-5.3 LI-5.4	SI-5.1 SI-5.2





AKS University  
Faculty of Pharmaceutical Science & Technology  
Rajiv Gandhi Institute of Pharmacy  
Curriculum of B. Pharmacy (Pathophysiology) Program

**Course Code: BP204T**

**Course Title: Pathophysiology**

**Pre-requisite:** Pathophysiology is the study of causes of diseases and reactions of the body to such disease producing causes. This course is designed to impart a thorough knowledge of the relevant aspects of pathology of various conditions with reference to its pharmacological applications, and understanding of basic pathophysiological mechanisms. Hence it will not only help to study the syllabus of pathology, but also to get baseline knowledge required to practice medicine safely, confidently, rationally and effectively.

**Rationale/ Objectives:** Upon completion of the subject student shall be able to –  
1. Describe the etiology and pathogenesis of the selected disease states;  
2. Name the signs and symptoms of the diseases; and  
3. Mention the complications of the diseases.

**Course Outcome:**

**CO-BP204T-1:** To know the basic principle of cell injury, Cell adaptations & inflammations.

**CO-BP204T-2:** To know various causes symptoms of diseases related to cardiovascular system, Respiratory system & Urinary system

**CO-BP204T-3:** To understand Disease progress process along with symptoms of endocrine system, Nervous system & Gastrointestinal system

**CO-BP204T-4:** To Describe the etiology and pathogenesis of various disease states, of bones and joints & Principles of cancer.

**CO-BP204T-5:** To understand the complications that can arise from the disease like HIV, Typhoid, Meningitis & Tuberculosis with their management



## Scheme of Studies

Course code	Title of the course	Program Name	Total number of contact hours/week						Credit
			Classroom Instruction (A)		Practical (P)	S W	S L	Total Hour s (H)	
			Lectur e	Tuto rial					
BP204T	Pathophysiology (Theory)	B. Pharmacy	3	1	4	1	1	10	6

### Legend:

**CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others),

**LI:** Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)

**SW:** Sessional Work (includes assignment, seminar, mini project etc.),

**SL:** Self Learning, Credits.

**Note:** SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

### Theory Assessment

Board of Study	Course Code	Course Title	Scheme of Assessment ( Marks )						
			Progressive Assessment ( PRA)						
			Academic activity, Any three (Quiz/ Assignment, open book test, filed work and seminar)	Student teacher interaction	Class Attendance(A)	Total Marks (A)	Sessional Exam (B)	End Semester	Total Marks(A+B+C)
Pharmacy	BP204T	Pathophysiology	3	3	4	10	15	75	100



## Practical Assessment

Board of Study	Course Code	Course Title	Scheme of Assessment ( Marks )						
			Internal Assessment (A)			End Semester Examination(B)			Total Marks (A+B)
			Attendance	Record	Sessional Exam.				
Pharmacy	BP204	Pathophysiology	2	3	10	5	25	5	50

### Guidelines for the allotment of marks for attendance

Percentage of Attendance	Theory	Practical
95 – 100	4	2
90 – 94	3	1.5
85 – 89	2	1
80 – 84	1	0.5
Less than 80	0	0

### Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

### CO-BP204T-1: To Know the basic principle of cell injury, Cell adaptations & inflammations.

Item	Approx Hrs
Lecture & Tutorial	10+3=13
Practical(P)	0
SW	1
SL	1
<b>Total</b>	<b>15</b>



Session Outcome	Laboratory Instructions	Class room Instructions	Self learning
<p><b>So1.1: To know</b> Basic principles of Cell injury and Adaptation</p> <p><b>SO1.2 To understand the</b> Basic mechanism involved in the process of inflammation and repair.</p>	NA	<p><b>1.1Cell injury</b> Introduction, definitions, Homeostasis, Components and Types of Feedback systems, Causes of cellular injury, Pathogenesis</p> <p><b>1.2:</b> Morphology of cell injury</p> <p><b>1.3:</b> Cell swelling, Intra cellular accumulation, Calcification</p> <p><b>1.4:</b> Enzyme leakage and Cell Death Acidosis &amp; Alkalosis,</p> <p><b>1.5:</b> Electrolyte imbalance</p> <p><b>1T1 Tutorial Class</b></p> <p><b>1.6 Cell Inflammations &amp; repair</b></p> <p><b>1T2 Tutorial Class</b></p> <p><b>1.7:</b> Introduction, Clinical signs of inflammation</p> <p><b>1.8:</b> Mechanism of Inflammation – Alteration in vascular permeability and blood flow</p> <p><b>1.9:</b> migration of WBC's, Mediators of inflammation</p> <p><b>1T3 Tutorial Class</b></p> <p><b>1.10:</b> Basic principles of wound healing in the skin, Pathophysiology of Atherosclerosis</p>	<p><b>1.1</b> Basics morphology of Cells with their types.</p>

**Sessional & Assignment work:** Cell swelling, Intra cellular accumulation, Calcification, : Basic principles of wound healing in the skin, Patho-physiology of Atherosclerosis.

**CO-BP204T-2: To know various causes symptoms of diseases related to cardiovascular system, respiratory system & urinary system.**

Item	Approx Hrs
Lecture & Tutorial	10+3=13
Practical (P)	0
SW	1
SL	1
<b>Total</b>	<b>15</b>



Session Outcome	Laboratory Instructions	Class room Instructions	Self learning
<p><b>So2.1:</b> To know various causes symptoms of diseases related to cardiovascular system.</p> <p><b>SO2.2:</b> To know various causes symptoms of diseases related to respiratory system.</p> <p><b>SO2.3:</b> To know various causes symptoms of diseases related Urinary System</p>	NA	<p><b>2.1</b> Introduction, Brief information about the congestive heart failure</p> <p><b>2.2:</b> Pathogenesis of ischemic heart disease</p> <p><b>2.3:</b> Path physiology of hypertension with various causes.</p> <p><b>2.4:</b> Brief Information about respiratory system with their disease</p> <p><b>2.5:</b> Path physiology of asthma With their causes &amp; treatment.</p> <p><b>2T2 Tutorial Class</b></p> <p><b>2.6:</b> Path physiology of Chronic obstructive airways diseases</p> <p>2.7: Various causes of COPD with their treatment.</p> <p><b>1T3 Tutorial Class</b></p> <p><b>2.8:</b> Disorders of Urinary system.</p> <p><b>2.9:</b> Acute renal failure</p> <p><b>2.10:</b> chronic renal failure.</p>	<p><b>2.1</b> Gross anatomy&amp; Physiology of Cardiovascular system, Urinary system&amp; respiratory system.</p>

**Sessional & Assignment work:** Hypertension, congestive heart failure, ischemic heart disease, Asthma, Chronic obstructive airways diseases& Acute and chronic renal failure.



### Unit III

#### CO-BP204T-3: To understanding Disease progress process along with symptoms of endocrine System, Nervous system & Gastrointestinal system

Session Outcome	Laboratory Instructions	Class room Instructions	Self learning
<p><b>SO3.1:</b> To know various causes symptoms of Haematological Diseases:</p> <p><b>SO3.2:</b> To know various causes symptoms of Endocrine system Diseases</p> <p><b>SO3.3:</b> To know various causes &amp; symptoms of Nervous system</p> <p><b>SO3.4:</b> To know various causes &amp; symptoms of Gastrointestinal system.</p>	NA	<p><b>3.1:Introduction of Various hematological Diseases</b></p> <p><b>3.2: Pathogenesis of Iron deficiency with sign &amp; symptoms.</b></p> <p><b>3.3: Anemia With their types Vit B12 and folic acid),</b></p> <p><b>3T1 Tutorial Class</b></p> <p><b>3.4: Sickle cell anemia,</b></p> <p><b>3.5: Thalassaemia, hereditary acquired anemia &amp; hemophilia</b></p> <p><b>3.6:Various Endocrine Diseases</b></p> <p><b>3.7: Diabetes, thyroid diseases, disorders of sex hormones</b></p> <p><b>3T2 Tutorial Class</b></p> <p><b>3.8: Epilepsy, Parkinson's disease, stroke, psychiatric disorders</b></p> <p><b>3.9: Depression, schizophrenia and Alzheimer's disease</b></p> <p><b>3.10: Peptic Ulcer</b></p> <p><b>3T3 Tutorial Class</b></p>	<p>3.1: Gross anatomy &amp; Physiology of Nervous system.</p> <p>3.2 Pathogenesis of peptic ulcers</p>

**Sessional & Assignment work:** Diabetes, thyroid diseases, disorders of sex hormones, Epilepsy, Parkinson's disease, stroke, psychiatric disorders.



## Unit IV

**CO-BP204T-2: TO know various causes symptoms of diseases related to cardiovascular system, Respiratory system& Urinary system**

Item	Approx Hrs
Lecture & Tutorial	8+3=11
Practical(P)	0
SW	1
SL	1
<b>Total</b>	<b>13</b>

Session Outcome	Laboratory Instructions	Class room Instructions	Self learning
<p><b>SO4.1:</b> To know various causes symptoms of Disease of bones and joints</p> <p><b>SO4.2:</b> To know various causes cancer&amp; pathogenesis</p>	NA	<p><b>4.1:</b> Pathogenesis of Inflammatory bowel diseases,&amp; treatment.</p> <p><b>4.2: Pathogenesis of</b> jaundice&amp; hepatitis (A,B,C,D,E,F) alcoholic liver Disease.</p> <p><b>4.3:</b> Rheumatoid arthritis osteoporosis and gout</p> <p><b>4T1 Tutorial Class</b></p> <p><b>4.4:</b> Pathogenesis of cancer</p> <p><b>4.5:</b> Various causes of cancer</p> <p><b>4.6:</b> Classification, etiology of cancer</p> <p><b>4.7:</b> pathogenesis of Cancer</p> <p><b>4T2 Tutorial Class</b></p> <p><b>4.8: Precautions&amp; treatment of cancer</b></p> <p><b>4T3 Tutorial Class</b></p>	4.1: Gross anatomy& Physiology of Nervous system.

**Sessional & Assignment work:** Rheumatoid Arthritis, Osteoporosis, Gout, Classification, etiology and pathogenesis of Cancer



## Unit V

**CO-BP204T-5: To understand the complications that can arise from the disease like HIV, Typhoid, Meningitis& Tuberculosis with their management**

Item	Approx Hrs
Lecture &Tutorial	7+3=11
Practical(P)	0
SW	1
SL	1
<b>Total</b>	<b>12</b>

Session Outcome	Laboratory Instructions	Class room Instructions	Self learning
<b>SO4.1:</b> To Brief about Sexually transmitted diseases  <b>SO4.2:</b> TO understand about various Infectious diseases	<b>NA</b>	<b>5.1:</b> Pathogenesis of Meningitis diseases,& treatment. <b>5.2: Pathogenesis of</b> Typhoid,& Leprosy,. <b>5.3:</b> Rheumatoid arthritis osteoporosis and gout <b>5T1 Tutorial Class</b> <b>5.4:</b> Pathogenesis of Tuberculosis with sign& symptoms <b>5.5:</b> Urinary tract infections with their management <b>5.6:</b> Sexually transmitted diseases like AIDS. <b>5.7:</b> pathogenesis of Syphilis, Gonorrhea <b>4T2 Tutorial Class</b>	5.1: Gross anatomy& Physiology of reproductive system& Immune system.

**Suggested Sessional and assignment work:** Understand characteristics of microorganisms, including mode of transmission, etiopathogenesis, signs, symptoms, complications of Sexually transmitted disease.



### Brief of Hours suggested for the Course Outcomes

Course Out comes	Class Lecture (Cl)	(LI)	Sessional Work (SW)	Self Learning (Sl)	Total Hour (Cl+S W+Sl+ LI)
<b>Course Out comes:</b>					
<b>CO-BP204T-1:</b> To Know the basic principle of cell injury, Cell adaptations & inflammations	13	0	1	1	15
<b>CO-BP204T-2:</b> TO know various causes symptoms of diseases related to cardiovascular system, Respiratory system & Urinary system.	13	0	1	1	15
<b>CO-BP204T-3:</b> To understanding Disease progress process along with symptoms of endocrine, System, Nervous system & Gastrointestinal system	13	0	1	1	15
<b>CO-BP204T-4:</b> To Describe the etiology and pathogenesis of various disease states, of bones and joints & Principles of cancer.	11	0	1	1	13
<b>CO-BP204T-5:</b> To understand the complications that can arise from the disease like HIV, Typhoid, Meningitis & Tuberculosis with their management	10	0	1	1	12
<b>Total Hours</b>	60	0	5	5	70



## Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

Course Outcome	Unit Titles	Marks Distribution			Total Marks
		A	C	I	
CO-BP204 T-1::	To Know the basic principle of cell injury, Cell adaptations & inflammations	08	06	01	15
CO-BP204 T-2:	TO know various causes symptoms of diseases related to cardiovascular system, Respiratory system & Urinary system.	12	07	01	20
CO-BP204 T-3:	To understanding Disease progress process along with symptoms of endocrine, System, Nervous system & Gastrointestinal system	02	06	02	10
CO-BP204 T-4	: To Describe the etiology and pathogenesis of various disease states, of bones and joints & Principles of cancer.	10	02	03	15
CO-BP204 T-5:	To understand the complications that can arise from the disease like HIV, Typhoid, Meningitis & Tuberculosis with their management	05	07	03	15
Total		37	28	10	75

**Legend: A: Analyze, C: Create, I: Interpret**

The end of semester assessment for Pathophysiology will be held with written examination of 75 marks

**Note.** Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks.

Teachers can also design different tasks as per requirement, for end semester assessment.

### Suggested Instructional/Implementation Strategies:

1. Improved Lecture
2. Tutorial
3. Case Method
4. Group Discussion
5. Role Play
6. Demonstration



### Suggested Learning Resources:

S. No.	Title	Author	Publisher	Edition & Year
1	Pathologic Basis of Disease; South Asia	Vinay Kumar, Abul K. Abas, Jon C. Aster; Robbins & Cotran	Elsevier;	4 <sup>th</sup> edition 2014
2	Text book of Pathology	Harsh Mohan;	Jaypee Publications;	6 <sup>th</sup> edition 2010
3	The Pharmacological Basis of Therapeutics	Goodman and Gilman's,	The Point Lippincott Williams & Wilkins	Eighth Edition 2020
4	Applied Therapeutics, The Clinical use of Drugs.	Marry Anne K. K., Lloyd Yee Y., Brian K. A.	The Point Lippincott Williams & Wilkins	10 <sup>th</sup> edition 2012
5	Essentials of Medical Pharmacology,	K.D. Tripathi.	JAYPEE Brothers, Medical Publishers (P) Ltd, New Delhi.	6 <sup>th</sup> edition 2021
6	Ralston; Davidson's Principles and Practice of Medicine	Nicki R. Colledge, Brian R. Walker, Stuart H.	Hilton & Company, Kolkata,	21 <sup>st</sup> edition; 2010
7	Textbook of Medical Physiology	Guyton A, John .E Hall;	WB Saunders Company; -	12 <sup>th</sup> edition. 2010

#### Curriculum Development Team:

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### Course Outcome, Program Specific Outcome & Program Outcome Mapping

**Course Code: BP204T**

**Course Name: Pathophysiology**

Course Outcome	Program Outcome											Program Specific outcome			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
	Pharmacy knowledge	Planning Abilities	Problem analysis	Modern tool usage	Leadership skills	Professional Identity	Pharmaceutical Ethics	Communication	The pharmacist and society	Environment and sustainability	Life-long learning	Knowledge of drug discovery	Quality Analysis of API's	MOA of Drug	Biological evaluation of drug
<b>CO-1:</b> Principle of cell injury, Cell adoptions & inflammations	3	2	3	1	3	2	1	2	3	2	3	1	3	1	2
<b>CO-2:</b> Various causes symptoms of diseases related to cardiovascular system, Respiratory system & Urinary system.	2	3	1	3	0	2	0	1	2	3	3	3	2	1	3
<b>CO-3:</b> Disease progress process along with symptoms of endocrine, System, Nervous system & Gastrointestinal system	3	2	3	2		1	2	1	2	2	3	3	2	1	3
<b>CO-4:</b> the disease like HIV, Typhoid, Meningitis & Tuberculosis with their management	2	3	2	3	1	3	2	2	3	3	3	3	2	1	3
<b>CO-5:</b> To understand the complications that can arise from the disease like HIV, Typhoid, Meningitis & Tuberculosis with their management	3	3	1	1	1	3	0	3	1	2	3	2	2	2	2

**Legend: 1- Low, 2-Medium, 3-High**



### Course Curriculum Mapping

Pos& PSOs No	Cos No&	Title	SOs No	Class Room Instructions	Laboratory Instructions	Self learning
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	<b>CO-BP204T-1:</b>	To Know the basic principle of cell injury, Cell adoptions & inflammations	SO1.1 SO1.2 SO1.3	1.1,1.2,1.3,1.4,1.5,1.6,1.7,1.8,1.9		SI-1.1 SI-1.2
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	<b>CO-BP204T-2:</b>	TO know various causes symptoms of diseases related to cardiovascular system, Respiratory system & Urinary system.	SO-2.1 SO-2.2	2.1,2.2,2.3,2.4,2.5,2.6,2.7,2.8,2.9,2.10		SI-2.1 SI-2.2
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	<b>CO-BP204T-3:</b>	To understanding Disease progress process along with symptoms of endocrine, System, Nervous system & Gastrointestinal system	SO-3.1 SO-3.2	3.1,3.2,3.3,3.4,3.5,3.6,3.7,3.8,3.9,3.10		SI-3.1
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	<b>CO-BP204T-4</b>	: To Describe the etiology and pathogenesis of various disease states, of bones and joints & Principles of cancer.	SO-4.1 SO-4.2	4.1,4.2,4.3,4.4,4.5,4.6,4.7,4.8, 4.9, 4.10		SI-4.1
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	<b>CO-BP204T-5:</b>	To understand the complications that can arise from the disease like HIV, Typhoid, Meningitis & Tuberculosis with their management	SO-5.1 SO-5.2	5.1,5.2,5.3,5.4,5.5,5.6,5.7,5.8		SI-5.1





AKS University  
Faculty of Pharmaceutical Science & Technology  
Rajiv Gandhi Institute of Pharmacy  
Curriculum of B. Pharmacy (Computer Applications in Pharmacy) Program  
(Revised as on 01August2023)

**Semester-II**

**Course Code:** BP205T/BP 210P

**Course Title:** Computer Applications In Pharmacy

**Pre-requisite:** The Student should have basic knowledge of computer with their importance and Uses.

**Rationale/Objectives:** Upon completion of the course student shall be able to

- Design the prescription letter and patient history presentation.
- Use the computer application in lab and design the Google form for the pharmacy labs.
- Understand the medicinal and chemical formula by the computer application.

**Course Outcomes:**

**CO-BP205-1:** Understand the basic structure, operation and characteristics of digital computer.

**CO- BP205-2:** To determine the level of web programming and design the pharmacy database.

**CO- BP205-3:** To Use different Application of computers In Pharmacy.

**CO- BP205-4:** Know the concept of Bioinformatics and Impact of Bioinformatics in Vaccine discovery.

**CO- BP205-5:** Understand the Computers as data analysis in Preclinical development.



:Coursecode	Title of the course	Program Name	Total Number of contact hours/Week						Credit
			Classroom Instruction(A)		Practical (P)	S W	S L	Total Hours (H)	
			Lecture	Tutorial					
BP205T	Computer Applications In Pharmacy	B. Pharmacy	3	1	4	1	1	10	6

**Legend:**

**CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others,

**LI:** Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)

**SW:** Sessional Work (includes assignment, seminar, mini project etc.),

**SL:** Self Learning, Credits.

**Note:** SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

**Theory Assessment**

Board of Study	Course Code	CourseTitle	Scheme of Assessment ( Marks )					End semester Assessment	Total Marks(A+B+C)
			Progressive Assessment ( PRA)						
			Academic activities Any three (Quiz, Assignment, open book test, filed work and seminar)	Student teacher interaction	Class Attendance (AT)	(A)  Total Marks	Sessional Exam (B)		
Pharmacy	BP205 T	Computer Applications In Pharmacy I	3	3	4	10	15	75	100



## Practical Assessment

Board of Study	Course Code	Course Title	Scheme of Assessment ( Marks )						
			Internal Assessment (A)			End Semester Examination(B)			Total Marks  (A+B)
			Attendance	Record	Sessional  Exam.				
						Synopsi s	Experiment	Via	
Pharmacy	BP2 05T	Computer Applications In Pharmacy	2	3	10	5	25	5	50

## Guidelines for the allotment of marks for attendance

Percentage of Attendance	Theory	Practical
95 – 100	4	2
90 – 94	3	1.5
85 – 89	2	1
80 – 84	1	0.5
Less than 80	0	0



**Course Curriculum Detailing:**

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

**CO-BP104-1:** Understand the basic structure, operation and characteristics of digital computer.

Item	Approx Hrs
Lecture & Tutorial	10+3=13
Practical(P)	16
SW	1
SL	1
Total:	31

Session Outcomes(SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self Learning (SL)
<b>Theory</b> <b>SO1.1:</b> Number system  <b>SO1.2:</b> Types of Number system.  <b>SO1.3:</b> Conversion of decimal to binary number system and binary to octal number system.  <b>SO1.4:</b> Binary addition. And subtraction.  <b>SO1.5:</b> One's and Two's complement, binary division and Multiplication.	1.1 Design a questionnaire using a word processing package to gather information about a particular disease.  1.2 Create a HTML web page to show personal information.	1.1 Number system: 1.2 Binary number system, 1.3 Decimal number system, 1.4 Octal number system, <b>1T1 Tutorial Class</b> 1.5 Hexadecimal number systems, 1.6 conversion decimal to binary, 1.7 binary to decimal, <b>1T2 Tutorial Class</b> 1.8 octal to binary etc, 1.9 binary addition, 1.10 binary subtraction – 1.11 One's complement <b>1T1 Tutorial Class</b> , Two's complement method, binary Multiplication, binary division.	1.1: Conversion of binary to octal number system.  1.2: Conversion of decimal number system to binary number system.

**Suggested Assignments:** Types of Number system, binary multiplication and binary division



## Unit II

**CO-BP104-2: understand the client and server communication and develop the pharmacy drug data base.**

Item	Approx Hrs
Lecture & Tutorial	10+3=13
Practical(P)	8
SW	1
SL	1
Total:	23

Session Outcomes(SOs)	Laboratory Instruction (LI)	om Instruction (CI)	f Learning (SL)
<b>Theory</b> <b>SO2.1:</b> Introduction to HTML, XML,CSS and Programming languages  <b>SO2.2:</b> introduction to web servers.  So3.3: Introduction to databases.  SO4: working with MYSQL, MS ACCESS.  SO5: Understand the Pharmacy Drug database.	2.1 Retrieve the information of a drug and its adverse effects using online tools  2.2 Creating mailing labels Using Label Wizard , generating label in MS WORD  2.3 Create a database in MS Access to store the patient information with the required fields Using access	2.1Web technologies: Introduction to HTML, 2.2 XML,CSS and Programming 2.3languages, 2.4 introduction to web servers and Server Products <b>2T1 Tutorial Class</b> 2.5: Introduction to databases, 2.6 MYSQL, MS ACCESS, 2.7 Pharmacy Drug database	2.1: Design the web page for patient monitoring.  2.2 Develop the patient database.

**Suggested Assignments :** introduction to web servers, Introduction to database, Understand the Pharmacy Drug database



### Unit III

#### CO-205-3: To Use different Application of computers in Pharmacy.

Item	ApproxHrs
Lecture & Tutorial	10+3=13
Practical(P)	12
SW	1
SL	1
Total:	27

Session Outcomes(SOs)	Laboratory Instruction (LI)	Room Instruction (CI)	Self Learning (SL)
<b>Theory</b> <b>SO3.1:</b> Application of computers in Pharmacy  <b>SO3.2:</b> Drug information storage and retrieval  <b>SO3.3:</b> Pharmacokinetics, Mathematical model in Drug design.  <b>SO3.4:</b> Hospital and Clinical Pharmacy, Electronic Prescribing and discharge (EP) systems, barcode medicine identification  <b>SO3.5:</b> Automated dispensing of drugs, mobile technology and adherence monitoring	3.1. Design a form in MS Access to view, add, delete and modify the patient record in the database 3.2. Generating report and printing the report from patient database 3.3. Creating invoice table using –MS Access	3.1 Application of computers in Pharmacy – Drug information. 3.2 storage and retrieval, Pharmacokinetics, 3.3 Mathematical model in Drug design, Hospital and Clinical Pharmacy, 3.4 Electronic Prescribing and discharge (EP) systems, barcode medicine identification and 3.5: automated dispensing of drugs, mobile technology and adherence monitoring Diagnostic System, 3.6: Lab-diagnostic System, Patient Monitoring System, 3.7 Pharma Information System	Study of Mathematical model in Drug design, Hospital and Clinical Pharmacy.

#### Suggested Assignments:

Automated dispensing of drugs, mobile technology and adherence monitoring, Hospital and Clinical Pharmacy, Electronic Prescribing and discha



**Unit IV:****CO-BP104-4: know the concept of Bioinformatics and Impact of Bioinformatics in Vaccine Discovery.**

Item	ApproxHrs
Lecture & Tutorial	10
Practical(P)	8
SW	1
SL	1
Total:	20

Session Outcomes(SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	SelfLearning (SL)
Theory SO4.1: Bioinformatics: Introduction  SO4.2: Objective of Bioinformatics:  SO4.3: Bioinformatics Databases  SO4.4: Concept of Bioinformatics, Impact of Bioinformatics:  SO5: Impact of Bioinformatics in Vaccine Discovery:	4.1: Drug information storage and retrieval using MS Access.  4.2: Creating and working with queries in MS Access.	4.1 Bioinformatics: Introduction, 4.2 Objective of Bioinformatics,  4.3 Bioinformatics Databases,  4.4 Concept of Bioinformatics,  4.5 Impact of Bioinformatics in Vaccine Discovery.	<b>4.1:</b> Study the Bioinformatics  Databases.

**Suggested Assignments:** Bioinformatics, Impact of Bioinformatics in Vaccine Discovery, Concept of Bioinformatics



## Unit V

**CO-BP205-5: Understand the Computers as data analysis in Preclinical development.**

Item	ApproxHrs
Lecture &Tutorial	8+2=10
Practical(P)	0
SW	1
SL	1
Total:	20

Session Outcomes(SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self Learning (SL)
<b>Theory</b> <b>SO5.1:</b> To know the Computers as data analysis in Preclinical development  <b>SO5.2: understand</b> Laboratory Information management System (LIMS)  SO5.3: Know the Text Information Management System(TIMs)	5.11. Exporting Tables, Queries, Forms and Reports to web pages  5.2. Exporting Tables, Queries, Forms and Reports to XML pages	5.1: Computers as data analysis in Preclinical  5.2: Development: Chromatographic 5T1 Tutorial Class 5.3Data analysis(CDS), 5T2: Tutorial Class 5.4 Laboratory Information management System (LIMS)  5.5 Text Information Management System(TIMs)	<b>5.1:</b> Laboratory Information management System (LIMS)



### Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (Cl)	LI (I)	Session al Work (S)	Self Learning (Sl)	Total Hour (Cl+S W+ Sl+LI)
CO-BP205-1: Understand the basic stricture, operation and characteristics of digital computer.	13	16	1	1	31
CO-BP205-2: understand the client and server communication and develop the pharmacy drug database.	13	8	1	1	23
CO-BP205-3: To Use different Application of computers in Pharmacy.	13	12	1	1	27
CO-BP205-4: know the concept of Bioinformatics and Impact of Bioinformatics in Vaccine Discovery.	10	8	1	1	20
CO-BP205-5: Understand the Computers as data analysis in Preclinical development	10	0	1	1	12
<b>Total Hours</b>	59	44	5	5	113



## Suggestion for End Semester Assessment

### Suggested Specification Table (For ESA)

Course Outcome	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
<b>CO-BP205-1:</b>	Understand the basic structure, operation and characteristics of digital computer.	08	06	01	15
<b>CO-BP205-2:</b>	Understand the client and server communication and develop the pharmacy drug database.	12	07	01	20
<b>CO-BP205-3:</b>	Understand the client and server communication and develop the pharmacy drug database.	02	06	02	10
<b>CO-BP205-4:</b>	To Use different Application of computers in Pharmacy. atics and Impact of Bioinformatics in	10	02	03	15
<b>CO-BP205-5:</b>	Understand the Computers as data analysis in Preclinical development	05	07	03	15
<b>Total</b>		<b>37</b>	<b>28</b>	<b>10</b>	<b>75</b>

**Legend: R: Remember, U: Understand, A: Apply**

The end of semester assessment for Computer application in Pharmacy will be held with written examination of 75 marks

**Note.** Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks. Teachers can also design different tasks as per requirement, for end semester assessment.

### **Suggested Instructional/Implementation Strategies:**

1. Improved Lecture
2. Tutorial
3. Case Method
4. Group Discussion
5. Role Play & Demonstration



**Suggested Learning Resources:**

<b>S. No.</b>	<b>Title</b>	<b>Author</b>	<b>Publisher</b>	<b>Edition &amp; Year</b>
1	Computer Application in Pharmacy	William E.Fassett –Lea and Febiger	600 South Washington Square	USA, (215) 922-1330.
2	Computer Application in Pharmaceutical Research and Development	Sean Ekins – Wiley-Interscience, A John Willey and Sons	Wiley and Sons, INC., Publication	USA- 2nd edition, 1969
3	Bioinformatics (Concept, Skills and Applications)	S.C. Rastogi	CBS Publishers and Distributors, 4596/1- A, 11 Darya Gani	6 <sup>th</sup> edition New Delhi – 110 002 (INDIA)
4	Microsoft office Access	Application Development Using VBA,	Wiley Dreamtech India (P)	4 <sup>th</sup> edition 2003

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## Course Outcome & Program Specific outcome Program Outcome Mapping

**Course Code: BP205 T**

**Course Title: Computer Application in Pharmacy**

Course Outcome	Program Outcome											Program Specific outcome			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
	Pharmacy knowledge	Planning Abilities	Problem analysis	Modern tool usage	Leadership skills	Professional Identity	Pharmaceutical Ethics	Communication	The pharmacist and society	Environment and sustainability	Life-long learning	Knowledge of drug discovery	Quality Analysis of API's	MOA of Drug	Biological evaluation of drug
<b>CO-1:</b> Understand the basic structure, operation and characteristics of digital computer.	3	2	3	1	3	2	1	2	3	2	3	1	3	1	2
<b>CO-2:</b> To determine the level of web programming and design the pharmacy database	2	3	1	3	1	2	1	1	2	3	3	3	2	1	3
<b>CO-3:</b> To Use different Application of computers in Pharmacy.	3	2	3	2	1	1	2	1	2	2	3	3	2	1	3
<b>CO-4:</b> Know the concept of Bioinformatics and Impact of Bioinformatics in vaccine discovery	2	3	2	3	1	3	2	2	3	3	3	3	2	1	3
<b>CO-5:</b> data analysis in Preclinical development	3	3	1	1	1	3	1	3	1	2	3	2	2	2	2

**Legend: 1- Low, 2-Medium, 3-High**



### Course Curriculum Mapping

Pos& PSOs No	Cos No	Title	SOs No	Class Room Instructions	Laboratory Instructions	Self learning
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	<b>CO-BP205T-1</b>	Understand the basic structure, operation and characteristics of digital computer.	SO1.1 SO1.2	1.1,1.2,1.3,1.4,1.5,1.6,1.7,1.8,1.9,1.10	LI1.1 LI1.2	SI-1.1 SI-1.2
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	<b>CO-BP205T-2</b>	To determine the level of web programming and design the pharmacy database	<b>SO-2.1</b>	2.1,2.2,2.3,2.4,2.5,2.6,2.7,2.8,2.9,2.10	LI2.1 LI2.2	SI-2.1
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	<b>CO-BP205T-3</b>	To Use different Application of computers in Pharmacy.	SO3.1	3.1,3.2,3.3,3.4,3.5,3.6,3.7,3.8,3.9,3.10	LI3.1 LI3.2	SI3.1
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	<b>CO-BP205T-4</b>	Know the concept of Bioinformatics and Impact of Bioinformatics in vaccine Discovery.	SO-4.1 SO-4.2	4.1,4.2,4.3,4.4,4.5,4.6,4.7,4.8.	LI4.1 LI4.2	SI-4.1
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	<b>CO-BPT205T-5</b>	Understand the Computers as data analysis in Preclinical development.	SO-5.1 SO-5.2	5.1,5.2,5.3,5.4,5.5,5.6,5.7,5.8	LI5.1 LI5.2	SI-5.1





AKS University  
Faculty of Pharmaceutical Science & Technology  
Rajiv Gandhi Institute of Pharmacy  
Curriculum of B. Pharmacy (Environmental Sciences) Program  
(Revised as on 01August2023)

**Semester-II**

**Course Code:** BP206 T

**Course Title:** Environmental Sciences

**Pre-requisite:** Student should have basic knowledge of nature and their surroundings.

**Rationale:** The students studying Environmental Science should possess foundational understanding about environment and its components. They should also know the importance of ecosystems in our surroundings.

**Course Outcomes:**

**BP206 T.1:** Create the awareness about environmental problems among learners.

**BP206 T.2:** Impart basic knowledge about the environment and its allied problems.

**BP206 T.3:** Develop an attitude of concern for the environment.

**Scheme of Studies:**

Board of Study	Course Code	Course Title	Scheme of studies (Hours/Week)				Total Study Hours (CI+LI+SW+SL)	Total Credits (C)
			CI	LI	SW	SL		
Pharmacy	BP206 T	Environmental Science	3	0	1	1	5	3

**Legend:** **CI:** Classroom Instruction (Includes different instructional strategies i.e. ,Lecture(L) and Tutorial (T) and others),

**LI:** Laboratory Instruction (Includes Practical performance in laboratory workshop, field or other locations using different instructional strategies)

**SW:** Sessional Work (includes assignment, seminar, mini-project etc.),

**SL:** Self Learning,

**C:** Credits.

**Note:** SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.



**Scheme of Assessment:****Theory:**

Board of Study	Course Code	Course Title	Scheme of Assessment (Marks)							
			Progressive Assessment (PRA)						End Semester Assessment (ESA)	Total Marks (PRA+ESA)
			Class/Home Assignment 5 number 3 marks each (CA)	Class Test 2 (2 best out of 3) 10 marks each (CT)	Seminar one (SA)	Class Activity any one (CAT)	Class Attendance (AT)	Total Marks (CA+CT+SA+CAT+A)		
PCC	BP206T	Environmental Science	15	20	5	5	5	50	50	100



### Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

**BP206 T.1:** Create the awareness about environmental problems among learners.

#### Approximate Hours

Item	Appx Hrs.
CI	10
LI	0
SW	1
SL	2
Total	12

Session Outcomes (SOs)	Laboratory Instructions (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO1.1 Know multidisciplinary nature of environmental science. SO1.2 Learn about the natural resources. SO1.3 Know the importance of forest. SO1.4 Learn the conservation of resources. SO1.5 Know alternative energy resources.	.	<b>Unit-1 Introduction</b> 1 The Multidisciplinary nature of environmental studies. 2 Natural Resources 3 Renewable and non-renewable resources. <b>1T1: Tutorial Classes</b> 4 Natural resources and associated problems. 5 Forest resources. 6 Water resources. <b>1T2 Tutorial Classes</b> 7 Mineral resources. 8 Food resources 9 Energy resources 10 Land resources: Role of an individual in conservation of natural resources. <b>1T3: Tutorial Classes</b>	1.1 What is Environmental Science? 1.2 What are resources?

#### SW-1 Suggested Sessional Work (SW):

##### a. Assignments:

- Write the importance of forest.
- Define deforestation and write its causes.
- Describe food problem & write the causes of world food problems.
- Write the uses of minerals & describe the effects of mineral extraction on environment.



**BP206T.2: Impart basic knowledge about the environment and its allied problems.****Approximate Hours**

Item	Appx Hrs
CI	10
LI	0
SW	2
SL	2
Total	14

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
<b>SO2.1</b> Understand the concept of ecosystem. <b>SO2.2</b> Learn the structure of ecosystem. <b>SO2.3</b> Know the function of ecosystem. <b>SO2.4</b> Describe the structure of forest ecosystem. <b>SO2.5</b> Learn energy flow in ecosystem.		<b>Unit-2 Ecosystems</b> 2.1 Concept of an ecosystem. 2.2 Structure of an ecosystem 2.3 Function of an ecosystem <b>2.T-1 Tutorial Classes</b> 2.4 Introduction and types of ecosystems 2.5 Forest ecosystem 2.6 Grassland ecosystem <b>2.T-1 Tutorial Classes</b> 2.7 Desert ecosystem 2.8 Aquatic ecosystem – Lakes & river ecosystem 2.9 Ponds and stream ecosystem <b>2.T-1 Tutorial Classes</b> 2.10 oceans & estuaries ecosystem	2.1 What is biotic and a biotic components of environment? 2.2 What are interactions?

**SW-2 Suggested Sessional Work (SW):****a. Assignments:**

- What do you mean by ecosystem? Describe the structure of ecosystem.
- Give a brief classification of ecosystem.
- Write the function of an ecosystem.

**b. Mini Project:**

Visit to various ecosystem and study biotic and a biotic ecosystem.



**BP206 T.3: Develop an attitude of concern for the environment.****Approximate Hours**

Item	Appx Hrs
CI	09
LI	0
SW	3
SL	2
Total	14

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
<b>SO3.1</b> Learn about pollution and its sources.  <b>SO3.2</b> Know the sources of different pollutant.  <b>SO3.3</b> Understand the harmful effects of air pollution.  <b>SO3.4</b> Learn the control of pollution.  <b>SO3.5</b> Describe the role of an individual in prevention of pollution.		<b>Unit-3: Pollution</b> 3.1 What is pollution? 3.2 Air Pollution: Definition & Causes 3.3 Effects and control of air pollution <b>3T1 Tutorial Classes</b> 3.4 Acid rain, Global Warming, 3.5 Greenhouse effect & Depletion of ozone layer. 3.6 Water Pollution: Definition & causes 3.7 Water Pollution: effects & control <b>3T2 Tutorial Class</b> 3.8 Soil Pollution: Definition & causes 3.9 Soil Pollution: effects & control 3.10 Role of an individual in prevention of pollution. <b>3T3 Tutorial Class</b>	i. What is pollution basic introduction?  ii. What is pollutant?

**SW-3 Suggested Sessional Work (SW):****a. Assignments:**

- Write an essay on air pollution.
- What do you mean by acid rain write its causes and effects.
- Describe the effects of water pollution.
- How soil pollution can be control?

**b. Other Activities(Specify):**

Visit to different polluted sites and study the source of pollution and their effects.



**Brief of Hours suggested for the Course Outcome**

Course Outcomes	Class Lecture (Cl)	Sessional Work (SW)	Self-Learning (Sl)	Total hour (Cl+SW+Sl)
BP206 T.1: Create the awareness about environmental problems among learners.	10	1	2	13
BP206 T.2: Impart basic knowledge about the environment and its allied problems.	10	2	2	14
BP206 T.3: Develop an attitude of concern for the environment.	10	2	2	14
Total Hours	30	05	06	41

**Suggestion for End Semester Assessment**

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	Create the awareness about environmental problems among learners.	03	01	01	05
CO-2	Impart basic knowledge about the environment and its allied problems.	02	06	02	10
CO-3	Develop an attitude of concern for the environment.	03	07	05	15
<b>Total</b>		<b>11</b>	<b>26</b>	<b>13</b>	<b>50</b>

**Legend: R: Remember, U: Understand, A: Apply**

The end of semester assessment for Fundamental of Environmental Science will be held with written examination of 50 marks

**Note.** Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks. Teachers can also design different tasks as per requirement, for end semester assessment.

**Suggested Instructional/Implementation Strategies:**

1. Improved Lecture
2. Tutorial
3. Case Method
4. Group Discussion
5. Role Play
6. Visit to cement plant
7. Face book, twitter, What's App, Mobile, Online sources)
8. Brainstorming



**Suggested Learning Resources:**

<b>S. No.</b>	<b>Title</b>	<b>Author</b>	<b>Publisher</b>	<b>Edition &amp; Year</b>
1	Environmental Science	Y.K. Sing	New Age International Pvt, Publishers, Bangalore	4 <sup>th</sup> edition 2011
2	Environmental Biology	Agarwal, K.C	Nidi Publ. Ltd. Bikaner.	Six edition 2001
3	The Biodiversity of India	Bharucha Erach	Mapin Publishing Pvt. Ltd., Ahmedabad – 380 013, India	4 <sup>th</sup> edition 2020
4	Perspective in Environmental Studies	C.P. Kaushik & Anubha Kaushik	New age publication	- 2018

**Curriculum Development Team:**

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3. Mrs. Suman Patel, Department of environmental Science, AKS University



### Course Outcome, Program Outcome, Program Specific Outcome Mapping

Course Code: BP203T

Course Name: Environmental Sciences

Course Outcome	Program Outcome											Program Specific outcome			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
	Pharmacy knowledge	Planning Abilities	Problem analysis	Modern tool usage	Leadership skills	Professional Identity	Pharmaceutical Ethics	Communication	The pharmacist and society	Environment and sustainability	Life-long learning	Knowledge of drug discovery	Quality Analysis of API's	MOA of Drug	Biological evaluation of drug
<b>CO-1:</b> Create the awareness about environmental problems among learners	2	2	1	3	3	2	1	2	3	2	3	1	3	1	2
<b>CO-2:</b> Impart basic knowledge about the environment and its allied problems	2	3	1	3	1	2	1	1	2	3	3	3	2	1	3
<b>CO-3:</b> Develop an attitude of concern for the environment	1	2	1	2	2	1	2	1	2	2	3	3	2	1	3

**Legend: 1- Low, 2-Medium, 3-High**



**Legend: 1- Low, 2-Medium, 3-High**  
**Course Curriculum Mapping**

<b>Pos&amp; PSOs No</b>	<b>Cos No</b>	<b>Title</b>	<b>SOs No</b>	<b>Class Room Instructions</b>	<b>Laboratory Instruction</b>	<b>Self learning</b>
Pos:1,2,3, 4,5,6,7,8,9 ,10,11 PSOs:1,2, 3,4,5,6	<b>CO-BP206T-1</b>	Create the awareness about environmental problems among learners.	SO1.1 SO1.2 SO1.3 SO1.4 SO1.5	1.1,1.2,1.3,1.4, 1.5,1.6,1.7,1.8, 1.9,1.10		SI-1.1 SI-1.2
Pos:1,2,3, 4,5,6,7,8,9 ,10,11 PSOs:1,2, 3,4,5,6	<b>CO-BP206T-2</b>	Impart basic knowledge about the environment and its allied problems.	<b>SO-2.1</b> <b>SO-2.2</b> <b>SO-2.3</b> <b>SO-2.4</b> <b>SO-2.5</b>	2.1,2.2,2.3,2.4, 2.5,2.6,2.7,2.8, 2.9,2.10		SI-2.1 SI-2.2
Pos:1,2,3, 4,5,6,7,8,9 ,10,11 PSOs:1,2, 3,4,5,6	<b>CO-BP206 T-3</b>	Develop an attitude of concern for the environment.	SO3.1 SO3.2 SO3.3 SO3.4 SO3.5	3.1,3.2,3.3,3.4, 3.5,3.6,3.7,3.8, 3.9,3.10		SI3.1 SI3.1





AKS University  
Faculty of Pharmaceutical Science & Technology  
Rajiv Gandhi Institute of Pharmacy  
Curriculum of B. Pharmacy (Pharmaceutical organic chemistry-II) Program  
(Revised as on 01August2023)  
**Semester-III**

<b>Course Code:</b>	<b>BP301T/BP305P</b>
<b>Course Title:</b>	<b>Pharmaceutical organic chemistry-II</b>
<b>Pre-requisite:</b>	The Student should have basic knowledge of organic substance with their importance and Uses.
<b>Rationale/Objective s:</b>	<p>Up on completion of the course student shall be able to</p> <ul style="list-style-type: none"><li>● To understand the sources of impurities and methods to determine the impurities in drugs.</li><li>● To Use different chemical methods to prepare organic pharmaceuticals.</li><li>● Understand the medicinal and pharmaceutical importance of organic compounds</li></ul>

**Course Out comes:**

- CO-BP301T-1:** To understand the Analytical, synthetic and other evidences in the derivation of Structure of benzene, Orbital picture, resonance in benzene, Reactions of benzene
- CO-BP301T -2:** To understand the Structure and uses of phenol , aromatic amine, aromatic acids.
- CO-BP301T -3:** To use different chemical methods to find acid value, Saponification value , Ester value, Iodine value.
- CO-BP301T -4:** Understand the medicinal and pharmaceutical importance of naphthalene, Phenanthrene, Anthracene,
- CO-BP301T -5:** Understand the Stabilities the cycloalkane.



### Scheme of Studies

Course code	Title of the course	Program Name	TOTAL Number of contact hours/Week						Credit
			Classroom Instruction (A)		Practical (P)	S W	S L	Total Hours (H)	
			Lecture	Tutorial					
BP301 T	Pharmaceutical Organic Chemistry-II Theory	B. Pharmacy	3	1	4	1	1	10	6

**Legend:**

**CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others),

**LI:** Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)

**SW:** Sessional Work (includes assignment, seminar, mini project etc.),

**SL:** Self Learning, Credits.

**Note:** SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.



## Theory Assessment

Boardof Study	Course Code	Course Title	Scheme of Assessment ( Marks )						
			Progressive Assessment ( PRA)						
			Academic activity, Any three (Quiz/ Assignment, open book test, filed work and seminar)	Student teacher interaction	Class Attendance (AT)	Total Marks (A)	Sessional Exam (B)	EndSemester Assessment(C)	Total Marks(A+B+ C)
Pharmacy	BP301T	Pharma ceutical Organic Chemistry-II	3	3	4	10	15	75	100

## Practical Assessment

Board of Study	Course Code	Course Title	Scheme of Assessment ( Marks )						
			Internal Assessment (A)			End Semester Examination (B)			Total Marks (A+)
			Attendance	Record	Sessional Exam.	Synopsis	Experiment	Viva	
Pharmacy	BP301T	Pharmaceutical Organic Chemistry-II	2	3	10	5	25	5	50

## Guidelines for the allotment of marks for attendance

Percentage of Attendance	Theory	Practical
95 – 100	4	2
90 – 94	3	1.5
85 – 89	2	1
80 – 84	1	0.5
Less than 80	0	0



**Course-Curriculum Detailing:**

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

**CO-BP301-1: to understand the reaction of benzene for synthesis of product in medical field.**

Item	Approx Hrs
Lecture & Tutorial	10+3=13
Practical(P)	16
SW	1
SL	1
Total:	31

Session Outcomes(SOs)	Laboratory Instruction (LI)	Class room Instruction(CI)	Self Learning (SL)
<b>Theory</b> <b>SO1.1:</b> Analytical, synthetic and other evidences in the derivation of structure of benzene <b>SO1.2:</b> Explain Orbital picture, resonance in benzene, aromatic characters, Huckel's rule <b>SO1.3</b> Explain Reactions of benzene <b>SO1.4</b> Understand orientation of mono substituted benzene compounds <b>SO1.5</b> Structure and uses of DDT. <b>Practical</b> <b>SO-P- 1.1:</b> To synthesis of benzanilide from aniline. <b>SO-P- 1.2:</b> To synthesis of 2,4,6 Tribromoaniline from Aniline <b>SO-P-1.3:</b> Acetanilide by halogenations(Bromination)reaction <b>SO-P-1.4:</b> Benzoic acid from Benzyl chloride by oxidation reaction	<b>1.3:</b> Acetanilide by halogenations (Brominating) reaction  <b>1.4:</b> Benzoic acid from Benzyl chloride by oxidation reaction	<b>Unit-1</b> <b>1.1</b> Analytical, synthetic and other evidences in the derivation of structure of benzene, <b>1.2</b> Orbital picture, resonance in benzene, <b>1.3</b> aromatic characters, Huckel's rule. <b>1.4</b> Reactions of benzene - nitration, sulphonation, halogenations reactivity. <b>1.5</b> Friedel crafts alkylation-reactivity, limitations, <b>1.6</b> Friedel crafts acylation. <b>1.7</b> Substituent's, effect of substituent's on reactivity <b>1.8</b> orientation of mono substituted benzene compounds towards electrophilic substitution reaction. <b>1.9</b> Structure and uses of Saccharin. <b>1.10</b> Structure and uses of BHC and Chloramne <b>1T.1:</b> Orbital picture of benzene  <b>1T.2:</b> Halogenations of benzene  <b>1T.3:</b> Structure and uses of DDT	<b>1.1:</b> Structure and uses of DDT, BHC  <b>1.2:</b> Structure and uses of Saccharin and Chloramines



**Suggested Assignments:** Discuss Reactions of benzene - nitration, sulphonation, halogenations reactivity, Friedelcrafts alkylation-reactivity, limitations, Friedelcrafts acylation.

## Unit II

**CO-BP301-2: TO determine the acidity of phenols, and understand the aromatic acid and amines.**

Item	Approx Hrs
Lecture & Tutorial	10+3=13
Practical(P)	8
SW	1
SL	1
Total:	23

Session Outcomes(SOs)	Laboratory Instruction (LI)	Class room Instruction(CI)	Self Learning (SL)
<p><b>Theory</b>  <b>SO2.1:</b> Understand of Acidity of phenols, effect of substituents on acidity, qualitative tests.  <b>SO2.2:</b> Explain Structure and uses of phenol, cresols, resorcinol, naphthols.  <b>SO2.3:</b> Explain Aromatic Amines - Basicity of amines, effect of substituents on basicity.  <b>SO2.4</b> Explain synthetic uses of aryl diazonium salt.</p> <p><b>SO2.5</b> Understand and explain of aromatic acids-acidity, effect of substituent on acidity and reaction of benzoic acid.</p> <p><b>Practical</b>  <b>SO-P- 2.1:</b> Preparation of 1-Phenylazo-2-naphthol from Aniline by diazotization and coupling  <b>SO-P-2.2:</b> preparation of Benzil from Benzoin by oxidation reaction.</p>	<p>Preparation of 1-Phenylazo-2-naphthol from Aniline by diazotization and coupling oxidation reaction:  <b>3.</b> preparation of Benzil from Benzoin by oxidation reaction.</p>	<p><b>Unit-2</b>  <b>Phenols, Aromatic amines, Aromatic acids</b>  <b>2.1</b> Acidity of phenols,  <b>2.2</b> effect of substituents on acidity.  <b>2.3</b> qualitative tests of phenols.  <b>2.4</b> Structure and uses of cresols, resorcinol, naphthols.  <b>2.5</b> Aromatic Amines - Basicity of amines,  <b>2.6</b> effect of substituents on basicity.  <b>2.7</b> synthetic uses of aryl diazonium salt.  <b>2.8</b> Acidity of aromatic acids.  <b>2.9</b> effect of substituents on acidity.  <b>2.10</b> important of benzoic acid  <b>2T.1:</b> Properties of Phenols.  <b>2T.2:</b> Properties of Aromatic amines.  <b>2T3:</b> Properties of Aromatic acids.</p>	<p><b>2.1:</b> Study the Structure and uses of phenol, cresols, resorcinol, naphthols.</p>

**Suggested Assignments:** Discuss Acidity of phenols, Structure and uses of phenol, cresols, resorcinol, naphthols



### Unit III

**CO-BP301-3: To Use different chemical methods to prepare fats and oils and its properties.**

Item	Approx Hrs
Lecture & Tutorial	10+3=13
Practical(P)	12
SW	1
SL	1
Total:	27

Session Outcomes(SOs)	Laboratory Instruction (LI)	Class room Instruction(CI)	Self Learning(SL)
<b>Theory</b> SO3.1 Understand of fatty acid reaction SO3.2 Explain Hydrolysis, Hydrogenation, Saponification. SO3.3 Explain Rancidity of oils, drying of oils, SO3.4 Explain Analytical constants Acid value, Saponification. SO3.5 Explain Ester value, Iodine value, <b>Practical</b> <b>SO-P- 3.1:</b> Determination of saponification value in given oil sample. <b>SO-P- 3.2:</b> Determination of acid value in given oil sample. <b>SO-P- 3.3:</b> Determination of iodine value in given oil sample.	<b>3.3.</b> Determination and significance of saponification value, acid value, Iodine value, Acetyl value.	<b>3.1:</b> fatty acid reaction <b>3.2:</b> Hydrolysis of oils. <b>3.3:</b> Hydrogenation of oils. <b>3.4:</b> Determination of saponification value. <b>3.5:</b> Determination of acid value. <b>3.6:</b> Determination of Ester value. <b>3.7:</b> determination and significance of Iodine value, <b>3.8</b> Determination of Acetyl value, <b>3.9</b> Determination of Reichert Meissl (RM) value. <b>3.10</b> Determination of Rancidity of oils. <b>3T1:</b> Difference between oils and fats. <b>3T2</b> significance of hydrolysis of oils. <b>3T3</b> Saponification value.	<b>3.1:</b> Hydrogenation of oils.

**Suggested Assignments:** Discuss Fatty acids– reactions



**Unit IV: CO-BP301-4:** To study of polynuclear hydrocarbons of various reaction used in pharmaceutical industry.

Item	Approx Hrs
Lecture & Tutorial	13
Practical(P)	8
SW	1
SL	1
Total:	20

Session Outcomes(SOs)	Laboratory Instruction (LI)	Class room Instruction(CI)	Self Learning(SL)
<p><b>Theory</b>  SO4.1 Understand of reaction of Polynuclear hydrocarbons.</p> <p>SO4.2 Explain Structure and medicinal uses of Naphthalene.</p> <p>SO4.3 Explain Structure and medicinal uses of Anthracene</p> <p>SO4.4 Explain Structure and medicinal uses of Phenanthrene,</p> <p><b>Practical</b>  <b>SO-P- 4.1:</b> student are perform to crystallization of Naphthalene.  <b>SO-P- 4.2:</b> student are perform to steam distillation.</p>	<p>To prepare &amp; Identified the Ferrous sulphate  : To prepare &amp; Identified the Copper sulphate</p>	<p><b>Unit – 4</b>  4.1 Introduction of Polynuclear Hydrocarbon.  4.2 classification of Polynuclear Hydrocarbon.  4.3 Introduction of Naphthalene.  4.4 Synthesis of Naphthalene  4.5 Reaction of Naphthalene  4.6 Synthesis of Phenanthrene.  4.7 Reaction of Phenanthrene.  4.8 Introduction of Anthracene  4.9 Synthesis of Anthracene.  4.10 Reaction of Anthracene.</p> <p><b>4T1:</b> Structure and medicinal uses of Diphenylmethane  <b>4T.2:</b> Structure and medicinal uses of Triphenylmethane  <b>4T3:</b> Structure and medicinal uses of Anthracene.</p>	<p><b>4.1:</b> Study the Structure and medicinal uses of Naphthalene.</p>

**Suggested Assignments:** Discuss reaction of Polynuclear hydrocarbons



**Unit V**

**CO-BP301-5:** To study of cyclo alkanes of various reaction used in pharmaceutical industry.

Item	Approx Hrs
Lecture & Tutorial	8+2=10
Practical(P)	0
SW	1
SL	1
Total:	20

Session Outcomes(SOs)	Laboratory Instruction (LI)	Class room Instruction(CI)	Self Learning (SL)
<b>Theory</b> SO5.1 Understand Baeyer's strain theory and stabilities of cycloalkane. SO5.2 Explain limitation of Baeyer's strain theory. SO5.3 Explain Coulson and Moffitt's modification. SO5.4 Explain Sachse Mohr's theory(Theory of strainless rings),, SO5.5 Understand and explain of reactions of cyclopropane and cyclobutane.	NA	<b>Unit-5.</b> 5.1 Introduction of Cycloalkanes. 5.2 Baeyer's strain theory 5.3 limitation of Baeyer's strain theory 5.4 Coulson and Moffitt's modification 5.5 Sachse Mohr's theory 5.6 Introduction of cyclopropane, 5.7 reactions of cyclopropane , cyclobutane. 5.8 reactions of cyclobutane. <b>5T1:</b> Tutorial Class <b>5T.2:</b> Tutorial class	<b>5.1:</b> Baeyer's strain theory and stabilities of cycloalkane.



### Brief of Hours suggested for the Course Outcome

Course Out comes	Class Lecture (Cl)	(L)	Sessional Work (SW)	Self Learning (Sl)	Total Hour (Cl+SW+ Sl+LI)
<b>CO-BP301-1:</b> To understand the General methods of preparation and reactions of benzene and its derivatives compounds to be explained	13	16	1	1	31
<b>CO-BP301-2:</b> To determine the acidity of phenols and its derivatives, aromatic amines, and aromatic acids of various reaction used in pharmaceutical industry.	13	8	1	1	23
<b>CO-BP301-3:</b> To study of fats and oils of various reaction used in pharmaceutical industry.	13	12	1	1	27
<b>CO-BP301-4:</b> To study of poly-nuclear hydrocarbons of various reaction used in pharmaceutical industry.	10	8	1	1	20
<b>CO-BP301-5:</b> Understand the medicinal and pharmaceutical importance reaction of Polynuclear hydrocarbons.	10	0	1	1	12
<b>Total Hours</b>	<b>59</b>	<b>44</b>	<b>5</b>	<b>5</b>	<b>113</b>



**Suggestion for End Semester Assessment**  
Suggested Specification Table (For ESA)

Course Outcome	Unit Titles	Marks Distribution			Total Marks
		A	C	I	
<b>CO-BP301-1:</b>	To understand the General methods of preparation and reactions of benzene and its derivatives compounds to be explained	08	06	01	15
<b>CO-BP104-1- 2:</b>	To determine the acidity of phenols and its derivatives, aromatic amines, and aromatic acids of various reaction used in pharmaceutical industry.	12	07	01	20
<b>CO-BP3013:</b>	To study of fats and oils of various reaction used in pharmaceutical industry.	02	06	02	10
<b>CO-BP301-4:</b>	To study of polynuclear hydrocarbons of various reaction used in pharmaceutical industry.	10	02	03	15
<b>CO-BP301-5:</b>	Understand the medicinal and pharmaceutical	05	07	03	15
<b>Total</b>		<b>37</b>	<b>28</b>	<b>10</b>	<b>75</b>

**Legend:**A: Analyse, C: Create,I: Interpret

The end of semester assessment for Pharmaceutical organic chemistry-II will be held with written examination of 75 marks

**Note.** Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks. Teachers can also design different tasks as per requirement for end semester assessment.

**Suggested Instructional/Implementation Strategies:**

1. Improved Lecture
2. Tutorial
3. Case Method
4. Group Discussion
5. Role Play
6. Demonstration
7. ICT Based Teaching Learning (Video Demonstration/Tutorials CBT, Blog,Face book, Twitter, Whats app, Mobile, Online sources)
8. Brainstorming



### Suggested Learning Resources:

S. No.	Title	Author	Publisher	Edition & Year
1	Advanced Organic Chemistry	Morrison & Boyd	Pearson education	7 <sup>th</sup> edition 2010
2	A Text book of Organic Chemistry	Arun Bahl , B.S Bahl	S.Chand	22 <sup>nd</sup> edition, 2019
3	Text book of Organic Chemistry	P.L.Soni	Sultan Chand,	29 <sup>th</sup> edition, 2012
4	Organic Chemistry	R. T. Morrison and R. N. Boyd	Pearson education india	7 <sup>th</sup> Edition 2010
5	Advanced organic chemistry	Dr. Jagdamba singh, Dr. LDS Yadav	Pragati prakashan	14 <sup>th</sup> edition 2017
6	Organic Chemistry	J. Clayden	Oxford Press	2 <sup>nd</sup> edition, 2023

### Curriculum Development Team:

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**Course Outcome, Program Specific Outcome& Program Outcome Mapping**

**Course Code: BP301T/BP305P**

**Course Name: Pharmaceutical organic chemistry-II**

Course Outcome	Program Outcome											Program Specific outcome			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
	Pharmacy knowledge	Planning Abilities	Problem analysis	Modern tool usage	Leadership skills	Professional Identity	Pharmaceutical Ethics	Communication	The pharmacist and society	Environment and sustainability	Life-long learning	Knowledge of drug discovery	Quality Analysis of API's	MOA of Drug	Biological evaluation of drug
<b>CO-1:</b> General methods of preparation and reactions of benzene and its derivatives compounds	3	2	3	1	3	2	1	2	3	2	3	1	3	1	2
<b>CO-2:</b> Acidity of phenols and its derivatives, aromatic amines,	2	3	1	3	1	2	1	1	2	3	3	3	2	1	3
<b>CO-3:</b> Fats and oils of various reaction used in pharmaceutical industry	3	2	3	2	1	1	2	1	2	2	3	3	2	1	3
<b>CO-4:</b> Fats and oils of various reaction used in pharmaceutical industry.	2	3	2	3	1	3	2	2	3	3	3	3	2	1	3
<b>CO-5:</b> Poly-nuclear hydrocarbons of various reaction used in pharmaceutical industry	3	3	1	1	1	3	1	3	1	2	3	2	2	2	2

**Legend: 1- Low, 2-Medium, 3-High**



## Course Curriculum Mapping

Pos& PSOs No	Cos No&	Title	SOs No	Class Room Instructions	Laboratory Instructions	Self learning
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	CO-1	To understand the General methods of preparation and reactions of benzene and its derivatives compounds to be explained	SO1.1 SO1.2 SO1.3 SO1.4 SO1.5	1.1,1.2,1.3,1.4,1.5,1.6,1.7,1.8,1.9,1.10 T1, T2, T3	LI-1.1 LI-1.2 LI-1.3 LI-1.4 LI-1.5 LI-1.6 LI-1.7	SI-1.1 SI-1.2
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	CO-2	To determine the acidity of phenols and its derivatives, aromatic amines, and aromatic acids of various reaction used in pharmaceutical industry.	SO-2.1 SO-2.2 SO-2.3 SO-2.4 SO-2.5	2.1,2.2,2.3,2.4,2.5,2.6, T1, T2, T3	LI-2.1 LI-2.2	SI-2.1 SI-2.2
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	CO-3	To study of fats and oils of various reaction used in pharmaceutical industry.	SO-3.1 SO-3.2 SO-3.3 SO-3.3 SO-3.4 SO-3.5	3.1,3.2,3.3,3.4,3.5,3.6,3.7,3.8,3.9,3.10 T1, T2, T3	LI-3.1 LI-3.2 LI-3.3 LI-3.4 LI-3.5	SI-3.1 SI-3.2
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	CO-4	To study of fats and oils of various reaction used in pharmaceutical industry.	SO-4.1 SO-4.2 SO-4.3 SO-4.4	4.1,4.2,4.3,4.4,4.5,4.6,4.7,4.8., 4.9, 4.10 T1, T2, T3	LI-4.1 LI-4.2	SI-4.1 SI-4.2
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	CO-5	To study of poly-nuclear hydrocarbons of various reaction used in pharmaceutical industry.	SO-5.1 SO-5.2 SO-5.3 SO-5.4 SO-5.5	5.1,5.2,5.3,5.4,5.5,5.6,5.7,5.8, 5.9, T1, T2, T3	LI-5.1 LI-5.2	SI-5.1 SI-5.2





AKS University  
Faculty of Pharmaceutical Science & Technology  
Rajiv Gandhi Institute of Pharmacy  
Curriculum of B. Pharmacy (Physical Pharmaceutics-I) Program  
(Revised as on 01August2023)

**Semester-III**

**Course Code:** BP302T/BP306P

**Course Title:** Physical Pharmaceutics-I theory

**Pre-requisite:** The Student should have basic knowledge of solution, solute, solvent and their properties.

**Rationale/Objectives:** Upon completion of the course student shall be able to

- Understand various physicochemical properties of drug molecules in the designing the dosage forms
- Know the principles of chemical kinetics & to use them for stability testing and determination of expiry date of formulations
- Demonstrate use of physicochemical properties in the formulation development and evaluation of dosage Forms.

**Course Outcomes:**

- BP302.1: To Understand the concept of solubility and its importance in preparation of pharmaceutical products.
- BP 302.2: We read about the state of matter, their changes and physicochemical properties of drug molecule with importance.
- BP 302.3: To understand the surface and interfacial phenomenon with their measurement and use of HLB scale.
- BP302.4: To gain knowledge about complication, protein binding with complex and drug distribution.
- BP302.5: To understand the functioning of pH , buffers and their uses in pharmaceutical and biological systems.



## Scheme of Studies

Course code	Title of the course	Program Name	TOTAL Number of contact hours/Week						Credit
			Classroom Instruction (A)		Practical(P)	S W	S L	Total Hours (H)	
			Lecture	Tutorial					
BP302 T	Physical pharmaceutics 1 theory	B. Pharmacy	3	1	4	1	1	10	6

### Legend:

**CI:** Class room Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others),

**LI: Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)**

**SW: Sessional Work** (includes assignment, seminar, mini project etc.),

**SL:** Self Learning, Credits.

**Note:** SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

### Theory Assessment

Board of Study	Course Code	Course Title	Scheme of Assessment(Marks)					EndSemester Assessment(C)	Total Marks(A+B+C)
			Progressive Assessment(PRA)						
			Academic activity, Any three (Quiz/ Assignment, open book test, filed work and seminar)	Student teacher interaction	Class Attendane(AT)	Total Marks (A)	Sessional Exam(B)		
Pharmacy	BP302T	Physical Pharmaceutics-1 theory	3	3	4	10	15	75	100



## Practical Assessment

Board of Study	Course Code	Course Title	Scheme of Assessment(Marks)						Total Marks  (A+B)
			Internal Assessment(A)			End Semester Examination(B)			
			Attendance	Record	Sessional Exam.				
						Synopsis	Experiment	Viva	
Pharmacy	BP- 306P	Physical pharmaceuticals -I theory-	2	3	10	5	25	5	50

## Guidelines for the allotment of marks for attendance

Percentage of Attendance	Theory	Practical
95 – 100	4	2
90 – 94	3	1.5
85 – 89	2	1
80 – 84	1	0.5
Less than 80	0	0



## Course-Curriculum

### Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

**CO-BP302-1: To Understand the concept of solubility and its importance in preparation of pharmaceutical products.**

Item	Approx Hrs
Lecture & Tutorial	10+3=13
Practical(P)	20
SW	1
SL	1
Total:	35

Session Outcomes(SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
<b>Theory</b> <b>SO1.1:</b> Solubility and their characteristics. <b>SO1.2:</b> Diffusion Principle in biological system. <b>SO1.3:</b> Distribution law was studied <b>Practical</b> <b>SO-P-1.1:</b> The solubility of drug at room temperature was determined. <b>SO-P-1.2:</b> pKa value by Half Neutralization Henderson Hasselbalch equation was determined. <b>SO-P-1.3:</b> Partition co-efficient of benzoic acid in benzene and water was determined. <b>SO-P-1.4:</b> Partition co-efficient of Iodine in CCl <sub>4</sub> and water was determined. <b>SO-P-1.5:</b> % Composition of NaCl in a solution using phenol- water system by CST method was determined.	<b>1:</b> Drug solution was prepared. <b>2:</b> Half neutralization/ Henderson Hasselbalch equation determined. <b>3:</b> To perform Partition co-efficient of benzoic acid in benzene and water <b>4:</b> To perform Partition co-efficient of Iodine in CCl <sub>4</sub> and water. <b>5:</b> To perform CST method	1. Solubility expression, mechanisms of solute 2. solvent interaction 3. Ideal solubility parameters 4. Salvation and association 5. Binary Solution <b>1T.1:</b> Tutorial class 6. Quantitative approach to the factors influencing solubility of drugs. 7. Solubility of gas in liquids <b>7.1.7</b> Solubility of liquids in liquids. <b>1.8:</b> Procedure of limit test of Arsenic. <b>1T.2:</b> Tutorial class Critical solution temperature and application Distribution law and its limitation, application <b>1T3:</b> Tutorial class	<b>1.1</b> Study the aim, objectives and importance of solubility in various dosage forms.

**Suggested Assignments:** Solubility parameters, quantitative approach to the factor influencing, solubility of drugs, salvation and association, Distribution Law and limitation, Critical Solution Temperature



## Unit-II

**CO-BP302-2:** To Know about the state of matter, their changes and physicochemical properties of drug molecule with importance.

Item	Approx Hrs
Lecture & Tutorial	10+3=13
Practical(P)	0
SW	1
SL	1
Total:	15

Session Outcomes(SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self Learning (SL)
<b>Theory SO1.1:</b> State of Matter changes in state of matter. <b>SO1.2:</b> State of matter changes in state of matter. <b>SO1.3:</b> Physicochemical properties of drug molecules and determination		1: Changes in state of matter. 2: Latent Heat, vapour pressure. 3: Sublimation critical point, eutectic mixture. 4: Gases Aerosols 5: Inhalers, relative humidity. <b>2T.1:</b> Tutorial Class liquid complexes, liquid crystals, glassy states solid-crystalline, amorphous & polymorphism. Refractive index, optical rotation dielectric constant, dipole moment, <b>1T.2:</b> Tutorial class dissociation constant, determinations and applications <b>1T3:</b> Tutorial class	2.1: Determination of different physical chemical properties and their effects

**Suggested Assignments:** Sublimation critical point, Eutectic mixtures, dissociation constant, changes in state of matter and polymorphism



### Unit III

**CO-BP302-3:** Understand the surface and interfacial phenomenon with their measurement and use of HLB scale

Item	ApproxHrs
Lecture & Tutorial	10+3=13
Practical(P)	12
SW	1
SL	1
Total:	27

Session Outcomes(SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
<b>Theory</b> <b>SO3.1:</b> Surface and interfacial tensions with their measurements <b>SO3.2:</b> HLB scale value surface agent <b>SO3.3:</b> Solubilisation, detergency, adsorption at solid interface <b>Practical</b> <b>SO-P-3.1:</b> Determination of HLB number of a surfactants by saponification method. <b>SO-P-3.2:</b> Determination of critical micellar concentration of surfactants. <b>SO-P-3.3:</b> Determination of surface tension of given liquids by drop count and drop weight method.	<b>3.1:</b> Saponification method was performed. <b>3.2:</b> Surfactants SLS solution was prepared. <b>3.3:</b> Critical micelle concentration was determined <b>3.4:</b> Surface tension using stalagmometer was performed <b>3.5:</b> To performed drop count and drop weight method	<b>31:</b> Liquid interface <b>32:</b> Surface and interfacial tensions <b>3.3:</b> Surface free energy <b>3.4:</b> Measurement of surface & interfacial tensions. <b>3T.1:</b> Tutorial Class <b>35:</b> Spreading coefficient <b>36:</b> Adsorption at liquid interfaces <b>37:</b> Surface active agents. <b>38:</b> HLB Scale. <b>3T.2:</b> Tutorial class <b>38:</b> Solubilisation <b>39:</b> Detergency, adsorption at solid interface. <b>3T3:</b> Tutorial class	<b>31:</b> Study of different types of surfactants that different detergent contains, including shampoo preparation

**Suggested Assignments:** Liquid interface, surface & inter facial tensions, Surface free energy, Measurement of surface & interfacial tensions, spreading co efficient



**Unit IV: CO-BP302-4:** To gain knowledge about complexation, protein binding with complex and drug distribution.

Item	Approx Hrs
Lecture & Tutorial	8+3=11
Practical(P)	12
SW	1
SL	1
Total:	25

Session Outcomes(SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self Learning (SL)
<p><b>Theory</b></p> <p><b>SO4.1:</b> Introduction,</p> <p><b>SO4.2:</b> Classification of complexation.</p> <p><b>SO4.3:</b> Complexation applications</p> <p><b>SO4.4:</b> Complexation and drug action.</p> <p><b>SO4.5:</b> Thermodynamic treatment of stability constants</p> <p><b>Practical SO-P-4.1:</b> Determination of stability constant and donor acceptor ratio of PABA-Caffeine complex by solubility method</p> <p><b>SO-P- 4.2:</b> Determination of stability constant and donor acceptor ratio of Cupric-Glycine complex by pH titration method</p> <p><b>SO-P-4.3:</b> Determination of Freundlich and Langmuir constants Using activated charcoal</p>	<p>1: Prepare the caffeine complex</p> <p>2: Donor/Acceptor ratio by solubility method was determined</p> <p>3: Glycine and Cupric solution was prepared.</p> <p>4: pH meter was calibrated</p> <p>5: pH titration method was performed</p>	<p><b>4.1:</b> Introduction,</p> <p><b>4.2:</b> Classification of complexation.</p> <p>4.3: Complexation applications.</p> <p><b>4.4:</b> Methods of analysis.</p> <p><b>4T1:</b> Tutorial Class</p> <p><b>4.5:</b> Protein binding..</p> <p><b>4.6:</b> Complexation and drug action</p> <p><b>4.7:</b> Crystalline structures of complexes.</p> <p><b>4.8:</b> Thermodynamic treatment of stability constants.</p> <p><b>3T.2:</b> Tutorial class</p>	<p><b>4.1:</b> Understanding the distribution Action after binding to a protein.</p>

**Suggested Assignments:** Introduction, Classification of Complexation, methods of analysis, protein binding, Complexation and drug action,



## Unit-V

**CO-BP302-5:** To understand the functioning of pH , buffers and their uses in pharmaceutical and biological systems.

Item	Approx Hrs
Lecture & Tutorial	7+2=9
Practical(P)	0
SW	1
SL	1
Total:	11

Session Outcomes(SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
<b>Theory</b>  <b>SO5.1:</b> Sorensen's pH scale.  <b>SO5.2:</b> pH determination (electrometric & calorimetric).  <b>SO5.3:</b> Application of buffers. <b>SO5.4:</b> Buffered isotonic solution.	NA	<b>5.1:</b> Sorensen's pH scale. <b>5.2:</b> pH determination (electrometric & calorimetric). <b>5.3:</b> Application of buffers <b>5.4:</b> Buffer equation. <b>5T1:</b> Tutorial Class <b>5.5:</b> Buffer capacity <b>5.6:</b> Buffer in pharmaceutical & biological systems. <b>5.7:</b> Buffered isotonic solution <b>5T.2:</b> Tutorial class	<b>5.1:</b> Look at different body fluids pH & understand what effect they will have if their pH changes

**Assignments:** Sorensen's pH scale, pH determination (electrometric and calorimetric), applications of buffers, Buffer equation, buffer capacity



### Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (Cl)	(L)	Sessional Work (SW)	Self Learning (Sl)	Total Hour ( Cl+SW+ Sl +LI)
<b>CO-BP302-1:</b> To Understand the concept of solubility and it's importance in preparation of pharmaceutical products.	13	16	1	1	31
<b>CO- BP302-2:</b> We read about the state of matter, their changes and physicochemical properties of drug molecule with importance.	13	8	1	1	23
<b>CO-BP302-3:</b> To understand the surface and interfacial phenomenon with their measurement and use of HLB scale.	13	12	1	1	27
<b>CO- BP302-4:</b> To gain knowledge about complexation, protein binding with complex and drug distribution.	10	8	1	1	20
<b>CO- BP302-5:</b> To understand the functioning of pH , buffers and their uses in pharmaceutical and biological systems.	10	0	1	1	12
<b>Total Hours</b>	59	44	5	5	113



**Suggestion for End Semester Assessment**  
Suggested Specification Table (For ESA)

Course Outcome	Unit Titles	Marks Distribution			Total Marks
		A	C	I	
<b>CO-BP302-1:</b>	To Understand the concept of solubility and its importance in preparation of pharmaceutical products.	08	06	01	15
<b>CO-BP302-2:</b>	We read about the state of matter, their changes and physicochemical properties of drug molecule with importance.	12	07	01	20
<b>CO-BP302- 3:</b>	To understand the surface and Interfacial phenomenon with their measurement and use of HLB scale.	02	06	02	10
<b>CO-BP302- 4:</b>	To gain knowledge about complexation, protein binding with complex and drug distribution.	10	02	03	15
<b>CO-BP302- 5:</b>	To understand the functioning of pH , buffers and their uses in Pharmaceutical and biological systems.	05	07	03	15
<b>Total</b>		<b>37</b>	<b>28</b>	<b>10</b>	<b>75</b>

**Legend: A:Analyse, C: Create, I: Interpret**

The end of semester assessment for physical pharmaceuticals-I will be held with written examination of 75 marks

**Note.** Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks. Teachers can also design different tasks as per requirement, for end semester assessment.

**Suggested Instructional/ Implementation Strategies:**

1. Improved Lecture
2. Tutorial
3. Case Method
4. Group Discussion
5. Role Play
6. Demonstration
7. ICT Based Teaching Learning (Video Demonstration/Tutorials CBT ,Blog, Face book, Twitter, Whats app, Mobile, Online sources)
8. Brainstorming



**Suggested Learning Resources:**

S.No	Title	Author	Publisher	dition& Year
1	Physical Pharmacy	Alfred Martin	Lippincott Williams & Wilkins	1 January 1993
2	Experimental Pharmaceutics	Eugene, Parott.	Burgess publishing company	4 <sup>th</sup> edition 2008
3	Tutorial Pharmacy	Cooper and Gunn.	CBS Publishers	12 <sup>th</sup> edition 2008
4	Pharmaceutical Dosage forms. Disperse systems	Lieberman H.A, Lachman C	Marcel Dekkar Inc.	2 <sup>nd</sup> edition, 2019 volume 1,2, 3
5	Stoklosa & Ansel's Pharmaceutical Calculations	Lea &Febiger	Wolters Kluwer Health	16 <sup>th</sup> edition 2021
6.	Physical Pharmaceutics	C.V.S. Subramanyam	Vallabh prakashan	1 <sup>st</sup> edition 2019

**Curriculum Development Team:**

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## Course outcomes & program outcomes mapping

### Course Outcome, Program Specific Outcome& Program Outcome Mapping

**Course Code: BP302T/BP306P**

**Course Name: Physical Pharmaceutics-I**

Course Outcome	Program Outcome											Program Specific outcome			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
	Pharmacy knowledge	Planning Abilities	Problem analysis	Modern tool usage	Leadership skills	Professional Identity	Pharmaceutical Ethics	Communication	The pharmacist and society	Environment and sustainability	Life-long learning	Knowledge of drug discovery	Quality Analysis of API's	MOA of Drug	Biological evaluation of drug
<b>CO-1:</b> The concept of solubility and its importance	3	2	3	1	3	2	1	2	3	2	3	1	3	1	2
<b>CO-2:</b> State of matter, their changes and physicochemical properties of drug molecule	2	3	1	3	1	2	1	1	2	3	3	3	2	1	3
<b>CO-3:</b> The surface and Interfacial phenomenon	3	2	3	2		1	2	1	2	2	3	3	2	1	3
<b>CO-4:</b> Complexation, protein binding with complex and drug distribution.	2	3	2	3	1	3	2	2	3	3	3	3	2	1	3
<b>CO-5:</b> The functioning of pH , buffers and their uses in Pharmaceutical and biological systems	3	3	1	1	1	3	1	3	1	2	3	2	2	2	2

**Legend: 1- Low, 2-Medium, 3-High**



## Course Curriculum Mapping

Pos& PSOs No	Cos No&	Title	SOs No	Class Room Instructions	Laboratory Instructions	Self learning
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	CO-1	To Understand the concept of solubility and its importance in preparation of pharmaceutical products.	SO1.1 SO1.2 SO1.3 SO1.4 SO1.5	1.1,1.2,1.3,1.4,1.5,1.6,1.7,1.8,1.9,1.10 T1, T2, T3	LI-1.1 LI-1.2 LI-1.3 LI-1.4 LI-1.5 LI-1.6 LI-1.7	SI-1.1 SI-1.2
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	CO-2	To Know about the state of matter, their changes and physicochemical properties of drug molecule with importance.	SO-2.1 SO-2.2 SO-2.3 SO-2.4 SO-2.5	2.1,2.2,2.3,2.4,2.5,2.6, T1, T2, T3	LI-2.1 LI-2.2	SI-2.1 SI-2.2
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	CO-3	To understand the surface and Interfacial phenomenon with their measurement and use of HLB scale.	SO-3.1 SO-3.2 SO-3.3 SO-3.3 SO-3.4 SO-3.5	3.1,3.2,3.3,3.4,3.5,3.6,3.7,3.8,3.9,3.10 T1, T2, T3	LI-3.1 LI-3.2 LI-3.3 LI-3.4 LI-3.5	SI-3.1 SI-3.2
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	CO-4	To gain knowledge about complexation, protein binding with complex and drug distribution.	SO-4.1 SO-4.2 SO-4.3 SO-4.4	4.1,4.2,4.3,4.4,4.5,4.6,4.7,4.8., 4.9, 4.10 T1, T2, T3	LI-4.1 LI-4.2	SI-4.1 SI-4.2
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	CO-5	To understand the functioning of pH , buffers and their uses in Pharmaceutical and biological systems.	SO-5.1 SO-5.2 SO-5.3 SO-5.4 SO-5.5	5.1,5.2,5.3,5.4,5.5,5.6,5.7,5.8, 5.9, T1, T2, T3	LI-5.1 LI-5.2	SI-5.1 SI-5.2





AKS University  
Faculty of Pharmaceutical Science & Technology  
Rajiv Gandhi Institute of Pharmacy  
Curriculum of B. Pharmacy (Pharmaceutical Microbiology) Program  
(Revised as on 01August2023)

**Semester-III**

**CourseCode:** BP303T& BP307P

**CourseTitle:** Pharmaceutical Microbiology

**Pre-requisite:** Student should have basic knowledge of biology, related biological processes, biochemistry, microbial world and their products.

**Rationale/Objectives:** Upon completion of the course students shall be able to

- Understand methods of identification, cultivation and preservation of various microorganisms.
- To understand the importance and implementation of sterilization in pharmaceutical processing and industry.
- Learn sterility testing of pharmaceutical products.
- Carried out microbiological standardization of Pharmaceuticals.
- Understand the cell culture technology and its applications in pharmaceutical industries.

**Course Outcomes:**

**CO-BP303-1:** To understand the methods of identification, cultivation and preservation of various micro-organisms.

**CO-BP303-2:** To understand the importance and implementation of sterilization in pharmaceutical processing and industry.

**CO-BP303-3:** To acquire knowledge of concepts of microbiology and learn sterility testing of pharmaceutical products.

**CO-BP303-4:** To evaluate the methods used in studying bacteria and classifying them. To carried out microbiological standardization of pharmaceuticals.

**CO-BP303-5:** To understand the cell culture technology and its application in pharmaceutical industries.



## Scheme of Studies

Course code	Titleofthe course	Program Name	TOTAL Number of contact hours/Week						Credit
			Class room Instruction (A)		Practical (P)	S W	S L	Total Hours (H)	
			Lecture	Tutorial					
BP303T/ BP307P	Pharmaceutical Microbiology Theory	B. Pharmacy	3	1	4	1	1	10	6

### Legend:

**CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture(L) and Tutorial(T) and others)

**LI:** Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)

**SW: Sessional Work** (includes assignment, seminar, mini project etc.),

**SL:** Self Learning, Credits.

**Note:** SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

### Theory Assessment

Board of Study	Course Code	Course Title	Scheme of Assessment (Marks)						
			Progressive Assessment (PRA)						
			Academic activity, Anythree (Quiz/ Assignment, open book test, filed work and seminar)	Student teacher interaction	Class Attendance(AT)	Total Marks (A)	Sessional Exam(B)	End Semester Assessment (C)	Total Marks (A+B+C)
Pharmacy	BP- 303T	Pharmaceutica 1 Microbiology	3	3	4	10	15	75	100



## Practical Assessment

Board of Study	Course Code	Course Title	Scheme of Assessment (Marks)						
			Internal Assessment(A)			End Semester Examination (B)			Total Marks
			Attendance	Record	Sessional Exam.	Synopsis	Experiment	Viv a	(A+B)
Pharmacy	BP-307P	Pharmaceutical Microbiology	2	3	10	5	25	5	50

## Guidelines for the allotment of marks for attendance

Percentage of Attendance	Theory	Practical
95–100	4	2
90–94	3	1.5
85–89	2	1
80–84	1	0.5
Less than 80	0	0

### Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.



## Unit I

**CO-BP303-1:** To understand the methods of identification, cultivation and preservation of various micro-organisms.

Item	ApproxHrs
Lecture & Tutorial	10+02=12
Practical(P)	03
SW	02
SL	01
Total:	18

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
<b>Theory</b> <b>SO1.1:</b> Introduction, history and scope of microbiology <b>SO1.2:</b> Applications of microbiology in pharmaceuticals industry. <b>SO1.3:</b> Classification of bacteria, culture media and growth. <b>SO1.4:</b> To learn different microscopy techniques. <b>SO1.5:</b> Principles of different staining techniques. <b>Practical SO-P-1.1:</b> Introduction and study of different equipment and processing. <b>SO-P-1.2:</b> Media preparation and culture techniques. <b>SO-P-1.3:</b> Isolation of pure cultures.	<b>1.1</b> Introduction and study of different equipment's and processing, e.g., B.O.D. incubator, laminar flow, aseptic hood, autoclave, hot air sterilizer, deep freezer, refrigerator, microscopes used in experimental microbiology. <b>1.2</b> Sub culturing of bacteria and fungus. Nutrient stabs and slants preparations. <b>1.3</b> Isolation of pure culture of micro-organisms by multiple streak plate technique and other techniques.	Introduction, history of micro biology, its branches, scope and its importance. Introduction to prokaryotes and eukaryotes. Study of ultra structure and morphological classification of bacteria, nutritional requirements, raw material used for culture media and physical parameters for growth, growth curve, isolation and preservation method for pure cultures, cultivation of anaerobes, quantitative measurement of the bacterial growth (total and viable count). Study of different types of face contrast microscopy, dark field microscopy and electron microscopy. <b>1T.1:</b> Ultra structure of bacterial cell. <b>1T.2:</b> Types of microscopy.	1. Cell structure, cell organelles and cell division.

Item	Approx Hrs
Lecture & Tutorial	10+2=12
Practical(P)	03
SW	01
SL	02
Total:	18

### Suggested Assignments:

1. Role of microorganisms in production of pharmaceuticals products.
2. Diagrammatic representation of different types of microscopy.
3. Chart to show types of culture media used to grow different types of microorganisms.



## Unit II

**CO-BP303-2:** To understand the importance and implementation of sterilization in pharmaceutical processing and industry.

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
<p><b>Theory SO2.1:</b> Identification of bacteria and biochemical tests.</p> <p><b>SO2.2:</b> Methods of sterilization.</p> <p><b>SO2.3:</b> Evaluation of sterilization methods.</p> <p><b>SO2.4:</b> Sterility indicators.</p> <p><b>Practical</b></p> <p><b>SOP-2.1:</b> Sterilization methods</p> <p><b>SOP2.2:</b> Different staining techniques</p> <p><b>SO-P- 2.3:</b> Biochemical tests</p>	<p><b>2.1:</b> Sterilization of glassware,</p> <p>2.2 preparation and sterilization of media.</p> <p>2.3 Staining methods- Simple, Grams staining and acid fast staining (Demonstration with practical).</p> <p>2.4 Biochemical tests</p>	<p>Identification of bacteria using staining techniques (simple, Gram's &amp; Acid-fast staining) and biochemical tests (IMViC).</p> <p>Study of principle procedure, merits, demerits and applications of physical, chemical gaseous, radiation and mechanical method of sterilization.</p> <p>Evaluation of the efficiency of sterilization methods.</p> <p>Equipments employed in large scale sterilization.</p> <p>Sterility indicators.</p> <p><b>2T .1</b> Evaluation of the efficiency of sterilization methods.</p> <p><b>2T.2</b> Equipments employed in large scale sterilization.</p>	<p>2.1. Mode of nutrition in micro-organisms.</p> <p>2.2 Different types of stains and their functions.</p>

**Suggested Assignments: 1.** Read research paper related to sterility indicators and their application in pharmaceuticals.



### Unit III

**CO-BP303-3:** To acquire knowledge of concepts of microbiology and learn sterility testing of pharmaceutical products.

Item		Approx Hrs	
Lecture & Tutorial		10+2=12	
Practical(P)		02	
SW		1	
SL		1	
Total:		16	

  

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self Learning(SL)
<b>Theory</b> <b>SO3.1:</b> Study of fungi and viruses. <b>SO3.2:</b> Disinfectants and their mode of action. <b>SO3.3:</b> Evaluation of disinfectants. <b>SO3.4:</b> Sterility testing of products. <b>Practical SO-P-3.1:</b> Bacteriological analysis of water. <b>SO-P-3.2:</b> Sterility testing of Pharmaceuticals.	Bacteriological analysis of water. Sterility testing of pharmaceuticals.	Study of morphology, classification, reproduction/replication and cultivation of fungi and viruses. Classification and mode of action of disinfectants. Factors influencing disinfection, antiseptics and their evaluation. For bacterio-static and bactericidal actions. Evaluation of bactericidal & bacterio-static. Sterility testing of products (solid, liquid, ophthalmic and other sterile products) according to IP, BP and USP. <b>3T.1</b> Cultivation of viruses. <b>3T.2</b> Sterility testing of products.	General structure of fungi and virus. Types of disinfectant and antiseptics.

**Suggested Assignments:** 1. Diagrammatic representation of replication in viruses and reproduction in fungi



## Unit IV

**CO-BP303-4:** To evaluate the methods used in studying bacteria and classifying them. To carried out microbiological standardization of pharmaceuticals.

Item	Approx Hrs
Lecture & Tutorial	08+2=11
Practical(P)	02
SW	1
SL	02
Total:	16

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self Learning (SL)
<b>Theory</b> <b>SO4.1</b> Designing of aseptic area. <b>SO4.2:</b> Microbiological assay. <b>SO4.3:</b> Standardization methods of antibiotics, vitamins and amino acids. <b>SO4.4:</b> Assessment of new antibiotic. <b>Practical</b> <b>SO-P-4.1:</b> Microbial assay of antibiotics by cup-plate method and other methods. <b>SO-P-4.2:</b> Motility determination by hanging drop method.	4.1 Microbial assay of antibiotics by cup-plate method and other methods. 4.2 Motility determination by hanging drop method.	4.1 Designing of aseptic area, laminar flow equipments; 4.2 study of different sources of contamination in an aseptic area 4.3 method of prevention, clean area classification. 4.4 Principles and methods of different microbiological assay. 4.5 Methods for standardization of antibiotics. 4.6 Assessment of new antibiotic. <b>4T.1</b> 4.7 Microbiological assay. <b>4T.2</b> Clean area classification. 4.8. Methods for standardization of, vitamins and amino acids	4.1 Working principle of laminar airflow. 4.2 Function of antibiotics, vitamins and amino acids.

**Suggested Assignments:** 1. Find out some research papers related to assessment of new antibiotic.  
 2. Watch some youtube, videos related to drug designing.



## Unit V

**CO-BP303-5:** To understand the cell culture technology and its application in pharmaceuticals industries.

Item	Approx Hrs
Lecture & Tutorial	07+01=08
Practical(P)	02
SW	1
SL	1
Total:	12

Session Outcomes(SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self Learning (SL)
<b>Theory</b> <b>SO5.1:</b> Spoilage and its types <b>SO5.2:</b> Factors affecting microbial spoilage. <b>SO5.3:</b> Assessment of spoilage. <b>SO5.4:</b> Preservation and evaluation of pharmaceutical products. <b>SO5.5:</b> Applications of animal cell culture.	1 Bacteriological analysis of water.	Types of spoilage. Factors affecting the microbial spoilage of pharmaceutical products, sources and types of microbial contaminants. Assessment of microbial spoilage. Preservation of pharmaceutical products using antimicrobial agents, evaluation of microbial stability of formulations. Growth of animal cell in culture, general procedure for cell culture. Primary, established and transformed cell culture. Application of cell culture in pharmaceutical industry and research. <b>5T.1</b> Evaluation of microbial stability of pharmaceutical formulations.	<b>5.1:</b> Preparation of pharmaceutical formulations. <b>5.2:</b> Types of cell cultures.

**Suggested Assignments:** 1. Find out some research papers related to application of animal cell cultures.  
 2. Write about different methods used for bacteriological analysis of water.



**Brief of Hours suggested for the Course Outcome**

<b>Course Outcomes</b>	<b>Class Lecture (Cl)</b>	<b>(LI)</b>	<b>Session al Work (SW)</b>	<b>Self Learning(Sl)</b>	<b>Total Hour (Cl+SW+ Sl+LI)</b>
<b>CO-BP303-1:</b> To understand the methods of identification, cultivation and preservation of various micro-organisms.	12	03	02	01	18
<b>CO-BP303-2:</b> To understand the importance and implementation of sterilization in pharmaceutical processing and industry.	12	03	01	02	18
<b>CO-BP303-3:</b> To acquire knowledge of concepts of microbiology and learn sterility Testing of pharmaceutical products.	12	02	01	01	16
<b>CO-BP303-4:</b> To evaluate the methods used in studying bacteria and classifying them. To Carried out microbiological standardization of pharmaceuticals.	11	02	01	02	16
<b>CO-BP303-5:</b> To understand the cell culture technology and its application in pharmaceuticals industries.	08	02	01	01	12
<b>Total Hours</b>	55	12	06	07	80



**Suggestion for End Semester Assessment**  
Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Mark
		A	C	I	
CO-1	To understand the methods of identification, cultivation and preservation of various micro-organisms.	08	06	02	16
CO-2	To understand the importance and implementation of sterilization in pharmaceutical processing and industry.	08	06	01	15
CO-3	To acquire knowledge of co concepts of microbiology and learn sterility testing of pharmaceutical products.	08	07	01	16
CO-4	To evaluate the methods used in studying bacteria and classifying them. To carried out microbiological Standardization of pharmaceuticals.	08	07	01	16
CO-5	To understand the cell culture technology and its application in pharmaceuticals industries.	07	06	01	14
Total		39	32	06	77

**Legend: A: Analyze, C: Create, I: Interpret**

The end of semester assessment for Pharmaceutical Microbiology will be held with written examination of 75 marks.

**Note.** Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks. Teachers can also design different tasks as per requirement, for end semester assessment.

**Suggested Instructional/Implementation Strategies:**

1. Improved Lecture
2. Tutorial
3. Case Method
4. Group Discussion
5. Role Play
6. Demonstration
7. ICT Based Teaching Learning (Video Demonstration/Tutorials CBT, Blog, Face book, Twitter, Whats app, Mobile, Online sources)
8. Brainstorming



### Suggested Learning Resources:

S. No.	Title	Author	Publisher	Edition&Year
1	Pharmaceutical Microbiology	W.B. Hugo and A.D. Russel	Blackwell Scientific publication s, Oxford London.	8 <sup>th</sup> Edition 2013
2	Industrial Microbiology	Prescot and Dunn	CBS Publishers &Distributors, Delhi.	4 <sup>th</sup> edition 2004
3	Microbiology	Pelczar, Chan Kreig	Tata McGraw Hilledn	5 <sup>th</sup> edition 2023
4	Text Book of Microbiology	Ananth narayan	Universities press(Orient-Longman, Chennai)	12 <sup>th</sup> Edition 2022
5	Pharmaceutical Microbiology	N.K.Jain	Vallabh Prakashan, Delhi	!st Edition 2019
6	Tutorial Pharmacy	Cooper and Gunn's	CBS Publisher and Distribution	12 <sup>th</sup> Edition 2008

#### Curriculum Development Team:

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**Course Outcome, Program Specific Outcome& Program Outcome Mapping**

**Course Code: BP303T& BP307P**

**Course Name: Pharmaceutical microbiology**

Course Outcome	Program Outcome											Program Specific outcome			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
	Pharmacy knowledge	Planning Abilities	Problem analysis	Modern tool usage	Leadership skills	Professional Identity	Pharmaceutical Ethics	Communication	The pharmacist and society	Environment and sustainability	Life-long learning	Knowledge of drug discovery	Quality Analysis of API's	MOA of Drug	Biological evaluation of drug
<b>CO-1:</b> Cultivation and preservation of various micro-organisms.	3	2	3	1	3	2	1	2	3	2	3	1	3	1	2
<b>CO-2:</b> The importance and implementation of sterilization	2	3	1	3	1	2	1	1	2	3	3	3	2	1	3
<b>CO-3:</b> To acquire knowledge of concepts of microbiology and learn sterility testing of pharmaceutical products.	3	2	3	2	2	1	2	1	2	2	3	3	2	1	3
<b>CO-4:</b> Bacteria and classifying them.	2	3	2	3	1	3	2	2	3	3	3	3	2	1	3
<b>CO-5:</b> Cell culture technology and its application	3	3	1	1	1	3	1	3	1	2	3	2	2	2	2



## Course Curriculum Mapping

Pos& PSOs No	Cos No&	Title	SOs No	Class Room Instructions	Laboratory Instructions	Self learning
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	CO-1	To understand the methods of identification, cultivation and preservation of various micro-organisms.	SO1.1 SO1.2 SO1.3 SO1.4 SO1.5	1.1,1.2,1.3,1.4,1.5,1.6,1.7,1.8,1.9,1.10 T1, T2, T3	LI-1.1 LI-1.2 LI-1.3 LI-1.4 LI-1.5 LI-1.6 LI-1.7	SI-1.1 SI-1.2
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	CO-2	To understand the importance and implementation of sterilization in pharmaceutical processing and industry.	<b>SO-2.1</b> <b>SO-2.2</b> <b>SO-2.3</b> <b>SO-2.4</b> <b>SO-2.5</b>	2.1,2.2,2.3,2.4,2.5,2.6, T1, T2, T3	LI-2.1 LI-2.2	SI-2.1 SI-2.2
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	CO-3	To acquire knowledge of concepts of microbiology and learn sterility testing of pharmaceutical products.	<b>SO-3.1</b> <b>SO-3.2</b> <b>SO-3.3</b> <b>SO-3.3</b> <b>SO-3.4</b> <b>SO-3.5</b>	3.1,3.2,3.3,3.4,3.5,3.6,3.7,3.8,3.9,3.10 T1, T2, T3	LI-3.1 LI-3.2 LI-3.3 LI-3.4 LI-3.5	SI-3.1 SI-3.2
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	CO-4	To evaluate the methods used in studying bacteria and classifying them. To carried out microbiological Standardization of pharmaceuticals.	<b>SO-4.1</b> <b>SO-4.2</b> <b>SO-4.3</b> <b>SO-4.4</b>	4.1,4.2,4.3,4.4,4.5,4.6,4.7,4.8., 4.9, 4.10 T1, T2, T3	LI-4.1 LI-4.2	SI-4.1 SI-4.2
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	CO-5	To understand the cell culture technology and its application in pharmaceuticals industries.	SO-5.1 SO-5.2 SO-5.3 SO-5.4 SO-5.5	5.1,5.2,5.3,5.4,5.5,5.6,5.7,5.8, 5.9, T1, T2, T3	<b>LI-5.1</b> <b>LI-5.2</b>	<b>SI-5.1</b> <b>SI-5.2</b>





AKS University  
Faculty of Pharmaceutical Science & Technology  
Rajiv Gandhi Institute of Pharmacy  
Curriculum of B. Pharmacy (Pharmaceutical Engineering) Program  
(Revised as on 01August2023)  
**Semester-III**

**Course Code:** BP304T/BP308P

**Course Title:** **Pharmaceutical Engineering**

**Pre-requisite:** The main purpose of subject is to impart the students the knowledge of how the secondary metabolites are produced in the crude drugs, how to isolate and identify and produce them industrially.

**Rationale/Objectives:** This course is designed to impart a fundamental knowledge on the art and science of various unit operations used in pharmaceutical industry.

**Course Outcomes:**

**CO-BP304-1:** To know the various unit operations used in Pharmaceutical industries.

**CO-BP304-2:** To understand the material handling techniques.

**CO-BP304- 3:** To perform various processes involved in pharmaceutical manufacturing process

**CO-BP304-4:** To carry out various test to prevent environmental pollution.

**CO-BP304-5:** To appreciate and comprehend significance of plant lay out design for optimum use of resources. Preventive methods used for corrosion control in Pharmaceutical industries.



## Scheme of Studies

Course code	Title of the course	Program Name	TOTAL Number of contact hours/Week						Credit
			Classroom Instruction(A)		Practical (P)	SW	SL	Total Hours (H)	
			Lecture	Tutorial					
BP304 T	Pharmaceutical Engineering (Theory)	B. Pharmacy	3	1	4	1	1	10	6

### Legend:

**CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others)

**LI:** Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using Different instructional strategies)

**SW:** Sessional Work (includes assignment, seminar, mini project etc.),

**SL:** Self Learning,

**C:** Credits

**Note:** SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning

### Theory Assessment

Board of Study	Course Code	Course Title	Scheme of Assessment(Marks)						
			Progressive Assessment (PRA)						
			Academic activity, Any three (Quiz/ Assignment, open book test, filed work and seminar)	Student teacher interaction	Class Attendance (AT)	Total Marks (A)	Sessional Exam(B)	End Semester Assessment (C)	Total Marks(A+B+C )
Pharmacy	BP-304T	Pharmacutical Engineering	3	3	4	10	15	75	100



## Practical Assessment

Board of Study	Course Code	Course Title	Scheme of Assessment(Marks)						
			Internal Assessment(A)			End Semester Examination(B)			Total Marks (A+B)
			Attendance	Record	Sessional Exam.	Synopsis	Experiment	Viva	
Pharmacy	BP-308P	Pharmaceutical Engineering	2	3	10	5	25	5	50

### Guidelines for the allotment of marks for attendance

Percentage of Attendance	Theory	Practical
95–100	4	2
90–94	3	1.5
85–89	2	1
80–84	1	0.5
Less than 80	0	0

### Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.



**CO-BP304-1:** To know the various unit operations used in Pharmaceutical industries.

Item	Approx Hrs
Lecture & Tutorial	10+3=13
Practical(P)	4
SW	1
SL	1
Total:	19

Session Outcomes(SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
<b>SO1.1</b> Flow of fluid. <b>SO1.2</b> Objectives, Mechanisms & Laws governing size reduction. <b>SO1.3</b> Objectives, applications & mechanism of size separation. <b>Practical</b> <b>SO-P-1.1</b> Determination of radiation constant of brass, iron, unpainted and painted glass. <b>1.2</b> steam distillation to calculate the efficiency of steam distillation. <b>1.3</b> To determine the overall heat transfer coefficient by heat exchanger.	1.1 Determination of radiation constant of brass, iron, unpainted and painted glass.	1.1 Types of manometers, Reynolds number and its significance, Bernoulli's theorem and its applications. 1.2 Energy losses, Orifice meter, Venturimeter 1.3 Pitot tube and Rotometer. 1.4 Objectives, Mechanisms & Laws governing size reduction, factors affecting size reduction. 1.5 principles, construction, working, uses, merits and demerits of Hammer mill, ball mill. 1.6 principles, construction, working, uses, merits and demerits of fluid energy mill, Edge runner mill & end runner mill. 1.7 Objectives, applications & mechanism of size separation. 1.8 official standards of powders, sieves, size separation Principles, construction, working, uses, merits and demerits of Sieve shaker. 1.9 Principles, construction, working, uses, merits and demerits of cyclone separator, Air separator. 1.10 Principles, construction, working, uses, merits and demerits of Bag filter & elutriation tank. <b>Tutorial</b> 1.1 Bernoulli's theorem and its applications. 1.2 principles, construction, working, uses, merits and demerits of fluid energy mill. 1.3 Objectives, applications & mechanism of size separation	1.1 knowledge on the working and uses of various instruments used in pharmaceutical industry.

**Suggested Assignments:**

Reynolds number and its significance, factors affecting size reduction, Edge runner mill & end runner mil, official standards of powders, Bag filter & elutriation.



## Unit II

**CO-BP304-2:** To understand the material handling techniques.

Item	Approx Hrs
Lecture & Tutorial	10+3=13
Practical(P)	4
SW	1
SL	1
Total:	19

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
<b>Theory</b> <b>SO2.1</b> Objectives, applications & Heat transfer mechanisms. <b>2.2</b> Objectives, applications and factors influencing evaporation <b>2.3</b> Basic Principles and methodology of various distillation, <b>Practical</b> <b>SO-P-</b> <b>2.1</b> Construction of drying curves (for calcium carbonate and starch). <b>2.2</b> Determination of moisture content and loss on drying. <b>2.3</b> Determination of humidity of air – i) From wet and dry bulb temperatures – use of Dew point method.	2.1 Construction of drying curves (for calcium carbonate and starch). 2.2 Determination of moisture content and loss on drying. 2.3 Determination of humidity of air – i) From wet and dry bulb temperatures – use of Dew point method.	2.1 Objectives, applications & Heat transfer mechanisms. Fourier's law. 2.2 Heat transfer by conduction, convection & radiation. 2.3 Heat interchangers & heat exchangers. 2.4 Objectives, applications and factors influencing evaporation. 2.5 differences between evaporation and other heat process. 2.6 principles, construction, working, uses, merits and demerits of Steam jacketed kettle, climbing film evaporator. 2.7 forced circulation evaporator, multiple effect evaporator & Economy of multiple effect evaporator. 2.8 Basic Principles and methodology of simple distillation, flash distillation. 2.9 fractional distillation, distillation under reduced pressure. 2.10 steam distillation & molecular distillation. <b>Tutorial</b> 2.1 Heat transfer by conduction, convection & radiation. 2.2 differences between evaporation and other heat process. 2.3 steam distillation & molecular distillation.	2.1 principles, construction, working, uses, merits and demerits of Steam jacketed kettle, horizontal tube evaporator.

### Suggested Assignments:

Heat interchangers & heat exchangers, Multiple effect evaporator & Economy of multiple effect evaporators Fractional distillation, distillation under reduced pressure.



### Unit III

**CO-BP304-3:** To perform various processes involved in pharmaceutical manufacturing process.

Item	Approx Hrs
Lecture & Tutorial	10+3=13
Practical(P)	4
SW	1
SL	1
Total:	19

Session Outcomes(SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self Learning (SL)
<p><b>Theory</b>  <b>SO3.1</b> measurements &amp; applications of Equilibrium Moisture content.  <b>3.2</b> Objectives, applications &amp; factors affecting mixing.</p> <p><b>Practical</b>  <b>SO-P- 3.1</b> Description of Construction working and application of Pharmaceutical Machinery such as rotary tablet machine, fluidized bed coater, fluid energy mill, de humidifier.</p> <p><b>3.2</b> Size analysis by sieving – To evaluate size distribution of tablet granulations – Construction of various size frequency curves including arithmetic and logarithmic probability plots.</p>	<p>3.1 Description of Construction working and application of Pharmaceutical Machinery such as rotary tablet machine, fluidized bed coater, fluid energy mill, de humidifier.</p> <p>3.2 Size analysis by sieving to evaluate size distribution of tablet granulations.</p> <p>3.3 Construction of various size frequency curves including arithmetic and logarithmic probability plots.</p>	<p>3.1 Objectives, applications &amp; mechanism of drying process.</p> <p>3.2. measurements &amp; applications of Equilibrium Moisture content, rate of drying curve.</p> <p>3.3 principles, construction, working, uses, merits and demerits of Tray dryer, drum dryer spray dryer.</p> <p>3.4 principles, construction, working, uses, merits and demerits of fluidized bed dryer, vacuum dryer, freeze dryer.</p> <p>3.5 Objectives, applications &amp; factors affecting mixing, Difference between solid and liquid mixing.</p> <p>3.6 Principles, Construction, Working, uses, Merits and Demerits of Double cone blender, twin shell blender, ribbon blender climbing film evaporator.</p> <p>3.7 Sigma blade mixer, Planetary mixers, Propellers.</p> <p>3.8 Turbines, Paddles &amp; Silverson Emulsifier.</p> <p><b>Tutorial</b></p> <p>3.1 measurements &amp; applications of Equilibrium Moisture content .</p> <p>3.2. mechanism of solid mixing, liquids mixing and semisolids mixing.</p> <p>3.3 principles, construction, working, uses, merits and demerits of fluidized bed dryer.</p>	<p>3.1 knowledge on the various processes involved in pharmaceutical manufacturing process.</p>

**Suggested Assignments:** principles, construction, working, uses, merits and demerits of Tray dryer Principles , Construction, Working, uses, Merits and Demerits of Silverson Emulsifier.



**Unit IV:**

CO-BP304-4: To carry out various test to prevent environmental pollution.

Item	Approx Hrs
Lecture & Tutorial	10+3
Practical(P)	14
SW	1
SL	1
Total:	19

Session Outcomes(SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self Learning (SL)
<b>SO 4.1</b> Theories & Factors influencing filtration. <b>4.2</b> Objectives, principle & applications of Centrifugation. <b>Practical SO-P-4.1</b> Size reduction: To verify the laws of size reduction using ball mill. <b>4.2</b> determining Kicks, Rittinger's, Bond's coefficients, power requirement and critical speed of Ball Mill. <b>4.3</b> Demonstration of colloid mill, planetary mixer, fluidized bed dryer, freeze dryer and such other major equipment.	<b>4.1</b> Size reduction: To verify the laws of size reduction using ball mill <b>4.2</b> determining Kicks, Rittinger's, Bond's coefficients, power requirement and critical speed of Ball Mill. <b>4.3</b> Demonstration of colloid mill, planetary mixer, fluidized bed dryer, freeze dryer and such other major equipment.	<b>4.1</b> Objectives, applications, Theories & Factors influencing filtration <b>4.2.</b> filter aids, filter medias. Principle, Construction, Working, Uses, Merits and demerits of plate & frame filter. <b>4.3</b> principles, construction, working, uses, merits and demerits of rotary drum filter, Meta filter. <b>4.4</b> principles, construction, working, uses, merits and demerits of Cartridge filter, membrane filters and Seidtz filter. <b>4.5</b> Objectives, principle & applications of centrifugation . <b>4.6</b> principles, construction, working, uses, merits and demerits of Perforated basket centrifuge. <b>4.7</b> Non-perforated basket centrifuge. <b>4.8</b> semi continuous centrifuge . <b>Tutorial</b> <b>4.1</b> Theories & Factors influencing filtration. <b>4.2.</b> Non-perforated basket centrifuge <b>4.3</b> Objectives, principle & applications of super centrifuge.	<b>4.1</b> principles, construction, working, uses, merits and demerits of filter leaf.

**Suggested Assignments:**

Assignments Principle, Construction, Working, Uses, Merits and demerits of plate & frame filter. principles, construction, working, uses, merits and demerits of Perforated basket centrifuge.



**Unit V**

**CO-BP304-5:** To appreciate and comprehend significance of plant lay out design for optimum use of resources. Preventive methods used for corrosion control in Pharmaceutical industries.

Item	Approx Hrs
Lecture & Tutorial	10+3
Practical(P)	4
SW	1
SL	1
Total:	19

Session Outcomes(SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self Learning (SL)
<b>Theory</b> <b>SO5.1</b> Materials of pharmaceutical plant construction. <b>Practical:</b> <b>SO-P-5.1</b> Factors affecting Rate of Filtration and Evaporation (Surface area, Concentration and Thickness/ viscosity <b>5.2</b> To study the effect of time on the Rate of Crystallization. <b>5.3</b> To calculate the uniformity Index for given sample by using Double Cone Blender.	5.1 Factors affecting Rate of Filtration and Evaporation (Surface area, Concentration. and Thickness/ viscosity 5.2 To study the effect of time on the Rate of Crystallization. 5.3 To calculate the uniformity Index for given sample by using Double Cone Blender.	5.1 Factors affecting during materials selected for Pharmaceutical plant Construction. 5.2. Theories of corrosion. 5.3 types of corrosion. 5.4 Ferrous and nonferrous metals. 5.5 inorganic and organic non metals 5.6 basic of material handling systems. <b>Tutorial</b> 5.1 Pharmaceutical plant Construction. 5.2 basic of material handling systems. 5.3 prevention of corrosion.	5.1 To appreciate the various preventive methods used for corrosion control in Pharmaceutical industries.

**Suggested Assignments:** Theories of corrosion, types of corrosion and there prevention.



### Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (Cl)	(L)	Session all Work (SW)	Self Learning (Sl)	Total Hour (Cl+SW+ Sl+LI)
<b>CO-BP304-1:</b> To know the various unit operations used in Pharmaceutical industries.	13	4	1	1	19
<b>CO-BP504-2:</b> To understand the preparation and development of herbal formulation.	13	4	1	1	19
<b>CO-BP504-3:</b> To perform various processes involved in pharmaceutical manufacturing process.	13	4	1	1	19
<b>CO-BP504-4:</b> To carry out various test to prevent environmental pollution..	13	4	1	1	19
<b>CO-BP504-5:</b> To appreciate and comprehend significance of plant lay out design for optimum use of resources. preventive methods used for corrosion control in Pharmaceutical industries	13	4	1	1	19
<b>Total Hours</b>	65	20	5	5	95

### Suggestion for End Semester Assessment Suggested Specification Table (For ESA)

Course Outcome	Unit Titles	Marks Distribution			Total Marks
		A	C	I	
<b>CO-BP504-1:</b>	To know the various unit operations used in Pharmaceutical industries.	08	06	01	15
<b>CO-BP504-2:</b>	To understand the preparation and development of herbal formulation.	12	07	01	20
<b>CO- BP504- 3:</b>	To perform various processes involved in pharmaceutical manufacturing process.	02	06	02	10
<b>CO- BP504- 4:</b>	To carry out various test to prevent environmental pollution..	10	02	03	15
<b>CO -BP504- 5:</b>	To appreciate and comprehend significance of plant lay out design for optimum use of resources. preventive methods used for corrosion control in Pharmaceutical industries	05	07	03	15
<b>Total</b>		<b>37</b>	<b>28</b>	<b>10</b>	<b>75</b>

**Legend: A:Analyse , C: Create I: Interpret**

The end of semester assessment for Pharmaceutical Engineering Will be held with written examination of 75 marks

**Note.** Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks. Teachers can also design different tasks as per requirement, for end semester assessment.



### Suggested Instructional /Implementation Strategies:

1. Improved Lecture
2. Tutorial
3. Case Method
4. Group Discussion
5. Role Play
6. Demonstration
7. ICT Based Teaching Learning (Video Demonstration /Tutorials CBT, Blog, Face book, Twitter, Whats app, Mobile, Online sources)
8. Brainstorming

### Suggested Learning Resources:

S.No.	Title	Author	Publisher	Edition & Year
1	Introduction to chemical engineering.	Walter L Badger & Julius Banc hero	McGraw-Hill	5 <sup>th</sup> edition 2011
2	Solid phase extraction, Principles, techniques and applications by Nigel J.K. Simpson-Latest edition.	Nigel J.K. Simpson	CRC Press	6 <sup>th</sup> edition 2018
3	Unit operation of chemical engineering	McCabe & Smith	McGraw-Hill	7 <sup>th</sup> edition, 2022
4	Pharmaceutical engineering Unit Operations Principles and Practices.	C.V.S Subramanian et al	Vallabh Prakashan	1 January 2019
5	REMGINTON The Science & Practice of pharmacy	Martin	Elsevier Exclusive	23 <sup>rd</sup> edition, 2021
6	Physical pharmaceutics	C.V.S Subramanian et al	Vallabh Prakashan	1 <sup>st</sup> edition, 2019
7	Cooper and Gunn's Tutorial pharmacy	S.J. Carter	CBS Publisher	12 <sup>th</sup> edition, 2008

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**Course Outcome, Program Specific Outcome& Program Outcome Mapping**

**Course Code: BP104T**

**Course Name: Pharmaceutical Engineering**

Course Outcome	Program Outcome											Program Specific outcome			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
	Pharmacy knowledge	Planning Abilities	Problem analysis	Modern tool usage	Leadership skills	Professional Identity	Pharmaceutical Ethics	Communication	The pharmacist and society	Environment and sustainability	life-long learning	Knowledge of drug discovery	Quality Analysis of API's	MOA of Drug	Biological evaluation of drug
<b>CO-1:</b> various unit operations used in Pharmaceutical industries.	3	2	3	1	3	2	1	2	3	2	3	1	3	1	2
<b>CO-2:</b> To understand the material handling techniques.	2	3	1	3	1	2	1	1	2	3	3	3	2	1	3
<b>CO-3:</b> To perform various processes involved in pharmaceutical manufacturing process	3	2	3	2	1	1	2	1	2	2	3	3	2	1	3
<b>CO-4:</b> To carry out various to prevent environmental pollution.	2	3	2	3	1	3	2	2	3	3	3	3	2	1	3
<b>CO-5:</b> significance of plant lay out design & corrosion control in Pharmaceutical industries.	3	3	1	1	1	3	1	3	1	2	3	2	2	2	2

**Legend: 1- Low, 2-Medium, 3-High**



### Course Curriculum Mapping

Pos& PSOs No	Cos No&	Title	SOs No	Class Room Instructions	Laboratory Instructions	Self learning
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	CO-BP30 4-1	To know the various unit operations used in Pharmaceutical industries.	SO1.1 SO1.2 SO1.3	1.1,1.2,1.3,1.4,1.5,1.6,1.7,1.8,1.9,1.10	LI-1.1	SI-1.1
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	CO-BP30 4-2	To understand the material handling techniques.	SO-2.1 SO-2.2 SO-2.3	2.1,2.2,2.3,2.4,2.5,2.6,2.7,2.8,2.9,2.10	LI-2.1 LI-2.2 LI-2.3	SI-2.1
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	CO-BP30 4-3	To perform various processes involved in pharmaceutical manufacturing process.	SO-3.1 SO-3.2	3.1,3.2,3.3,3.4,3.5,3.6,3.7,3.8	LI-3.1 LI-3.2 LI-3.3	SI3.1
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	CO-BP30 4-4	To carry out various to prevent environmental pollution.	SO-4.1 SO-4.2	4.1,4.2,4.3,4.4,4.5,4.6,4.7,4.8.	LI-4.1 LI-4.2 LI-4.3	SI-4.1
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	CO-BP30 4-5	To appreciate and comprehend significance of plant lay out design for optimum use of resources. preventive methods used for corrosion control in Pharmaceutical industries.	SO-5.1	5.1,5.2,5.3,5.4,5.5,5.6	LI-5.1 LI-5.2 LI-5.3	SI-5.1





AKS University

**Rajeev Gandhi Institute of Pharmacy**  
**Curriculum of B. Pharmacy (Organic Chemistry-III) Program**  
**(Revised on 01 August 2023)**

**Semester-IV**

**Course Code:** BP401T

**Course Title:** Pharmaceutical Organic Chemistry - III

**Pre-requisite:** The Student should have basic knowledge of Inorganic substance with their importance and Uses.

**Rationale/Objective s:** Up on completion of the course student shall be able to

- To understand the sources of impurities and methods to determine the impurities in drugs.
- To Use different chemical methods to prepare organic pharmaceuticals.
- Understand the medicinal and pharmaceutical importance of organic compound

**Course Out comes:**

**CO-BP401-1:** To understand the Stereoisomerism, Optical isomerism– Optical activity, enantiomerism, diastereoisomerism, Mesocompounds.

**CO-BP401-2:** To determine the Geometrical isomerism Nomenclature of geometrical isomers.

**CO-BP401-3:** To Use different heterocyclic compounds: nomenclature and classification.

**CO-BP401-4:** To Use different Synthesis, reactions and medicinal uses of Pyrazole, Imidazole, Oxazole and Thiazole Compounds.

**CO-BP401-5:** To Understand the Reactions of synthetic importance.



## Curriculum of B. Pharmacy (Organic Chemistry-III)

### Scheme of Studies

Course Code	Title of the Course	Program Name	TOTAL Number of contact hours/Week						Credit
			Classroom Instruction (A)		Practical (P)	SW	SL	Total Hours (H)	
			Lecture	Tutorial					
BP401T	Pharmaceutical Organic Chemistry-III Theory	B. Pharmacy	3	1	0	1	1	6	4

**Legend:** **CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others).

**LI: Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)**

**SW: Sessional Work** (includes assignment, seminar, mini project etc.),

**SL: Self Learning, Credits.**

**Note:** SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

### Theory Assessment

Board of Study	Course Code	Course Title	Scheme of Assessment ( Marks )						
			Progressive Assessment ( PRA)						
			Academic activity, Any three (Quiz/ Assignment, open Book test, filed work and seminar)	Student teacher interaction	Class Attendance	(A) Total Marks	End Semester Assessment (B)	End Semester Assessment (C)	
Pharmacy -	BP401	Pharmaceutical organic chemistry-III	3	3	4	10	15	75	100



## Practical Assessment

Board of Study	Course Code	Course Title	Scheme of Assessment ( Marks )						
			Internal Assessment (A)			End Semester Examination(B)			Total Marks  (A+B)
			Attendance	Record	Session I  Exam.	Synopsis	Experiment	Viva	
Pharmacy	BP-401T	Pharmaceutical Organic Chemistry-III	2	3	10	5	25	5	50

### Guidelines for the allotment of marks for attendance

Percentage of Attendance	Theory	Practical
95 – 100	4	2
90–94	3	1.5
85–89	2	1
80–84	1	0.5
Less than 80	0	0



### Curriculum of B. Pharmacy (Organic chemistry III)

#### Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

**CO-BP401-1: To determine the Geometrical isomerism Nomenclature of geometrical isomers.**

Item	Approx Hrs
Lecture & Tutorial	10+3=13
Practical(P)	NA
SW	1
SL	1
Total:	15

Session Outcomes(SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
<b>Theory</b> <b>SO1.1:</b> Understand Optical isomerism– Optical activity, enantiomerism  <b>SO1.2:</b> Explain diastereo isomerism, meso compounds. Elements of symmetry, chiral and achiral molecules  <b>SO1.3:</b> Elements of symmetry  <b>SO1.4:</b> Reactions of chiral molecules  <b>SO1.5:</b> DL system of nomenclature of optical isomers <b>Practical</b> NA	NA	<b>Unit - 1</b> <b>1.1:</b> Introduction of Stereo isomerism <b>1.2:</b> Optical isomerism– <b>1.3:</b> Optical activity, enantiomerism <b>1.4:</b> diastereoisomerism, meso compounds <b>1.5:</b> Elements of symmetry, <b>1.6:</b> chiral and achiral molecules <b>1.7:</b> RS system of nomenclature of optical isomers <b>1.8:</b> Reactions of chiral molecules <b>1.9:</b> Racemic modification <b>1.10:</b> resolution of racemic mixture. <b>1T.1:</b> sequence rules <b>1T.2:</b> chiral and achiral molecules <b>1T.3:</b> classification of stereo isomerism.	<b>1.1:</b> Reactions of chiral molecules

**Suggested Assignments** Elements of symmetry, chiral and achiral molecules.



**Unit II****CO-BP401-2: To determine the Geometrical isomerism Nomenclature of geometrical isomers.**

Item	Approx Hrs
Lecture & Tutorial	10+3=13
Practical(P)	NA
SW	1
SL	1
Total:	15

Session Outcome	Laboratory Instruction(LI)	Class room Instruction (CI)	Self Learning (SL)
<b>Theory</b> <b>SO2.1:</b> Geometrical isomerism. <b>SO2.2:</b> Methods of determination of configuration of geometrical isomers. <b>SO2.3:</b> Conformational isomerism in Ethane, n-Butane and Cyclohexane. <b>SO2.4</b> Stereoisomerism in biphenyl compounds <b>SO2.5</b> Stereo specific and stereo selective reactions		<b>Unit - 2</b> <b>2.1</b> Geometrical isomerism <b>2.2</b> Nomenclature of geometrical isomers. <b>2.3</b> Nomenclature of EZ system. <b>2.4</b> Methods of determination configuration, of geometrical isomers <b>2.5</b> Stereo specific reactions <b>2.6::</b> Conformational isomerism in Ethane <b>2.7</b> Stereo isomerism in biphenyl compounds <b>2.8</b> stereo selective reactions <b>2.9</b> n-Butane and <b>2.10</b> Cyclohexane. <b>1T.1:</b> classification of geometrical isomerism. <b>1T.2:</b> chiral and achiral molecules <b>1T.3:</b> classification of conformational isomerism	2.1: Stereo specific and reactions stereo selective

**Suggested Assignments:** Conformational somerism in Ethane, n-Butane and Cyclo-hexane



### Unit III

**CO-BP401-3: To Use different heterocyclic compounds: nomenclature and classification.**

Item	Approx Hrs
Lecture & Tutorial	10+3=13
Practical(P)	NA
SW	1
SL	1
Total	15

Session Outcomes(SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
<p><b>Theory</b></p> <p><b>SO3.1:</b> introduction of heterocyclic compounds.</p> <p><b>SO3.2:</b> Nomenclature and classification of heterocyclic compounds.</p> <p><b>SO3.3:</b> Synthesis, reactions and medicinal uses of following compounds /derivatives Furan, and Thiophene.</p> <p><b>SO3.4:</b> Synthesis, reactions and medicinal uses of following compounds /derivatives Pyrrole</p> <p><b>SO3.5:</b> Relative aromaticity and reactivity of Pyrrole, Furan and Thiophene</p> <p><b>Practical</b> NA</p>		<p><b>Unit -3</b></p> <p><b>3.1</b> introduction of heterocyclic Compounds</p> <p><b>3.2</b> Nomenclature and classification of 5 membered compound heterocyclic compounds.</p> <p><b>3.3</b> Nomenclature and classification of 6-membered compound</p> <p><b>3.4</b> Synthesis, reactions of Furan</p> <p><b>3.5</b> Synthesis, reactions and medicinal uses of Thiophene.</p> <p><b>3.6</b> Synthesis, reactions and medicinal uses of Pyrrole</p> <p><b>3.7</b> medicinal uses of Furan.</p> <p><b>3.8</b> medicinal uses of Pyrrole,</p> <p><b>3.9</b> medicinal uses of Thiophene.</p> <p><b>3.10</b> Relative aromaticity and reactivity of Pyrrole, Furan and Thiophene</p> <p><b>1T.1:</b> Properties of Furan.</p> <p><b>1T.2:</b> Properties of Pyrrole.</p> <p><b>1T.3</b> Properties of Thiophene.</p>	<p><b>3.1:</b> Synthesis, reactions and medicinal uses of furan.</p>

**Suggested Assignments:** : to study of Relative aromaticity and reactivity of Pyrrole, Furan and Thiophene



**Unit IV: CO-BP401-4: To Use different Synthesis, reactions and medicinal uses of Pyrazole, Imidazole, Oxazole and Thiazole compounds**

Item	Approx Hrs
Lecture & Tutorial	10+3
Practical(P)	NA
SW	1
SL	1
Total:	15

Session Outcomes(SOs)	Laboratory Instruction (LI)	Class room Instruction(CI)	Self Learning(SL)
<b>Theory</b> <b>SO4.1:</b> Synthesis, reactions and medicinal uses of Pyrazole and Imidazole compounds. <b>SO4.2:</b> Synthesis, reactions and medicinal uses of Oxazole and Thiazole. compounds. <b>SO4.3:</b> Synthesis, reactions and medicinal uses of Oxazole and Thiazole. compounds. <b>SO4.4:</b> Pyridine, Quinoline, Isoquinoline, Acridine and Indole		<b>Unit - 4</b> <b>4.1:</b> Synthesis and medicinal uses of Pyrimidine. <b>4.2:</b> Synthesis and medicinal uses of ,Purine <b>4.3:</b> Synthesis and medicinal uses of Pyrazole, <b>4.4:</b> Synthesis and medicinal uses of Imidazole <b>4.5</b> Synthesis and medicinal uses of Oxazole <b>4.6</b> Synthesis and medicinal uses of thiazole. <b>4.7</b> Synthesis and medicinal uses of Pyridine, <b>4.8</b> Synthesis and medicinal uses of Quinoline <b>4.9</b> Synthesis and medicinal uses of Acridine <b>4.10</b> Synthesis and medicinal uses of Indole. <b>4T1:</b> Synthesis and medicinal uses of Pyrimidine <b>4T2:</b> Synthesis and medicinal uses of Purine, <b>4T.3:</b> Synthesis and	<b>4.1:</b> Synthesis, reactions and medicinal uses of Pyrazole and Imidazole compounds.

**Suggested Assignments:** Synthesis, reactions and medicinal uses of oxazole and thiazole Compounds



**Unit V: CO-BP401-5:** To Understand the medicinal and pharmaceutical importance of radiopharmaceuticals.

Item	Approx Hrs
Lecture & Tutorial	10+3=13
Practical(P)	0
SW	1
SL	1
Total:	15

Session Outcomes(SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
<b>Theory</b>  <b>SO5.1:</b> To Know the Reactions of synthetic Importance. <b>SO5.2:</b> To explain rearrangement and oxidation reaction	NA	<b>Unit – 5</b>  5.1 synthetic importance of reagents 5.2 Introduction of Metal hydride reduction 5.3 Uses of (NaBH <sub>4</sub> and LiAlH <sub>4</sub> ), 5.4 Application of Clemmensen reduction 5.5 Application of Clemmensen reduction 5.6 Application of Birch reduction 5.7 Application of Oppenauer-oxidation 5.8 Application of Dakin reaction. 5.9 Application of Beckmanns rearrangement 5.10 Schmidt rearrangement <b>5T1:</b> Claisen condensation <b>5T.2:</b> Schmidt condensation  <b>5T.3:</b> Dakin reaction	<b>5.1:</b> Metal hydride reduction (NaBH <sub>4</sub> and LiAlH <sub>4</sub> )



## Curriculum of B. Pharmacy

## Brief of Hours suggested for the Course Outcome

Course Out comes	Class Lecture (Cl)	(LI)	Sessional Work (SW)	Self Learning (Sl)	Total Hour (Cl+SW+Sl+LI)
<b>CO-BP401-1:</b> To understand the Stereoisomerism, Optical isomerism– Optical activity, enantiomerism, diastereo isomerism, meso compounds.	13	16	1	1	31
<b>CO-BP401-2:</b> To determine the Geometrical isomerism Nomenclature of geometrical isomers.	13	8	1	1	23
<b>CO-BP401-3:</b> To Use different hetero cyclic compounds: nomenclature and classification.	13	12	1	1	27
<b>CO-BP401-4:</b> To Use different Synthesis, reactions and medicinal uses of Pyrazole, Imidazole, Oxazole and Thiazole compounds.	10	8	1	1	20
<b>CO-BP401-5:</b> To Understand the Reactions of synthetic importance.	10	0	1	1	12
<b>Total Hours</b>	59	44	5	5	113



### Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

Course Outcome	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-BP401-1:	Stereoisomerism	08	06	01	15
CO-BP401-2:	Geometrical isomerism	12	07	01	20
CO-BP401-3:	Heterocyclic compounds	02	06	02	10
CO-BP401-4:	Synthesis, reactions and medicinal uses of compound	10	02	03	15
CO-BP401-5:	Reactions of synthetic importance	05	07	03	15
Total		37	28	10	75

**Legend:**      **R: Remember,**                      **U: Understand,**                      **A: Apply**

The end of semester assessment for Organic Chemistry-III will be held with written examination of 75 marks

**Note.** Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks.

Teachers can also design different tasks as per requirement, for end semester assessment.

#### **Suggested Instructional/Implementation Strategies:**

1. Improved Lecture
2. Tutorial
3. Case Method
4. Group Discussion
5. Role Play
6. Demonstration
7. ICT Based Teaching Learning (Video Demonstration/Tutorials CBT, Blog, Face book, Twitter, Whats app, Mobile, Online sources)
8. Brainstorming



### Curriculum of B. Pharmacy (organic chemistry I)

#### Suggested Learning Resources:

S. No.	Title	Author	Publisher	Edition & Year
1	Advanced Organic Chemistry	Morrison Boyd	Pearson education	Revised edition edition 2010
2	A Text book of Organic Chemistry	Arun Bahl , B.S Bahl	S.Chand	Revised edition, 2019
3	Organic Chemistry	P.L. Soni	Sultan Chand,	1983
4	Organic Chemistry	R. T. Morrison and R. N. Boyd	Prentice -Hall	6th Edition 2007
5	Advanced organic chemistry	Dr. Jagdamba singh, Dr. LDS Yadav	Pragati prakashan	Revised edition 2016
6	Organic Chemistry	J. Clayden	Oxford Press	Revised edition

#### Curriculum Development Team:

1. **Prof. SP Gupta**, Director, RGIP, AKS University
2. **Mr Satyendra Garg**, Assistant professor, Department of Pharmacy, AKS University
3. **Dr. Manoj Kumar Sharma**, Assistant professor, Department of Chemistry, AKS University



**Course Outcome, Program Specific  
Outcome & Program Outcome Mapping**

**Course Code: BP401T**

**Course Name: Pharmaceutical organic chemistry -III**

Course Outcome	Program Outcome											Program Specific outcome			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
	Pharmacy knowledge	Planning Abilities	Problem analysis	Modern tool usage	Leadership skills	Professional Identity	Pharmaceutical Ethics	Communication	The pharmacist and society	Environment and sustainability	Life-long learning	Knowledge of drug discovery	Quality Analysis of API's	MOA of Drug	Biological evaluation of drug
CO-1: Optical isomerism	3	2	3	1	3	2	1	2	3	2	3	1	3	1	2
CO-2: Nomenclature of geometrical isomers	2	3	1	3	1	2	0	1	2	3	3	3	2	1	3
CO-3: heterocyclic compounds: nomenclature and classification.	3	2	3	2	1	1	2	1	2	2	3	3	2	1	3
CO-4: Synthesis, reactions and medicinal uses of Pyrazole, Imidazole	2	3	2	3	1	3	2	2	3	3	3	3	2	1	3
CO-5: To Understand the Reactions of synthetic importance.	3	3	1	1	1	3	1	3	1	2	3	2	2	2	2

**Legend: 1- Low, 2-Medium, 3-High**



### Course Curriculum Mapping

Cos& PSOs No	Cos No	Title	SOs No	Class Room Instructions	Laboratory Instruction	Self Learning
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	CO-BP401T-1	To understand the Stereoisomerism, Optical isomerism– Optical activity, enantiomerism, diastereoisomerism, meso compounds.	SO1.1 SO1.2 SO1.3 SO1.4 SO1.5	1.1,1.2,1.3,1.4,1.5,1.6,1.7,1.8,1.9,1.10		SI-1.1
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	CO-BP401T-2	To determine the Geometrical isomerism Nomenclature of geometrical isomers.	SO-2.1 SO2.2 SO2.3 SO2.4 SO2.5	2.1,2.2,2.3,2.4,2.5,2.6,2.7,2.8,2.9,2.10		SI-2.1
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	CO-BP401T-3:	To Use different heterocyclic compounds: nomenclature and classification.	SO3.1 SO3.2 SO3.3 SO3.4 SO3.5	3.1,3.2,3.3,3.4,3.5,3.6,3.7,3.8,3.9,3.10		SI3.1
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	CO-BP401T-4	To Use different Synthesis, reactions and medicinal uses of Pyrazole, Imidazole, Oxazole and Thiazole compounds.	SO-4.1 SO-4.2 SO-4.3 SO-4.4	4.1,4.2,4.3,4.4,4.5,4.6,4.7,4.8,4.9,4.10		SI4.1
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	CO-BP401T-5	To Understand the Reactions of synthetic importance.	SO-5.1 SO-5.2 SO-5.3 SO-5.4 SO-5.5	5.1,5.2,5.3,5.4,5.5,5.6,5.7,5.8,5.9,5.10	-	SI-5.1





AKS University  
Faculty of Pharmaceutical Science & Technology  
Rajiv Gandhi Institute of Pharmacy  
Curriculum of B. Pharmacy (**Medicinal Chemistry–I**) Program  
(Revised as on 01August2023)  
**Semester-IV**

**CourseCode:** BP402T/BP406P  
**CourseTitle:** MEDICINAL CHEMISTRY–I

**Pre-requisite:** Students should have a basic knowledge of organic chemistry, and pharmaceutical or biological sciences and physical chemistry with Chemical compounds.

**Rationale/Objectives:** Upon completion of the course the student shall be able to

1. understand the chemistry of drugs with respect to their pharmacological activity
2. understand the drug metabolic pathways, adverse effect and therapeutic value of drugs
3. know the Structural Activity Relationship (SAR) of different class of drugs.
4. write the chemical synthesis of some drugs

**Course Outcomes:**

- CO-BP402T -1:** To understand the brief Introduction of Medicinal Chemistry, History and development of medicinal chemistry Physicochemical properties in relation to biological action & Drug metabolism.
- CO-BP402T-2:** To understand the Drugs acting on Autonomic Nervous System, Adrenergic Neurotransmitters,SAR of Sympathomimetic agents withstructure, mechanism of action, Structure activity relationship, synthesis anduses of Adrenergic Antagonists.
- CO-BP402T-3:** To understand the Cholinergic neurotransmitters, SAR of Parasympathomimetic agents,with structure, mechanism of action, Structure activity relationship, synthesis anduses of Parasympathomimetic agents and Cholinergic Blocking agents.
- CO-BP402T-4:** To understand the structure, mechanism of action, Structure activity relationship, synthesis anduses of Sedatives and Hypnotics, Antipsychotics & Anticonvulsants agents.
- CO-BP402T-5:** To understand the structure, mechanism of action, Structure activity relationship, synthesis of General anesthetics and Narcotic and non-narcotic analgesics.



## Scheme of Studies

Course code	Titleofthecourse	ProgramNa me	TOTALNumberofcontacthours/Week						Credit
			Classroom Instruction(A)		Practical(P)	SW	SL	Total Hours (H)	
			Lecture	Tutorial					
BP402T	Medicinal Chemistry-I (Theory)	B. Pharmacy	3	1	2	1	1	10	6

**Legend CI:** Class room Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and other, **LI:** Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other location using different instructional strategies)

**SW:** Sessional Work (includes assignment, seminar, mini-project etc.),

**SL:** Self Learning, Credits.

**Note:** SW&SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

## Theory Assessment

Board of Study	Course Code	Course Title	Scheme of Assessment (Marks)					End Semester Assessment (C)	Total Marks (A+B+C)
			Progressive Assessment (PRA)						
			Academic activity, Any three (Quiz/Assignment, open book test, file work and seminar)	Student teacher interaction	(Class Attendance)	Total Marks (A)	Sessional Exam (B)		
Pharmacy	BP402T	Medicinal Chemistry-I (Theory)	3	3	4	10	15	75	100



## Practical Assessment

Board of Study	Course Code	Course Title	Scheme of Assessment (Marks )						
			Internal Assessment (A)			End Semester Examination (B)			Total Marks (A+B)
			Attendance	Record	Professional Exam.	Synopsis	Experiment	Viva	
Pharmacy	BP402T	Medicinal Chemistry-I (Theory)	2	3	10	5	25	5	50

## Guidelines for the allotment of marks for attendance Percentage

### Attendance Theory/ Practical

Percentage of Attendance	Theory	Practical
95–100	4	2
90–94	3	1.5
85–89	2	1
80–84	1	0.5
Less than 80	0	0



## Curriculum of B. Pharmacy

### Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the over-all achievement of Course Outcomes (COs) upon the course's conclusion.

**CO-BP402T -1:** To understand the brief Introduction of Medicinal Chemistry, History and development of medicinal chemistry Physicochemical properties in relation to biological action & Drug metabolism.

### Attendance Theory/ Practical

Item	Approx Hrs
Lecture & tutorial	10+3=13
Practical(P)	08
SW	1
SL	1
Total:	23

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self Learning (SL)
<b>Theory</b>  <b>SO1.1</b> To understand Introduction to Medicinal Chemistry. <b>SO1.2</b> To understand History and development of medicinal chemistry. <b>SO1.3</b> To understand Physicochemical properties in relation to biological action. <b>SO1.4</b> To understand the Drug metabolism	<b>1.1</b> Assay of drugs Furosemide.	<b>1.1</b> Introduction to Medicinal Chemistry. <b>1.2</b> History and development of medicinal chemistry. <b>1.3</b> Physicochemical properties in relation to biological action Ionization, Solubility. <b>1.4</b> Physicochemical properties in relation to biological action of Partition Coefficient. <b>1T.1: Tutorial class</b> <b>1.5</b> Physicochemical properties in relation to biological action of Hydrogen bonding, Protein binding. <b>1.6</b> Physicochemical properties in relation to biological action of Chelation, Bioisosterism. <b>1.7</b> Physicochemical properties in relation to biological action of Optical and Geometrical isomerism. <b>1T.2: Tutorial class</b> <b>1.8</b> Drug metabolism principles- Phase I and Phase II. <b>1.9</b> Drug metabolism principles- Phase II <b>1.10</b> Factors affecting drug metabolism including stereo chemical aspects. <b>1T.3: Tutorial class</b>	<b>1.1</b> Study of the Introduction, History and development to Medicinal Chemistry with Physicochemical properties in relation to biological action and Drug metabolism.

### Suggested Assignments:

1. Explain the Introduction, History and development of medicinal chemistry.
2. Write the detail about Drug metabolism principles- Phase I and Phase II.



## Unit-II

**CO-BP402T-2:** To understand the Drugs acting on Autonomic Nervous System, Adrenergic Neurotransmitters, SAR of Sympathomimetic agents with structure, mechanism of action, Structure activity relationship, synthesis and uses of Adrenergic Antagonists.

Item	Approx Hrs
Lecture&Tutorial	10+3=13
Practical(P)	16
SW	2
SL	1
Total:	32

Session Outcomes(SOs)	Laboratory Instruction(LI)	Class room Instruction(CI)	Learning (SL)
<p><b>Theory</b>  <b>SO2.1</b> Brief introduction of Drugs acting on Autonomic Nervous System.</p> <p><b>SO2.2.</b> To understand the Adrenergic Neurotransmitters.</p> <p><b>SO2.3.</b> To understand the Sympathomimetic agents: SAR of Sympathomimetic agents.</p> <p><b>SO2.4.</b> Brief introduction of Adrenergic Antagonists.</p> <p><b>SO2.5.</b> To understand brief introduction, structure, synthesis, mechanism of action, and uses of Alpha adrenergic blockers.</p> <p><b>SO2.6.</b> To understand brief introduction, structure, synthesis, mechanism of action, and uses of Betaadrenergic blockers.</p>	<p><b>1.</b> Preparation of drugs/ intermediates            (1,3-pyrazole)            (1,3-oxazole)            (Benzimidazole)            (Benzotriazole)</p>	<p><b>2.1</b> Brief introduction of Drugs acting on Autonomic Nervous System.  <b>2.2</b> To understand the Adrenergic Neurotransmitters. Biosynthesis and catabolism of catecholamine. Adrenergic receptors (Alpha &amp; Beta) and their distribution.  <b>2.3</b> To understand the Sympathomimetic agents: SAR of Sympathomimetic agents.  <b>2.4</b> To understand the Structure, synthesis, SAR, MOA &amp; uses of Direct acting agents.  <b>2.T.1: Tutorial class</b>  <b>2.5</b> To understand the Structure, synthesis, SAR, MOA &amp; uses of Indirect acting agents.  <b>2.6</b> To understand the Agents with mixed mechanism Ephedrine, Metaraminol.  <b>2.7</b> To understand the Structure, synthesis, SAR, MOA &amp; uses of Alphaadrenergic blockers: Tolazoline*.  <b>2.8</b> To understand the Structure, synthesis, SAR, MOA &amp; uses of Phentolamine, Phenoxybenzamine, Prazosin, Dihydroergotamine, Methysergide.  <b>2.T.2: Tutorial class</b>  <b>2.9</b> To understand the Structure, synthesis, SAR, MOA &amp; uses of Beta adrenergic blockers: SAR of beta blockers, Propranolol*, Metibranolol, Atenolol, Betazolol, Bisoprolol, Esmolol, Metoprolol, Labetolol, Carvedilol.  <b>2.10</b> To understand the Structure, synthesis, SAR, MOA &amp; uses of Beta adrenergic blockers Metoprolol, Labetolol, Carvedilol.  <b>2.T.3: Tutorial class</b></p>	<p><b>2.1</b> Study of the introduction of Drugs acting on Autonomic Nervous System, Adrenergic Neurotransmitters, <b>2.2</b> SAR of Sympathomimetic agents with introduction of Adrenergic Antagonists &amp; structure, synthesis, mechanism of action, and uses of Alpha adrenergic blockers, Beta adrenergic blockers.</p>

### Suggested Assignments:

- Synthesis of Salbutamol, Phenylephrine, Tolazoline.
- Explain Alpha adrenergic blockers agents with synthesis, structure, MOA, SAR and Uses.
- Explain Betaadrenergic blockers Agents synthesis, structure, MOA, SAR and Uses



### Unit-III

**CO-BP402T-3:** To understand the Cholinergic neurotransmitters, SAR of Para-symphomimetic agents, with structure, mechanism of action, Structure activity relationship, synthesis and uses of Parasympathomimetic agents and Cholinergic Blocking agents.

Item	Approx Hrs
Lecture&Tutorial	10+3=13
Practical(P)	20
SW	1
SL	1
Total:	35

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
<p><b>SO3.1</b>To understand the Cholinergic neurotransmitters.</p> <p><b>SO3.2</b>To understand the SAR of Parasympathomimetic agents.</p> <p><b>SO3.3</b> To understand the Direct acting agents.</p> <p><b>SO3.4</b>To understand the Indirect acting/ Cholinesterase inhibitors (Reversible &amp; Irreversible).</p> <p><b>SO3.5</b>To understand the Cholinesterase reactivator.</p> <p><b>SO3.6</b>To understand the Solanaceous alkaloids and analogues.</p> <p><b>SO3.7</b>To understand the Synthetic cholinergic blocking agents.</p>	<p>1.Assay of drugs Atropin.</p> <p>2. Preparation of drugs/ intermediates. (2,3-diphenyl quinoxaline Benzocaine, Phenytoin, Phenothiazine.)</p>	<p>1 Brief introduction of Biosynthesis and catabolism of acetylcholine.</p> <p>2 Brief introduction of Cholinergic receptors (Muscarinic &amp; Nicotinic) and their distribution.</p> <p>3 Explain the SAR of Parasympathomimetic agents.</p> <p>4 Structure, Synthesis, SAR, MOA &amp; uses of Acetylcholine, Carbachol*, Bethanechol, Methacholine, Pilocarpine.</p> <p><b>3T.1: Tutorial class</b></p> <p>5 Structure, Synthesis, SAR, MOA &amp; uses of Physostigmine, Neostigmine*, Pyridostigmine, Edrophonium chloride, Tacrine hydrochloride, Ambenonium chloride, Isoflurophate, Echothiophate iodide, Parathione, Malathion.</p> <p>6 Structure, SAR, MOA &amp; uses of Pralidoxime chloride.</p> <p>7 Explain the : SAR of cholinolytic agents.</p> <p><b>3T.2: Tutorial class</b></p> <p>8 Introduction, Synthesis, SAR, MOA &amp; uses of Atropine sulphate, Hyoscyamine sulphate, Scopolamine hydrobromide, Homatropine hydrobromide, Ipratropium bromide*.</p> <p>9 Structure, Synthesis, SAR, MOA &amp; uses of Tropicamide, Cyclopentolate hydrochloride, Clidinium bromide, Dicyclomine hydrochloride*, Glycopyrrolate, Methantheline bromide, Propantheline bromide.</p> <p>10 Structure, Synthesis, SAR, MOA &amp; uses of Benztropine mesylate, Orphenadrine citrate, Biperidine hydrochloride, Procyclidine hydrochloride*, Tridihexethyl chloride, Isopropamide iodide, Ethopropazine hydrochloride.</p> <p><b>3T.3: Tutorial class</b></p>	<p>3.1 Study of the Cholinergic neurotransmitters with Parasympathomimetic</p>



### Suggested Assignments:

1. Synthesis, MOA and Uses of Procyclidine hydrochloride.
2. Explain Parasympathomimetic agents with drugs classification, Structure, Synthesis, MOA, SAR and Uses.
3. Explain Synthetic cholinergic blocking agents with synthesis, structure, MOA and Uses.
4. Explain SAR of Parasympathomimetic agents.

### Unit-IV:

**CO-BP402T-4:** To understand the structure, mechanism of action, Structure activity relationship, synthesis and uses of Sedatives and Hypnotics, Antipsychotics & Anticonvulsants agents.

Item	Approx Hrs
Lecture&Tutorial	8+3=11
Practical(P)	16
SW	1
SL	1
Total:	29

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
<b>SO4.1</b> To understand the Drugs acting on Central Nervous System. <b>SO4.2</b> To understand the Sedatives and Hypnotics. <b>SO4.3</b> To understand the Antipsychotics agents. <b>SO4.4</b> To understand the Anticonvulsants agents	<b>1.</b> Preparation of drugs/ intermediates (Phenytoin, Barbiturate) <b>2.</b> Assay of drugs (Phenobarbitone, Chlorpromazine)	4.1 Brief introduction of Drugs acting on Central Nervous System with Sedatives and Hypnotics. 4.2 Structure, synthesis, SAR, MOA & uses of Benzodiazepines, Chlordiazepoxide, Diazepam*, Oxazepam, Chlorazepate, Lorazepam, Alprazolam, Zolpidem. 4.3 Structure, synthesis, SAR, MOA & uses of barbiturates, Barbitol*, Phenobarbital, Mephobarbital, Amobarbital, Butobarbital, Pentobarbital, Secobarbital. 4.4 Structure, SAR, MOA & uses of, Glutethimide, Meprobamate, Ethchlorvynol, Triclofos sodium, Paraldehyde. <b>4T.1:Tutorial class</b> 4.1 Structure, SAR, MOA & uses of Promazine hydrochloride, Chlorpromazine hydrochloride*, Triflupromazine, Thioridazine hydrochloride, Piperacetazine hydrochloride, Prochlorperazine maleate, Trifluoperazine hydrochloride, Chlorprothixene, Thiothixene, Loxapine succinate, Clozapine. 4.2 Structure, SAR, MOA & uses of Haloperidol, Droperidol, Risperidone, Molindone hydrochloride, Sulpieride. <b>4T.2:Tutorial class</b> SAR of Anticonvulsants, mechanism of anticonvulsant action. With Structure, SAR, MOA & uses of 4.7 <b>Barbiturates:</b> Phenobarbitone, Methabarbitol. <b>Hydantoins:</b> Phenytoin*, Mephentyoin, Ethotoin <b>Oxazolinediones:</b> Trimethadione, Paramethadione. 4.8: Structure, SAR, MOA & uses of <b>Succinimides:</b> Phensuximide, Methsuximide, Ethosuximide <b>Urea and monoacylureas:</b> Phenacemide, Carbamazepine* <b>Benzodiazepines:</b> Clonazepam <b>Miscellaneous:</b> Primidone, Valproic acid, Gabapentin, Felbamate. <b>4T.3:Tutorial class</b>	4.1 Study of the Drugs acting on Central Nervous System Structure, synthesis, SAR, MOA & uses of Sedatives and Hypnotics agents. Antipsychotics agents. And Anticonvulsants agents.

### Suggested Assignments:

1. Write the detail about the Antipsychotics with classification.
2. Explain the SAR of Phenothiazines.
3. Explain SAR of Anticonvulsants, mechanism of anticonvulsant action
4. Write the SAR of Benzodiazepines & barbiturates.



## Unit-V

**CO-BP402T-5:** To understand the structure, mechanism of action, Structure activity relationship, synthesis of General anesthetics and Narcotic and non-narcotic analgesics.

Item	Approx Hrs
Lecture&Tutorial	7+3=10
Practical(P)	4
SW	1
SL	2
Total:	17

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
<b>SO5.1</b> To understand the Drugs acting on Central Nervous System. <b>SO5.2.</b> To understand the General anesthetics. <b>SO5.3.</b> To understand the Narcotic and non-narcotic analgesics. <b>SO5.4</b> To understands the Morphine and related drugs. <b>SO5.5</b> To understands the Narcotic antagonists. <b>SO5.6</b> To understands the Anti-inflammatory agents.	1. Assay of drugs Ibuprofen, Aspirin,	<b>5.1</b> Brief introduction of General anesthetics with Structure, synthesis, SAR, MOA & uses of Inhalation anesthetics. Dissociative anesthetics. <b>5.2</b> Brief introduction of General anesthetics with Structure, synthesis, SAR, MOA & uses of Structure, synthesis, SAR, MOA & uses of Ultra short acting barbiturates. <b>5T.1 Tutorial Class</b> <b>5.3</b> Brief introduction of General anesthetics with Structure, synthesis, SAR, MOA & uses of Structure, synthesis, SAR, MOA & uses of Dissociative anesthetics. <b>5.4</b> Brief introduction of Narcotic and non-narcotic analgesics. <b>5T.2Tutorial Class</b> <b>5.5</b> Structure, synthesis, SAR, MOA & uses of Morphine and related drugs. <b>5.6</b> Structure, synthesis, SAR, MOA & uses of Anti-inflammatory agents. <b>5.7</b> Structure, synthesis, SAR, MOA & uses of Narcotic antagonists. <b>5T.3Tutorial Class</b>	5.1 Study of the Drugs acting on Central Nervous System 5.2 study of the Structure, synthesis, SAR, MOA & uses of the Narcotic and non-narcotic analgesics,.

### **Suggested Sessional work Assignments:**

1. Explain the structure, synthesis, SAR, MOA and uses of Anti-inflammatory agent.
2. Short note about SAR of Morphine analogues.
3. Write the General anesthetics with structure, synthesis, SAR, Uses and MOA of Inhalation anesthetics.



### Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (Cl)	(LI)	Sessional Work (SW)	Self Learning (Sl)	Total Hour (Cl+ SW +Sl +LI)
<b>CO-BP402T -1:</b> To understand the brief Introduction of Medicinal Chemistry, History and development of medicinal chemistry Physicochemical properties in relation to biological action & Drug metabolism.	10	08	1	1	23
<b>CO-BP402T-2:</b> To understand the Drugs acting on Autonomic Nervous System, Adrenergic Neurotransmitters, SAR of Sympathomimetic agents with structure, mechanism of action, Structure activity relationship, synthesis and uses of Adrenergic Antagonists.	10	16	2	1	32
<b>CO-BP402T-3:</b> To understand the Cholinergic neurotransmitters, SAR of Parasympathomimetic agents, with structure, mechanism of action, Structure activity relationship, synthesis and uses of Parasympathomimetic agents and Cholinergic Blocking agents.	10	20	1	1	35
<b>CO-BP402T-4:</b> To understand the structure, mechanism of action, Structure activity relationship, synthesis and uses of Sedatives and Hypnotics, Antipsychotics & Anticonvulsants agents.	08	16	1	1	29
<b>CO-BP402T-5:</b> To understand the structure, mechanism of action, Structure activity relationship, synthesis of General anesthetics and Narcotic and non-narcotic analgesics.	07	12	1	2	25
<b>Total Hours</b>	<b>45</b>	<b>72</b>	<b>6</b>	<b>6</b>	<b>144</b>



**Suggestion for End Semester Assessment**  
Suggested Specification Table (For ESA)

Course Outcome	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
<b>CO-BP402T-1</b>	To understand the brief Introduction of Medicinal Chemistry, History and development of medicinal chemistry Physicochemical properties in relation to biological action & Drug metabolism.	08	06	01	15
<b>CO-BP402T-2</b>	To understand the Drugs acting on Autonomic Nervous System, Adrenergic Neurotransmitters, SAR of Sympathomimetic agents with structure, mechanism of action, Structure activity relationship, synthesis and uses of Adrenergic Antagonists.	10	07	01	18
<b>CO-BP402T-3</b>	To understand the Cholinergic neurotransmitters, SAR of Parasympathomimetic agents, with structure, mechanism of action, Structure activity relationship, synthesis and uses of Parasympathomimetic agents and Cholinergic Blocking agents.	02	06	02	10
<b>CO-BP402T-4</b>	To understand the structure, mechanism of action, Structure activity relationship, synthesis and uses of Sedatives and Hypnotics, Anti psychotics & Anticonvulsants agents.	10	03	02	15
<b>CO-BP402T-5</b>	To understand the structure, mechanism of action, Structure activity relationship, synthesis of General anesthetics and Narcotic and non-narcotic analgesics.	05	07	03	15
<b>Total</b>		<b>35</b>	<b>29</b>	<b>9</b>	<b>73</b>

**Legend: R:Remember, U:Understand, A:Apply**

The end of semester assessment for Medicinal Chemistry–I -It will be held with written examination of 75 marks

**Note.** Detailed assessment rubric need to be prepared by the course wise teachers for above tasks.

Teachers can also design different tasks as per requirement, for end semester assessment.

**Suggested Instructional/Implementation Strategies:**

1. Improved Lecture
2. Tutorial
3. Case Method
4. Group Discussion
5. Role Play
6. Demonstration
7. ICT Based Teaching Learning (Video Demonstration/Tutorials CBT, Blog, Facebook, Twitter, Whatsapp, Mobile, Online sources)
8. Brainstorm



### Suggested Learning Resources:

S.No.	Title	Author	Publisher	Edition & Year
1	Organic medicinal and Pharmaceutical Chemistry	Wilson and Giswold's	Wolters Kluwer India Pvt.Ltd.	12 <sup>th</sup> edition 1 January 2010
2	Principles of Medicinal Chemistry	Foye's	Lippincott Williams & Wilkins	7 <sup>th</sup> edition 2012
3	Medicinal Chemistry	Burger's	Wiley_	8 <sup>th</sup> edition 22 April 2021
4	Introduction to principles of drug design	Smith and Williams	Taylor & Francis Ltd	4 <sup>th</sup> edition 2022
5	Pharmaceutical Sciences	Remington's	Elsevier exclusive	23 <sup>rd</sup> edition 2021
6	extra pharmacopoeia	Martindale's	Pharmaceutical press	40 <sup>th</sup> edition May 2020
7	Organic Chemistry	I.L.Finar	Pearson Education India	6 <sup>th</sup> edition 2002
8	The Organic Chemistry of Drug Synthesis.	Led nicer	Wiley	2007
9	Indian Pharmacopoeia.	-	-	9 <sup>th</sup> edition 2022
10	Textbook of practical organic chemistry	A.I.Vogel	Pearson India	5 <sup>th</sup> edition 2003

#### Curriculum Development Team:

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**Course Outcome, Program Specific Outcome & Program Outcome Mapping**

**Course Code: BP402T/BP406P**

**Course Name: MEDICINAL CHEMISTRY-I**

Course Outcome	Program Outcome											Program Specific outcome			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
	Pharmacy knowledge	Planning Abilities	Problem analysis	Modern tool usage	Leadership skills	Professional Identity	Pharmaceutical Ethics	Communication	The pharmacist and society	Environment and sustainability	Life-long learning	Knowledge of drug discovery	Quality Analysis of API's	MOA of Drug	Biological evaluation of drug
<b>CO-1:</b> History and development of medicinal chemistry Physicochemical	3	2	3	1	3	2	1	2	3	2	3	1	3	1	2
<b>CO-2:</b> Autonomic Nervous System, Adrenergic Neurotransmitters, SAR of Sympathomimetic agents	2	3	1	3	1	2	1	1	2	3	3	3	2	1	3
<b>CO-3:</b> The Cholinergic neurotransmitters, SAR of Parasympathomimetic agents	3	2	3	2	1	1	2	1	2	2	3	3	2	1	3
<b>CO-4:</b> synthesis and uses of Sedatives and Hypnotics, Antipsychotics & Anticonvulsants agents.	2	3	2	3	1	3	2	2	3	3	3	3	2	1	3
<b>CO-5:</b> General anesthetics and Narcotic and non-narcotic analgesics.	3	3	1	1	1	3	2	3	1	2	3	2	2	2	2



## Course Curriculum Mapping

Pos& PSOs No	Cos No&	Title	SOs No	Class Room Instructions	Laboratory Instructions	Self learning
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	CO-BP402T-1	To understand the brief Introduction of Medicinal Chemistry, History and development of medicinal chemistry Physicochemical properties in relation to biological action & Drug metabolism.	SO1.1 SO1.2 SO1.3 SO1.4	1.1,1.2,1.3,1.4,1.5,1.6,1.7,1.8,1.9,1.10	LI-1.1	SI-1.1
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	CO-BP402T-2	To understand the Drugs acting on Autonomic Nervous System, Adrenergic Neurotransmitters, SAR of Sympathomimetic agents with structure, mechanism of action, Structure activity relationship, synthesis and uses of Adrenergic Antagonists.	SO-2.1 SO-2.2 SO-2.3 SO-2.4 SO-2.5 SO-2.6	2.1,2.2,2.3,2.4,2.5,2.6,2.7,2.8,2.9,2.10	LI-2.1	SI-2.1 SI-2.2
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	CO-BP402T-3	To understand the Cholinergic neurotransmitters, SAR of Parasympathomimetic agents, with structure, mechanism of action, Structure activity relationship, synthesis and uses of Parasympathomimetic agents and Cholinergic Blocking agents.	SO-3.1 SO-3.2 SO-3.3 SO-3.4 SO-3.5 SO-3.6 SO-3.7	3.1,3.2,3.3,3.4,3.5,3.6,3.7,3.8,3.9,3.10	LI-3.1 LI-3.2	SI-3.1
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	CO-BP402T-4	To understand the structure, mechanism of action, Structure activity relationship, synthesis and uses of Sedatives and Hypnotics, Antipsychotics & Anticonvulsants agents.	SO-4.1 SO-4.2 SO-4.3 SO-4.4	4.1,4.2,4.3,4.4,4.5,4.6,4.7,4.8.	LI-4.1 LI-4.2	SI-4.1
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	CO-BP402T-5	To understand the structure, mechanism of action, Structure activity relationship, synthesis of General anesthetics and Narcotic and non-narcotic analgesics.	SO-5.1 SO-5.2 SO-5.3 SO-5.4 SO-5.5 SO-5.6	5.1,5.2,5.3,5.4,5.5,5.6,5.7.	LI-5.1	SI-5.1 SI-5.2





# AKS University

AKS University  
Faculty of Pharmaceutical Science & Technology  
Rajiv Gandhi Institute of Pharmacy  
**Curriculum of B. Pharmacy (Physical Pharmaceutics-II) Program**  
**Semester-IV**

**Course Code:** BP403T/BP407P

**Course Title:** Physical Pharmaceutics-II (theory)

**Pre-requisite:** Students should have a basic knowledge of particle size of various dosage forms such as liquid dosage form. Example- colloidal , emulsion , suspension etc.

**Rationale/Objective s:** Upon the completion of the course student shall be able to

1. Understand various physicochemical properties of drug molecules in the designing the dosage forms.
2. Know the principles of chemical kinetics & to use them for stability Testing and determination of expiry date of formulations.
3. Demonstrate use of physicochemical properties in the formulation Development and evaluation of dosage forms.

**Course Out comes:**

**CO- BP 403.1:** To understand various physicochemical properties of drug molecules in the designing the dosage forms.

**CO- BP 403.2:** To understand about the flow properties of Newtonian and non-Newtonian system.

**CO- BP 403.3:** Demonstrate use of physicochemical properties in the formulation development and evaluation of dosage forms.

**CO- BP 403.4:** To understand the Micromeretics- fundamental and derived properties such as Particle size and distribution by different methods and determination of date of formulations.

**CO- BP 403.5:** To understand the principles of chemical kinetics of drug stability. Accelerated stability testing in expiration dating of pharmaceutical dosage forms.



## Scheme of Studies

Course code	Title of the course	Program Name	TOTAL Number of contact hours/Week						Credit
			Classroom Instruction (A)		Practical(P)	SW	SL	Total Hours(H)	
			Lecture	Tutorial					
BP403T	physical pharmaceuticals-II (Theory)	B. Pharmacy	3	1	4	1	1	10	6

**Legend: CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and dr

**LI:** Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)

**SW:** Sessional Work (includes assignment, seminar, mini project etc.),

**SL:** Self Learning, Credits.

**Note:** SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

Theory Assessment

Board of Study	Course Code	Course Title	Scheme of Assessment ( Marks )							
			Progressive Assessment ( PRA)							
			Academic activity,Any three (Quiz/ Assignment, open book test, filed work and seminar)	Student teacher interaction	Class Attendance(AT)	Total Marks (A)	SessionalExam (B)	EndSemester Assessment(C)		
Pharmacy	BP-403T	Physical pharmaceuticals-II	3	3	4	10	15	75	100	



## Practical Assessment

Board of Study	Course Code	Course Title	Scheme of Assessment ( Marks )						
			Internal Assessment (A)			End Semester Examination(B)			Total Marks (A+B)
			Attendance	Record	Sessional Exam.	Synopsis	Experiment	Viva	
Pharmacy	BP-403P	Physical pharmaceuticals-II(practical)	2	3	10	5	25	5	50

### Guidelines for the allotment of marks for attendance

Percentage of Attendance	Theory	Practical
95 – 100	4	2
90 – 94	3	1.5
85 – 89	2	1
80 – 84	1	0.5
Less than 80	0	0



**Course-Curriculum Detailing:**

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

**CO-BP403-1: To understand various physicochemical properties of drug molecules in the designing the dosage forms.**

Item	Approx Hrs
Lecture & Tutorial	8+3=11
Practical(P)	8
SW	1
SL	2
Total:	22

Session Outcomes(SOs)	Laboratory Instruction (LI)	Classroom Instruction(CI)	Self Learning (SL)
<p>Theory</p> <p><b>SO1.1:</b> Colloidal dispersions: introduction, definition and Classification of dispersed systems &amp; their general characteristic.</p> <p><b>SO1.2:</b> Size &amp; shapes of colloidal particles.</p> <p><b>SO1.3:</b> classification of colloids and comparative account of their general properties</p> <p><b>SO1.4:</b> Optical, kinetic &amp; electrical properties. Effect of electrolytes</p> <p><b>SO1.5:</b> coacervation, peptization &amp; protective action</p> <p><b>Practical</b></p> <p><b>SO-P- 1.1</b> To perform particle size, particle size distribution using sieving method has been done.</p> <p><b>SO-P-1.2</b> To perform particle size, particle size distribution using Microscopic method has been done.</p>	<p>1 Determination of particle size, particle size distribution using sieving method</p> <p>2 Determination of particle size, particle size distribution using Microscopic method</p>	<p>1 Introduction and definition of colloids</p> <p>2 Classification of dispersed systems &amp; their general characteristic</p> <p><b>1T.1:</b> Tutorial</p> <p>3 Size &amp; shapes of colloidal particles</p> <p>4 classification of colloids</p> <p>5 comparative account of their general properties</p> <p><b>1T.2:</b> Tutorial</p> <p>6 Optical, kinetic &amp; electrical properties</p> <p>7 Effect of electrolyte</p> <p>8 Coacervation, peptization &amp; protective action.</p> <p><b>1T.3:</b> Tutorial</p>	<p><b>1.1</b> Introduction of colloidal dispersion</p> <p><b>1.2</b> General discussion of various properties such as optical, kinetic, and electrolytes.</p>

**Suggested Assignments:**

1. Introduction of colloidal dispersion
2. General discussion of various properties such as optical, kinetic, and electrolytes.



## Unit II

**CO-BP403.2:** To understand about the flow properties of Newtonian and non-Newtonian system.

Item	Approx Hrs
Lecture & Tutorial	10+3=13
Practical (P)	8
SW	1
SL	2
Total:	24

Session Outcomes(SOs)	Laboratory Instruction(LI)	Class room Instruction(CI)	Self Learning (SL)
<b>Theory</b> <b>SO2.1: Rheology-</b> Introduction and types of Rheology <b>SO2.2:</b> Newtonian systems, law of flow, kinetic viscosity, effect of temperature <b>SO2.3:</b> Non-Newtonian system plastic, dilatant, pseudoplastic <b>SO2.4:</b> Thixotropy in formulation, determination of viscosity, capillary, falling Sphere, rotational viscometers <b>SO2.5: Deformation of solids:</b> Plastic and elastic deformation, Heckel equation, Stress, Strain, Elastic Modulus. <b>Practical</b> <b>SO-P-2.1</b> To perform the viscosity of liquid using Ostwald's viscometer has been done.  2.2 To perform the viscosity of semisolid by using Brookfield viscometer has been done.	2.1 Determination of viscosity of liquid using Ostwald's viscometer  2.2 Determination of viscosity of semisolid by using Brookfield viscometer	2.1 To brief Rheology and deformation of solids 2.2 Introduction and types of Rheology 2.3 Newtonian systems, law of flow, kinetic viscosity <b>2T.1:</b> Tutorial class  2.4 effect of temperature of Non-Newtonian system plastic, dilatant, pseudoplastic 2.5 Thixotropy in formulation 2.6 determination of viscosity 2.7 capillary, falling Sphere, rotational viscometers <b>2T.2:</b> Tutorial class 2.8 Deformation of solids: Plastic and elastic deformation 2.9 Detail in Heckel equation 2.10 Stress, Strain, Elastic Modulus <b>2T.3:</b> Tutorial class	2.1: Introduction of Rheology  2.2 General discussion of various flow properties such as Newtonian and non-Newtonian system

### Suggested Assignments:

1. Introduction and types of Rheology.
2. Detail in Thixotropy in formulation, determination of viscosity and their viscometers.



### Unit III

**CO-BP.3:** Demonstrate use of physicochemical properties in the formulation development and evaluation of dosage forms.

Item	Approx Hrs
Lecture & Tutorial	10+3=13
Practical(P)	8
SW	1
SL	2
Total:	24

Session Outcomes(SOs)	Laboratory Instruction(LI)	Class room Instruction(CI)	Learning(SL)
<b>Theory</b> <b>SO3.1</b> Introduction of Coarse dispersion <b>SO3.2</b> Suspension, interfacial properties of suspended particles, settling in Suspensions, formulation of flocculated and deflocculated suspensions  <b>SO3.3</b> Emulsions and theories of emulsification, micro emulsion and multiple emulsions  <b>SO3.4</b> Stability of emulsions and preservation of emulsions  <b>SO3.5</b> Rheological properties of emulsions and emulsion Formulation by HLB method.  <b>Practical</b> <b>SO-P-3.1</b> To perform the sedimentation volume with effect of different suspending agent has been done.  <b>3.2</b> To perform the sedimentation volume with effect of different concentration of single suspending agent has been done.	<b>3.1</b> Determination of sedimentation volume with effect of different suspending agent <b>3.2</b> Determination sedimentation volume with effect of different concentration of single suspending agent	3.1 Brief coarse dispersion 3.2 Introduction and define suspension 3.3 Explain interfacial properties of suspended particles 3.4 formulation of flocculated and deflocculated suspensions <b>3T.1:</b> Tutorial class 3.5 define emulsion, Explain theories of emulsification, micro emulsion and multiple emulsions 3.6 Stability and prevention of emulsion <b>3T.2:</b> Tutorial class 3.7 Discuss Rheology and its types 3.8 Rheological properties of emulsions 3.9 Formulation of Emulsion in various methods 3.10 Formulation of Emulsion by HLB method. <b>3T.3:</b> Tutorial class	<b>3.1</b> comparative study of suspension and emulsion according to particles  <b>3.2</b> Introduction of Rheology and Rheological properties of emulsion

### Suggested Assignments:

1. Write the suspension and emulsion according to suspending particles.



**Unit IV:**

**CO- BP 403.4:** To understand the Micromeritics- fundamental and derived properties such as Particle size and Size distribution by different methods and determination of date of formulations.

Item	Approx Hrs
Lecture & Tutorial	10+3=13
Practical(P)	8
SW	1
SL	2
Total	24

:

Session Outcomes(SOs)	Laboratory Instruction (LI)	Class room Instruction(CI)	Self Learning (SL)
<b>Theory</b> <b>SO4.1:</b> Introduction of Micromeritics <b>SO4.2:</b> Define Micromeritics and its types fundamental and derived properties <b>SO4.3:</b> Fundamental property of powder- particle size, particle shape by different method (counting and separation method) <b>SO4.4:</b> Determine of specific surface area by different method (permeability and adsorption). <b>SO4.5:</b> Derived properties of powders- Porosity, packing arrangement, densities, bulkiness & flow properties <b>Practical</b> <b>SO-P-4.1:</b> To perform bulk density, true density and porosity has been done. <b>SO-P-4.2</b> To perform the angle of repose and influence of lubricant on angle of repose has been done.	4.1 Determination of bulk density, true density and porosity 4.2 Determine the angle of repose and influence of lubricant on angle of repose	4.1 Define Micromeritics and its types- fundamental and derived properties 4.2 Fundamental property of powder- particle size by different method (counting and separation method) 4.3 particle shape by different method (counting and separation method) <b>4T.1:</b> Tutorial class 4.4 Determine of specific surface area by different method (permeability and adsorption). 4.5 Determine the particle size, particle number and particle weight 4.6 Explain Derived properties of powders <b>4T.2:</b> Tutorial class 4.7 Discuss Porosity of powder 4.8 packing arrangement of powder 4.9 densities and bulkiness of powder 4.10 Explain flow property of powder <b>4T.3:</b> Tutorial class	<b>4.1</b> Introduction and define Micromeritics <b>4.2</b> discuss in detail Fundamental and derived property of powder by different methods

**Suggested Assignments:**

1. Write about Micromeritics and detail the fundamental and derived properties of powder.



## Unit V

**CO-BP403-5:** To understand the principles of chemical kinetics of drug stability, Accelerated stability testing in expiration dating of pharmaceutical dosage forms.

Item	Approx Hrs
Lecture & Tutorial	10+3=13
Practical(P)	12
SW	1
SL	2
Total:	28

Session Outcomes(SOs)	Laboratory Instruction(LI)	Class room Instruction(CI)	Self Learning (SL)
<p><b>Theory</b> <b>SO5.1:</b> Define drug stability according to kinetics reaction <b>SO5.2:</b> Explain order of reaction such as zero, pseudo-zero, first &amp; second order <b>SO5.3:</b> units of basic rate constants and determination of reaction order <b>SO5.4:</b> Physical and chemical factors influencing the chemical degradation of pharmaceutical product <b>SO5.5:</b> Accelerated stability testing in expiration dating of pharmaceutical dosage forms. Photolytic degradation and its prevention</p> <p><b>Practical:</b> <b>SO-P-5.1</b> To perform the reaction rate constant first order has been done <b>SO-P-5.2</b> To perform the reaction rate constant second order has been done  <b>SO-P-5.3</b> to perform the accelerated stability has been done.</p>	<p>5.1 Determination of reaction rate constant first order. 5.2 Determination of reaction rate constant second order 5.3 Determine of the Accelerated stability studies</p>	<p>5.1 Define drug stability according to kinetics reaction 5.2 Explain order of reaction such as zero and pseudo-zero order 5.3 Explain order of reaction like first &amp; second order <b>5T.1:</b> Tutorial class 5.4 units of basic rate constants and determination of reaction order 5.5 Physical factors influencing the degradation of pharmaceutical product 5.6 Chemical factors influencing the chemical degradation of pharmaceutical product 5.7 Chemical degradation of pharmaceutical product: (temperature, solvent, ionic strength, dielectric constant, specific &amp; general acid base catalysis) <b>5T.2:</b> Tutorial class 5.8 Accelerated stability testing in expiration dating of pharmaceutical dosage forms 5.9 Stabilization of medicinal agents against common reactions like hydrolysis &amp; oxidation 0 Photolytic degradation and its prevention <b>5T.3:</b> Tutorial class</p>	<p><b>5.1:</b> Introduction of drug stability according to kinetics reaction  <b>5.2:</b> Discuss in detail about the order of reaction such as zero, pseudo-zero, first &amp; second order</p>

### Suggested Sessional work

**Assignments:** 1. Write about the drug stability of kinetic reaction like zero, pseudo-zero, first & second order.



### Brief of Hours suggested for the Course Outcome

Course Out comes	Class Lecture (Cl)	(LI)	Sessional Work (SW)	Self Learning (Sl)	Total Hour (Cl+SW+ Sl+LI)
<b>CO- BP 403.1:</b> To understand various physicochemical properties of drug molecules in the designing the dosage forms.	11	8	1	2	22
<b>CO- BP 403.2:</b> To understand about the flow properties of Newtonian and non-Newtonian system.	13	8	1	2	24
<b>CO- BP 403.3:</b> Demonstrate use of physicochemical properties in the formulation development and evaluation of dosage forms	13	8	1	2	24
<b>CO- BP 403.4:</b> To understand the Micromeretics- fundamental and derived properties such as Particle size and distribution by different methods and determination of date of formulations.	13	8	1	2	24
<b>CO- BP 403.5:</b> To understand the principles of chemical kinetics of drug stability. Accelerated stability testing in expiration dating of pharmaceutical dosage forms	13	12	1	2	28
<b>Total Hours</b>	63	44	5	10	122



**Suggestion for End Semester Assessment**  
Suggested Specification Table (For ESA)

Course Outcome	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
<b>CO-BP403-1:</b>	To understand various physicochemical properties of drug molecules in the designing the dosage forms.	08	06	01	15
<b>CO-BP403-2:</b>	To understand about the flow properties of Newtonian and non-Newtonian system.	12	07	01	20
<b>CO-BP403-3:</b>	Demonstrate use of physicochemical properties in the formulation development and evaluation of dosage forms.	02	06	02	10
<b>CO-BP403-4:</b>	To understand the Micromeritics- fundamental and derived properties such as Particle size and distribution by different methods and determination of date of formulations	10	02	03	15
<b>CO-BP403-5:</b>	To understand the principles of chemical kinetics of drug stability. Accelerated stability testing in expiration dating of pharmaceutical dosage forms	05	07	03	15
<b>Total</b>		<b>37</b>	<b>28</b>	<b>10</b>	<b>75</b>

**Legend: R: Remember, U: Understand, A: Apply**

The end of semester assessment for Physical pharmaceutics-II will be held with written examination of 75 marks.

**Note.** Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks.

Teachers can also design different tasks as per requirement, for end semester assessment.

**Suggested Instructional/Implementation Strategies:**

1. Improved Lecture
2. Tutorial
3. Case Method
4. Group Discussion
5. Role Play
6. Demonstration
7. ICT Based Teaching Learning (Video Demonstration/Tutorials CBT, Blog, Face book, Twitter, Whats app, Mobile, Online sources)



## Suggested Learning Resources:

S. No.	Title	Author	Publisher	Edition & Year
1	Physical Pharmacy	Alfred Martin	publisher by Lippincott	7 <sup>th</sup> edition 2016
2	Experimental pharmaceutics	Eugene, Parott	Publisher by Burgess	4 <sup>th</sup> edition 2008
3	Tutorial pharmacy	Cooper and Gunn	— publisher BY CBS	8 <sup>th</sup> edition 2017
4	Pharmaceutical calculations, Lea & Febiger	Stocklosam J.	publisher BY Philadelphia	6 <sup>th</sup> editions 2021
5	Pharmaceutical Dosage forms, Tablets	Lieberman H.A, Lachman C.	Publisher BY Marcel Dekkar Inc	Volume-1 to 3-2022
6	Pharmaceutical dosage forms. Dispersesystems	Lieberman H.A, Lachman C.	publisher BY Marcel Dekkar Inc	volume 1, 2, 3-2023
7	Physical Pharmaceutics	Ramasamy C, and Manavalan R.	publisher by Pharmamed	9 <sup>th</sup> edition 2024

## Curriculum Development Team:

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**Course Outcome, Program Specific Outcome& Program Outcome Mapping**

**Course Code: BP403T/BP407P**

**Course Name: Physical Pharmaceutics-II (theory)**

Course Outcome	Program Outcome											Program Specific outcome			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
	Pharmacy knowledge	Planning Abilities	Problem analysis	Modern tool usage	Leadership skills	Professional Identity	Pharmaceutical Ethics	Communication	The pharmacist and society	Environment and sustainability	Life-long learning	Knowledge of drug discovery	Quality analysis of API's	MOA of Drug	Biological evaluation of drug
<b>CO-1:</b> physicochemical properties of drug molecules in the designing the dosage forms	3	2	3	1	3	2	1	2	3	2	3	1	3	1	2
<b>CO-2:</b> To understand about the flow properties of Newtonian and non-Newtonian system.	2	3	1	3	1	2	0	1	2	3	3	3	2	1	3
<b>CO-3:</b> Demonstrate use of physicochemical properties in the formulation development and evaluation of dosage forms.	3	2	3	2	1	1	2	1	2	2	3	3	2	1	3
<b>CO-4:</b> To understand the Micromeritics- fundamental and derived properties such as Particle size and distribution by different methods and determination of date of formulations.	2	3	2	3	1	3	2	2	3	3	3	3	2	1	3
<b>CO-5:</b> To understand the principles of chemical kinetics of drug stability. Accelerated stability testing in expiration dating of pharmaceutical dosage forms	3	3	1	1	1	3	1	3	1	2	3	2	2	2	2

**Legend: 1- Low, 2-Medium, 3-High**



### Course Curriculum Mapping

Pos& PSOs No	Cos No&	Title	SOs No	Class Room Instructions	Laboratory Instructions	Self learning
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	<b>CO-BP403-1</b>	To understand various physicochemical properties of drug molecules in the designing the dosage forms	SO1.1 SO1.2 SO1.3 SO1.4 SO1.5	1.1,1.2,1.3,1.4,1.5,1.6,1.7,1.8	LI-1.1 LI-1.2	SI-1.1 SI-1.2
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	<b>CO-BP403-2:</b>	To understand about the flow properties of Newtonian and non-Newtonian system.	SO-2.1 SO-2.2 SO-2.3 SO-2.4 SO-2.5	2.1,2.2,2.3,2.4,2.5,2.6,2.7,2.8,2.9,2.10	LI-2.1 LI-2.2	SI-2.1 SI-2.2
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	<b>CO-BP403-3:</b>	Demonstrate use of physicochemical properties in the formulation development and evaluation of dosage forms.	SO-3.1 SO-3.2 SO-3.3 SO-3.4	3.1,3.2,3.3,3.4,3.5,3.6,3.7,3.8,3.9,3.10	LI-3.1 LI-3.2	SI-3.1 SI-3.2
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	<b>CO-BP403-4:</b>	To understand the Micromeritics- fundamental and derived properties such as Particle size and distribution by different methods and determination of date of formulations.	SO-4.1 SO-4.2 SO-4.3	4.1,4.2,4.3,4.4,4.5,4.6,4.7,4.8, 4.9, 4.10	LI-4.1 LI-4.2	SI-4.1 SI-4.2
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	<b>CO-BP403-5:</b>	To understand the principles of chemical kinetics of drug stability. Accelerated stability testing in expiration dating of pharmaceutical dosage forms	SO-5.1 SO-5.2 SO-5.3 SO-5.4 SO-5.5	5.1,5.2,5.3,5.4,5.5,5.6,5.7,5.8,5.9,5.10	LI-5.1 LI-5.2 LI-5.3	SI-5.1 SI-5.2





AKS University  
Faculty of Pharmaceutical Science & Technology  
Rajiv Gandhi Institute of Pharmacy  
**Curriculum of B. Pharmacy (Pharmacology-I) Program**  
**Semester-IV**

**Course Code:** BP404T& BP408P

**Course Title:** Pharmacology-I

**Pre-requisite:** Student should have basic knowledge of General Pharmacology, Anatomy & Physiology of human body, Biochemistry, Pathophysiology.

**Rationale/Objectives:** Upon completion of the course student shall be able to

- To understand the pharmacological actions of different categories of drugs
- To explain the mechanism of drug action at organ system/sub-cellular/macro molecular levels.
- To apply the basic pharmacological knowledge in the prevention and treatment of various diseases.
- To observe the effect of drugs on animals by simulated experiments
- To appreciate correlation of pharmacology with other biomedical sciences

**Course Outcomes:**

- CO-BP404-1:** To understand the general pharmacology, introduction to pharmacology & pharmacokinetics.
- CO-BP404-2:** To acquire the knowledge of pharmacodynamics, adverse drug reactions, drug interactions, (pharmacokinetic and pharmacodynamics) & drug discovery and clinical .
- CO-BP404-3:** To understanding the pharmacology of drugs acting on peripheral nervous system.
- CO-BP404-4:** To familiarize with basic concept of pharmacology of drugs acting on central nervous system.
- CO-BP404-5:** To comprehend the basic concepts of pharmacology of drugs acting on central nervous system.



## Scheme of Studies

Course code	Title of thecourse	Program Name	TOTAL Number of contact hours/Week						Credi t	15 We eks (H)
			Class room Instruction(A)		Practica l(P)	S W	S L	Total Hous (H)		
			Lecture	Tutorial						
BP40 4T	Pharmacology-I Theory	B. Pharmacy	3	1	4	1	1	10	6	150

**Legend:** **CI:** Class room Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others),

**LI:** Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)

**SW:** Sessional Work (includes assignment, seminar, mini project etc.),

**SL:** Self Learning, Credits.

**Note:** SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

## Theory Assessment

Boardof Study	Course Code	Course Title	Scheme of Assessment (Marks)						
			Progressive Assessment (PRA)						
			Academic activity, Any three (Quiz/Assignment , open book test,filed work and seminar)	Student tea cherintera ction	Class    Attendance (AT)	(A)  Total Marks	SessionalExam (B)		
Pharmacy	BP-404T	Pharma cology-I	3	3	4	10	15	75	100



## Practical Assessment

Boar of Study	Course Code	Course Title	Scheme of Assessment(Marks)						
			Internal Assessment(A)			End Semester Examination(B)			Total Marks (A+B)
			Attendance	Record	Sessional Exam.	Synopsis	Experiment	Viva	
Pharmacy	BP-408P	Pharmacology-I	2	3	10	5	25	5	50

### Guidelines for the allotment of marks for attendance

Percentage of Attendance	Theory	Practical
95–100	4	2
90–94	3	1.5
85–89	2	1
80–84	1	0.5
Less than 80	0	0

### Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.



## Unit-I

**CO-BP404-1:** To understand the general pharmacology, introduction to pharmacology & pharmacokinetics.

Item	Approx Hrs
Lecture & Tutorial	08+3=11
Practical(P)	24
SW	1
SL	1
Total:	37

Session Outcomes(SOs)	Laboratory Instruction (LI)	Classroom Instruction(CI)	Self Learning (SL)
<b>Theory</b> <b>SO1.1:</b> Introduction to Pharmacology <b>SO1.2:</b> Pharmacokinetics  <b>Practical</b> <b>SO-P-1.1:</b> Introduction to experimental Pharmacology <b>SO-P-1.2:</b> Commonly used instruments in experimental pharmacology. <b>SO-P-1.3:</b> Study of common laboratory animals. <b>SO-P-1.4:</b> Maintenance of laboratory animals as per CPCSEA guidelines. <b>SO-P-1.5:</b> Common laboratory techniques. Blood withdrawal, serum and plasma separation, anesthetics and euthanasia used for animal studies. <b>SO-P-1.6:</b> Study of different routes of drug administration in Mice /rats.	<b>1.1:</b> To study the introduction to Experimental pharmacology <b>1.2:</b> To study the commonly used instruments in experimental pharmacology. <b>1.3:</b> To study the common laboratory animals. <b>1.4:</b> To study the Maintenance of laboratory animals as per CPCSEA Guidelines. <b>1.5:</b> To study the Common laboratory techniques. Blood withdrawal, serum and plasma separation, anesthetics and euthanasia used for animal studies. <b>1.6:</b> To study the different routes of drugs administration in mice/rats.	1.1 Definition, historical landmarks and scope of pharmacology. 1.2 Nature and source of drugs, essential drugs concept and routes of drug administration. 1.3 Agonists, antagonists (competitive and non competitive), spare receptors. <b>1T.1</b> Tutorial Class 1.4 Addiction, tolerance, dependence, tachyphylaxis, idiosyncrasy, allergy 1.5 Membrane transport 1.6 Absorption, distribution, metabolism and excretion of drugs. <b>1T.2</b> Tutorial Class 1.7 Enzyme induction, enzyme inhibition. 1.8 Kinetics of elimination.  <b>1T.3</b> Tutorial Class	1.1: Nature and source of drugs. 1.2: Membrane transport.

**Suggested Assignments:** 1. Nature and source of drugs, 2. Routes of drug administration, 3. Membrane transport, 4. Absorption, distribution, metabolism and excretion of drugs, 5. Kinetics of elimination.



## Unit-II

**CO-BP404-2:** To acquired the knowledge of pharmacodynamics, adverse drug reactions, drug interactions (pharmacokinetic and pharmacodynamics) & drug discovery and clinical evaluation of new drugs.

Item	Approx Hrs
Lecture & Tutorial	12+3=15
Practical(P)	0
SW	1
SL	1
Total:	17

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self Learning (SL)
<b>Theory</b> <b>SO2.1:</b> Pharmacodynamics <b>SO2.2:</b> Adverse drug reactions <b>SO2.3:</b> Drug interactions <b>SO2.4:</b> Drug discovery and clinical evaluation of new drugs.	NA	2.1 Principles and mechanisms of drug action. 2.2 Receptor theories and classification of receptors. 2.3 Regulation of receptors. 2.4 Drug receptors interaction signal transduction mechanisms. 2.5 Dose response relationship, therapeutic index. <b>2T.1</b> Tutorial Class 2.6 Combined effects of drugs and factors modifying drug action. 2.7 Adverse drug reactions. 2.8 Drug interactions (pharmacokinetic and pharmacodynamics) 2.9 Drug discovery and clinical evaluation of new drugs. <b>2T.2</b> Tutorial Class 2.10 Drug discovery phase. 2.11 Preclinical evaluation phase. 2.12 Clinical trial phase. Phases of clinical trials and pharmacovigilance. <b>2T.3</b> Tutorial Class	1.1: Receptor theories and classification of receptors. 1.2: Adverse drug reactions.

**Suggested Assignments:** 1. Receptor theories, 2. Classification of receptors, 3. Combined effects of drugs and Factors modifying drug action, 4. Adverse drug reactions, 5. Clinical trial phase



### Unit-III

**CO-BP404-3: To understanding the pharmacology of drugs acting on peripheralnervous system.**

Item	Approx Hrs
Lecture &Tutorial	10+3=13
Practical(P)	16
SW	1
SL	1
Total	31

Session Outcomes(SOs)	Laboratory Instruction (LI)	Classroom Instruction(CI)	Self Learning (SL)
<b>Theory</b> <b>SO3.1:</b> Organization and function of ANS. <b>SO3.2:</b> Neuro-humoral transmission, co- transmission and classification of neurotransmitters. <b>SO3.3:</b> Parasympathomimetics, Parasympatholytics, Sympathomimetics, sympatholytics. <b>SO3.4:</b> Neuromuscular blocking agents and skeletal muscle relaxants (peripheral). <b>SO3.5:</b> Local anesthetic agents. <b>SO3.6:</b> Drugs used in myasthenia gravis and glaucoma.  <b>Practical</b> <b>SO-P-3.1:</b> Effect of drugs on ciliary motility of frog oesophagus. <b>SO-P 3.2:</b> Effect of drugs on rabbit eye. <b>SO-P-3.3:</b> Effects of skeletal muscle relaxants using rota-rod apparatus. <b>SO-P-3.4:</b> Study of local anesthetics by different methods.	<b>3.1:</b> To study the effect of drugs on ciliary motility of frog oesophagus. <b>3.2:</b> To study the effect of drugs on rabbit eye. <b>3.3:</b> To study the effects of skeletal muscle relaxants using rota-rod apparatus. <b>3.4:</b> To study the local anesthetics by different methods.	3.1 Organization and function of ANS. 3.2 Neurohumoral transmission, co-transmission and classification of neurotransmitters. 3.3 Parasympathomimetics <b>3T.1</b> Tutorial Class 3.4 Parasympatholytics 3.5 Sympathomimetics 3.6 sympatholytics <b>3T.2</b> Tutorial Class 3.7 Neuromuscular blocking agents and skeletal muscle relaxants (peripheral). 3.8 Local anesthetic agents. 3.9 Drugs used in myasthenia gravis 3.10 Drugs used in glaucoma <b>3T.3</b> Tutorial Class	3.1: Organization and function of ANS. 3.2: Classification of neurotransmitters.

**Suggested Assignments:** 1. Organization and function of ANS, 2. Neurohumoral transmission, 3. Co-transmission, 4. Classification of neurotransmitters, 5. Drugs used in myasthenia gravis.



#### Unit-IV

**CO-BP404-4: To familiarize with basic concept of pharmacology of drugs acting on central nervous system.**

Item	Approx Hrs
Lecture & Tutorial	08+3=11
Practical(P)	12
SW	1
SL	1
Total:	25

Session Outcomes(SOs)	Laboratory Instruction(LI)	Instruction(CI)	Learning(SL)
<b>Theory SO4.1:</b> Neurohumoral transmission <b>SO4.2:</b> General anesthetics and pre-anesthetics. <b>SO4.3:</b> Sedatives & hypnotics <b>SO4.4:</b> Centrally acting muscle relaxants. <b>SO4.5:</b> Anti-epileptics <b>SO4.6:</b> Alcohols and disulfiram  <b>Practical</b> <b>SO-P-4.1:</b> Study of effect of hepatic microsomal enzyme inducers on the phenobarbitone sleeping time in mice. <b>SO-P-4.2:</b> Effect of drugs on locomotor activity using actophotometer. <b>SO-P-4.3:</b> Anticonvulsant effect of drugs by MES and PTZ method.	<b>4.1:</b> To study the effect of hepatic microsomal enzyme inducers on the phenobarbitone sleeping time in mice. <b>4.2:</b> To study the effect of drugs on locomotor activity using actophotometer. <b>4.3:</b> To study the Anticonvulsant effect of drugs by MES and PTZ method.	4.1 GABA & Glutamate 4.2 Glycine, serotonin & dopamine. 4.3 General anesthetics <b>4T.1</b> Tutorial Class Pre-anesthetic medication. 4.5 Sedatives & hypnotics 4.6 Centrally acting muscle relaxants. <b>4T.2</b> Tutorial Class 7 Anti-epileptics 8 Alcohols and disulfiram <b>4T.3</b> Tutorial Class	4.1: Basic concepts in endocrine pharmacology.  4.2: Anterior Pituitary hormones.

**Suggested Assignments:** 1. GABA, 2. Pre-Anesthetic medication, 3. centrally acting muscle relaxants, 4. Alcohols, 5. Dopamine



## Unit-V

**CO-BP404-5: To comprehend the basic concepts of pharmacology of drugs acting on central nervous system.**

Item	Approx Hrs
Lecture & Tutorial	07+03=10
Practical(P)	08
SW	1
SL	1
Total:	20

Session Outcomes(SOs)	Laboratory Instruction (LI)	Practical Instruction(CI)	Self Learning(SL)
<b>Theory</b> <b>SO5.1:</b> Psycho pharmacological agents <b>SO5.2:</b> Drugs used in Parkinsons disease <b>SO5.3:</b> Drugs used in Alzheimer's disease. <b>SO5.4:</b> CNS stimulants and nootropics. <b>SO5.5:</b> Opioid analgesics and antagonists <b>SO5.6:</b> Drug addiction, drug abuse, tolerance and dependence. <b>Practical</b> <b>SO-P-5.1:</b> Study of stereotype and anti-catatonic activity of drugs on rats/mice. <b>SO-P-5.2:</b> Study of anxiolytic activity of drugs using rats/mice.	<b>5.1:</b> To study the Stereo type and anti-catatonic activity of drugs on rats/mice. <b>5.2:</b> To study the anxiolytic activity of drugs using rats/mice.	5.1 Psychopharmacological agents: Antipsychotics, antidepressants. 5.2 Psychopharmacological agents anti-anxiety agents, anti-manics and hallucinogens. <b>5T.1</b> Tutorial Class 5.3 Drugs used in Parkinsons disease 5.4 Drugs used in Alzheimer's disease. 5.5 CNS stimulants and nootropics. <b>5T.2</b> Tutorial Class 5.6 Opioid analgesics and antagonists 5.7 Drug addiction, drug abuse, tolerance and dependence. <b>5T.3</b> Tutorial Class	<b>5.1:</b> Drug addiction, drug abuse <b>5.2:</b> Tolerance and dependence

**Suggested Assignments:** 1. Antipsychotics, 2. Anti-manics, 3. Nootropics, 4. Drug addiction & drug abuse  
5. Tolerance and dependence.



### Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (Cl)	(LI)	Session a l Work (SW)	Self Learning (SI)	Total Hour (Cl+S W+ SI+LI)
<b>CO-BP404-1:</b> To understand the general pharmacology, Introduction to pharmacology & pharmacokinetics.	11	24	1	1	37
<b>CO-BP404-2:</b> To acquired the knowledge of pharmacodynamics, adverse drug reactions, drug interactions (pharmacokinetic and pharmacodynamics) & drug discovery and clinical evaluation of new drugs.	15	0	1	1	17
<b>CO-BP404-3:</b> To understanding the Pharmacology of drugs acting on peripheral nervous system.	13	16	1	1	31
<b>CO-BP404-4:</b> To familiarize with basic concept of Pharmacology of drugs acting on central nervous system.	11	12	1	1	25
<b>CO-BP404-5:</b> To comprehend the basic concepts of Pharmacology of drugs acting on central nervous system.	10	08	1	1	20
<b>Total Hours</b>	60	60	5	5	130



**Suggestion for End Semester Assessment**  
Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		A	C	E	
CO-1	To understand the general pharmacology, Introduction to pharmacology & pharmacokinetics.	08	06	01	15
CO-2	To acquired the knowledge of pharmacodynamics, adverse drug reactions, drug interactions (pharmacokinetic and pharmacodynamics) & drug discovery and clinical evaluation of new drugs.	08	07	01	16
CO-3	To understanding the Pharmacology of drugsacting on peripheral nervous system.	08	07	01	16
CO-4	To familiarize with basic concept of Pharmacology of drugs acting on central nervous system.	07	06	01	14
CO-5	To comprehend the basic concepts of Pharmacology of drugs acting on central nervous system.	08	07	01	16
Total		39	33	05	77

**Legend: A: Analyze, C: Create, E: Evaluate**

The end of semester assessment for Pharmacology-I will be held with written examination of 75marks

**Note.** Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks.

Teachers can also design different tasks as per requirement, for end semester assessment.

**Suggested Instructional/Implementation Strategies:**

1. Improved Lecture
2. Tutorial
3. Case Method
4. Group Discussion
5. Role Play
6. Demonstration
7. ICT Based Teaching Learning(Video Demonstration/TutorialsCBT,Blog,Facebook,Twitter,Whatsapp,Mobile,
8. online sources)
9. Brainstorming



### Suggested Learning Resources:

S. No.	Title	Author	Publisher	Edition & Year
1	Rang and Dale's Pharmacology	Rang H. P. Dale M. M., Ritter J.M., Flower R.J.	Churchil Livingstone Elsevier	10 <sup>th</sup> Edition, 2023
2	Basic and clinical pharmacology	Katzung B. G., Masters S. B., Trevor A.J.	Tata McGraw-Hill	12 <sup>th</sup> Edition, 2011
3	The Pharmacological Basis of Therapeutics	Goodman and Gilman's	Tata McGraw-Hill	14 <sup>th</sup> Edition, 2017
4	Applied Therapeutics, The Clinical use of Drugs, The Point	Marry Anne K. K., Lloyd Yee Y., Brian K. A., Robbin L.C., Joseph G.B., Wayne A.K., Bradley R.W.	Lippincott Williams & Wilkins	9 <sup>th</sup> Edition, 2008
5	Lippincott's Illustrated Reviews- Pharmacology	Mycek M.J, Gelnet S.B and Perper M.M.	Lippincott Williams & Wilkins	4 <sup>th</sup> Edition, 2009
6	Essentials of Medical Pharmacology	K.D. Tripathi	JAYPEE Brothers Medical Publishers (P) Ltd, New Delhi.	8 <sup>th</sup> Edition, 2021
7	Handbook of experimental pharmacology	Kulkarni S K	Vallabh Prakashan	3 <sup>rd</sup> Edition, 2007

### Curriculum Development Team:

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**Course Outcome, Program Specific Outcome& Program Outcome Mapping**

**Course Code: BP404T& BP408P**

**Course Name: Pharmacology-I**

Course Outcome	Program Outcome											Program Specific outcome			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
	Pharmacy knowledge	Planning Abilities	Problem analysis	Modern tool usage	Leadership skills	Professional Identity	Pharmaceutical Ethics	Communication	The pharmacist and society	Environment and sustainability	Life-long learning	Knowledge of drug discovery	Quality Analysis of API's	MOA of Drug	Biological evaluation of drug
<b>CO-1:</b> General pharmacology, introduction to pharmacology & pharmacokinetics.	3	2	3	1	3	2	1	2	3	2	3	1	3	1	2
<b>CO-2:</b> To acquire the knowledge of pharmacodynamics, adverse drug reactions, drug interactions	2	3	1	3	1	2	1	1	2	3	3	3	2	1	3
<b>CO-3:</b> To understanding the pharmacology of drugs acting on peripheral nervous system	3	2	3	2	1	1	2	1	2	2	3	3	2	1	3
<b>CO-4:</b> To familiarize with basic concept of pharmacology of drugs acting on central nervous system	2	3	2	3	1	3	2	2	3	3	3	3	2	1	3
<b>CO-5:</b> To comprehend the basic concepts of pharmacology of drugs acting on central nervous system	3	3	1	1	1	3	1	3	1	2	3	2	2	2	2

**Legend: 1- Low, 2-Medium, 3-High**



### Course Curriculum Mapping

Pos& PSOs No	Cos No	Cos Title	SOs No	Class Room Instructions	Laboratory Instructions	Self learning
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	<b>BP404-1</b>	To understand the general pharmacology, introduction to pharmacology & pharmacokinetics.	<b>SO1.1</b> <b>SO1.2</b>	1.1,1.2,1.3,1.4,1.5,1.6,1.7,1.8	LI-1.1 LI-1.2 LI-1.3 LI-1.4 LI-1.5 LI-1.6	SL-1.1 SL-1.2
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	<b>BP404-2</b>	To acquire the knowledge of pharmacodynamics, adverse drug reactions, drug interactions (pharmacokinetic and pharmacodynamics) & drug discovery and clinical evaluation of new drugs.	<b>SO2.1</b> <b>SO2.2</b> <b>SO2.3</b> <b>SO2.4</b>	2.1,2.2,2.3,2.4,2.5,2.6,2.7,2.8,2.9,2.10,2.11,2.12	-	SL-2.1 SL-2.2
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	<b>BP404-3</b>	To understanding the pharmacology of drugs acting on peripheral nervous system.	<b>SO-3.1</b> <b>SO-3.2</b> <b>SO-3.3</b> <b>SO-3.4</b> <b>SO-3.5</b> <b>SO-3.6</b>	3.1,3.2,3.3,3.4,3.5,3.6,3.7,3.8,3.9,3.10	LI-3.1 LI-3.2 LI-3.3 LI-3.4	SL-3.1 SL-3.2
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	<b>BP404-4</b>	To familiarize with basic concept of pharmacology of drugs acting on central nervous system.	<b>SO-4.1</b> <b>SO-4.2</b>	4.1,4.2,4.3,4.4,4.5,4.6,4.7,4.8.	LI-4.1 LI-4.2 LI-4.3	SL-4.1 SL-4.2
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	<b>BP404-5</b>	To comprehend the basic concepts of pharmacology of drugs acting on central nervous system.	<b>SO-5.1</b> <b>SO-5.2</b> <b>SO-5.3</b> <b>SO-5.4</b> <b>SO-5.5</b> <b>SO-5.6</b>	5.1,5.2,5.3,5.4,5.5,5.6,5.7	LI-5.1 LI-5.2	SL-5.1 SL-5.2





AKS University  
Faculty of Pharmaceutical Science & Technology  
Rajiv Gandhi Institute of Pharmacy  
Curriculum of B. Pharmacy (Pharmacognosy and Phytochemistry-I) Program  
(Revised as on 01August2023)**Semester-IV**

<b>Course Code:</b>	<b>BP405T/BP409P</b>
<b>Course Title:</b>	<b>Pharmacognosy and Phytochemistry-I</b>
<b>Pre-requisite:</b>	The subject involves the fundamentals of Pharmacognosy like scope, classification of crude drugs, their identification and evaluation, phyto chemicals present in them and their medicinal properties.
<b>Rationale/Objectives</b>	Upon completion of the course student shall be able to know the Introduction to Pharmacognosy and Quality control of crude drugs.

**Course Outcomes:**

- CO-BP405-1: To know the techniques in the cultivation and production of crude drugs.
- CO-BP405-2: To know the crude drugs, their uses and chemical nature.
- CO-BP405-3: To know the evaluation techniques for the herbal drugs.
- CO-BP405-4: To carry out the microscopic and morphological evaluation of crude drugs.
- CO-BP405-5: To modern methods of extraction, application.

**Scheme of Studies**



Course code	Title of the course	Program Name	TOTAL Number of contact hours/Week						Credit
			Classroom Instruction(A)		Practical (P)	SW	SL	Total Hours (H)	
			Lecture	Tutorial					
BP405T	Pharmacogn osy and Phyto chemistry-I (Theory)	B. Pharmacy	3	1	4	1	1	10	6

**Legend: CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others),  
**LI:** Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)

**SW:** Sessional Work (includes assignment, seminar, mini project etc.),

**SL:** Self Learning,

**C:** Credits

**Note:** SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning

### Theory Assessment

Board of Study	Course Code	Course Title	Scheme of Assessment(Marks)						
			Progressive Assessment (PRA)						
			Academic activity, Any three (Quiz/ Assignment, open book test, filed work and seminar)	Student teacher interaction	Class Attendance(AT)	Total Marks	Sessional Exam(B)		
Pharmacy	BP-405T	Pharmacognosy and Phytochemistry-I	3	3	4	10	15	75	100



## Practical Assessment

Board of Study	Course Code	Course Title	Scheme of Assessment(Marks)						
			Internal Assessment(A)			End Semester Examination(B)			Total Marks (A+B)
			Attendance	Record	Sessional Exam.	Synopsis	Experiment	Viva	
Pharmacy	BP-408P	Pharmacognosy and Phytochemistry-I	2	3	10	5	25	5	50

### Guidelines for the allotment of marks for attendance

Percentage of Attendance	Theory	Practical
95–100	4	2
90–94	3	1.5
85–89	2	1
80–84	1	0.5
Lessthan80	0	0



**Course-Curriculum Detailing:**

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

**CO-BP405-1:** To know the techniques in the cultivation and production of crude drugs.

Item	Approx Hrs
Lecture & Tutorial	10+3=13
Practical(P)	4
SW	1
SL	1
Total:	19

Session Outcomes(SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
<b>SO 1.1.</b> Introduction to pharmacognosy. <b>SO 1.2</b> Classification of drugs. <b>SO 1.3</b> Quality control of Drugs of Natural Origin <b>Practical</b> <b>SO-P-</b> Analysis of crude drugs by chemical tests: (i) Tragacanth (ii) Acacia (iii) Agar (iv) Gelatin (v) starch (vi) Honey (vii) Castor oil	1.1 Analysis of crude drugs by chemical tests: (i) Tragacanth (ii) Acacia (iii) Agar (iv) Gelatin (v) starch (vi) Honey (vii) Castor oil	1.1 Definition, history, scope and development of Pharmacognosy. 1.2 Sources of Drugs Plants, Animals, Marine & Tissue culture 1.3. Organized drugs, unorganized drugs. 1.4 Alphabetical, morphological, taxonomical Classification of drugs. 1.5 chemical, pharmacological, chemo and sero taxonomical classification of drugs 1.6 Adulteration of drugs of natural origin. 1.7 Evaluation by Organoleptic, microscopic, physical methods and properties 1.8 Evaluation by chemical and biological methods and properties. 1.9 Quantitative microscopy of crude drugs including Lycopodium spore method, leaf constants, camera Lucida 1.10 diagrams of microscopic objects to scale with camera Lucida. <b>Tutorial</b> 1.1 Organized drugs, unorganized drugs. 1.2 Adulteration of drugs of natural origin.	1.1. Sources of Drugs. 1.2. Taxonomical Classification of drugs 1.3 Quantitative microscopy of crude drugs.

**Suggested Assignments:** Quantitative microscopy of crude drugs including lycopodium spore method, leaf constants, camera lucida



**Unit- II.****CO-BP405-2:** To know the crude drugs, their uses and chemical nature.

Item	Approx Hrs
Lecture & Tutorial	10+3=13
Practical(P)	16
SW	1
SL	1
Total:	31

Session Outcomes(SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
<b>Theory</b> <b>SO2.1</b> Cultivation, Collection, Processing and storage of drugs of natural origin. <b>SO2.2</b> Study of Conservation of medicinal plants.  <b>Practical</b> <b>SO-P-2.1:</b> Exercise involving isolation & detection of active principles a. Caffeine - from tea dust. <b>SO-P-</b> Determination of a) stomatal number index b) Vein islet number, c) vein islet termination d) palisade ratio	2.1 Determination of a) stomatal number index b) Vein islet number, c) vein islet termination d) palisade ratio.	2.1 Cultivation of drugs of natural origin 2.2 Collection of drugs of natural origin  2.3 Factors influencing cultivation of medicinal plants. 2.4. Factors influencing cultivation of medicinal plants. 2.5. Plant hormones and their applications. 2.6 Plant hormones and their applications., 2.7 Polyploidy, mutation and with reference to medicinal plants. 2.8 hybridization with reference to medicinal plants. 2.9. Conservation of medicinal plants. 2.10 Conservation of medicinal plants.  <b>Tutorial</b> Plant hormones and their applications. Polyploidy, mutation and hybridization with reference to medicinal plants.	2.1 knowledge on the Factors influencing cultivation of medicinal plants. 2.2 Plant hormones and their applications.

**Suggested Assignments:** Polyploidy, mutation and hybridization with reference to medicinal plants.  
Cultivation, Collection, Processing and storage of drugs of natural origin



### Unit- III

**CO-BP405-3:** To know the evaluation techniques for the herbal drugs.

Item	Approx Hrs
Lecture & Tutorial	10+3=13
Practical(P)	8
SW	1
SL	1
Total:	23

Session Outcomes(SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Learning (SL)
<b>Theory</b> <b>SO3.1</b> Study plant tissue culture. <b>SO3.2</b> Edible vaccines <b>Practical</b> <b>SO-P- 3.1:</b> Determination of size of starch grains, calcium oxalate crystals by eye piece micrometer. Determination of Fiber length and width. Determination of number of starch grains by Lycopodium spore method.	3.1Determination of size of starch grains, calcium oxalate crystals by eye piece micrometer. 3.2Determination of Fiber length and width. 3.3Determination of number of starch grains by Lycopodium spore method.	3.1 Historical development of plant tissue culture. 3.2 types of cultures. 3.3. Nutritional requirements. 3.4growth and their maintenance 3.5 Applications of plant tissue culture in pharmacognosy. 3.6 Applications of plant tissue culture in pharmacognosy. 3.7 Edible vaccines. <b>Tutorial</b> Types of cultures, Applications of plant tissue culture in pharmacognosy	3.1To know the Historical development of plant tissue culture technique. 3.2Applications of plant tissue culture.

**Suggested Assignments:** Nutritional requirements, growth and their maintenance.



#### Unit -IV

**CO-BP405-4:** To carry out the microscopic and morphological evaluation of crude drugs.

Item	Approx Hrs
Lecture & Tutorial	10+3
Practical(P)	16
SW	1
SL	1
Total:	31

Session Outcomes(SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Learning (SL)
<b>SO4.1.</b> Pharmacognosy in various systems of medicine. <b>SO4.2.</b> Introduction to secondary metabolites. <b>Practical</b> SO-P-1. Determination of Ash value. SO-P-2. Determination of Extractive values of crude drugs.	4.1 Determination of Ash value. 4.2 Determination of Extractive values of crude drugs.	4.1 Role of Pharmacognosy in allopathy and traditional systems of medicine namely, Ayurveda, systems of medicine. 4.2 Role of Pharmacognosy in allopathy and traditional systems of medicine namely, Unani, systems of medicine. 4.3 Role of Pharmacognosy in allopathy and traditional systems of medicine namely Siddha, systems of medicine. 4.4. Role of Pharmacognosy in allopathy and traditional systems of medicine namely, Homeopathy and systems of medicine. 4.5. Role of Pharmacognosy in allopathy and traditional systems of medicine namely, Chinese systems of medicine. 4.6 Definition, classification, properties and test for identification of Alkaloids. 4.7 Definition, classification, properties and test for identification of Glycosides. 4.8 Definition, classification, properties and test for identification of Flavonoids. 4.9 Definition, classification, properties and test for identification of Tannins. 4.10 Definition, classification, properties and test for identification Volatile oil and Resins. <b>Tutorial</b> Role of pharmacognosy in allopathy and traditional systems of medicine.	4.1 Ayurveda , Unani, Siddha, Homeopathy and Chinese systems of medicine. 4.2 Definition , classification , properties and test for identification of secondary metabolites.

**Suggested Assignments:** Role of Pharmacognosy in allopathy and traditional systems of medicine namely.



**Unit-V**

**CO-BP405-5:** Study of biological source, chemical nature and uses of drugs of natural origin containing of crude drugs.

Item	Approx Hrs
Lecture & Tutorial	10+3
Practical(P)	8
SW	1
SL	1
Total:	23

Session Outcomes(SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self Learning (SL)
<b>Theory</b> <b>SO5.1</b> Plant products. <b>SO5.2</b> Primary metabolite. <b>SO5.3</b> Marine drugs. <b>Practical:</b> <b>SO-P-5.1</b> Determination of moisture content of crude drugs. <b>SO-P-5.2</b> Determination of swelling index and foaming.	5.1 Determination of moisture content of crude drugs 5.2 Determination of swelling index and foaming	<b>5.1.</b> Fibers - Cotton, Jute, Hemp. <b>5.2.</b> Hallucinogens, Teratogens, Natural allergens. <b>5.3</b> Carbohydrates: Acacia, Agar, Tragacanth, Honey <b>5.4</b> Proteins: Gelatin, casein, <b>5.5</b> Enzymes: proteolytic enzymes. <b>5.6.</b> Lipids Waxes, fats, fixed oils. <b>5.7</b> Novel medicinal agents from marine <b>5.8</b> Novel medicinal agents from marine. Tutorial Enzymes: Papain, bromelain, serratiopeptidase, urokinase, streptokinase, pepsin.	<b>5.1</b> Study of biological source, chemical nature and uses of drugs of natural origin containing Crude drugs. <b>5.2</b> Novel medicinal agents from marine.

**Suggested Assignments:** Plant Products: Fibers - Cotton, Jute, Hemp, Hallucinogens, Teratogens, Natural allergens Castor oil, Chaulmoogra oil, Wool Fat, Bees Wax.



### Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (Cl)	(LI)	Sessionl Work (SW)	Self Learning (SI)	Total Hour (Cl+SW+ SI+LI)
CO-BP405-1To know the techniques in the cultivation and production of crude drugs.	13	4	1	1	19
CO-BP405-2: To know the crude drugs, their uses and chemical nature.	13	16	1	1	31
CO-BP405-3: To . know the evaluation techniques for the herbal drugs.	13	8	1	1	23
CO-BP405-4: To carry out the microscopic and morphological evaluation of crude drugs.	13	16	1	1	31
CO-BP405-5: To modern methods of extraction, application	13	8	1	1	23
<b>Total Hours</b>	65	52	5	5	127



**Suggestion for End Semester Assessment**  
Suggested Specification Table (For ESA)

Course Outcome	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
<b>CO-BP405-1:</b>	To know the techniques in the cultivation and production of crude drugs	08	06	01	15
<b>CO-BP405-2:</b>	To know the crude drugs, their uses and chemical nature	12	07	01	20
<b>CO-BP405-3:</b>	To know the evaluation techniques for the herbal drugs	02	06	02	10
<b>CO-BP405-4:</b>	To carry out the microscopic and morphological evaluation of crude drugs.	10	02	03	15
<b>CO-BP405-5:</b>	To modern methods of extraction, application.	05	07	03	15
<b>Total</b>		<b>37</b>	<b>28</b>	<b>10</b>	<b>75</b>

**Legend: R: Remember, U: Understand, A: Apply**

The end of semester assessment for Pharmacognosy and Phyto chemistry-I Will be held with written examination of 75 marks

**Note.** Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks. Teachers can also design different tasks as per requirement, for end semester assessment.

**Suggested Instructional /Implementation Strategies:**

1. Improved Lecture
  2. Tutorial
  3. Case Method
  4. Group Discussion
  5. Role Play
  6. Demonstration
  7. ICT Based Teaching Learning (Video Demonstration /Tutorials CBT, Blog, Face book, Twitter, Whats app, Mobile, Online sources)
- Brainstorming



**Suggested Learning Resources:**

S.No.	Title	Author	Publisher	Edition & Year
1	Indian Pharmacopoeia	(IPC), Govt. of India	Govt. of India	Eighth edition, 2018
2	Pharmacognosy	W.C. Evans, Trease and Evans	W.B. Saunders & Co.,	16th edition London, 2009.
3	Pharmacognosy and Phyto chemistry	Mohammad Ali	CBS Publishers & Distribution, New Delhi.	Volume-I, 2008.
4	Text book of Pharmacognosy	C.K. Kokate, Purohit, Gokhale	Nirali Prakashan, New Delhi.	37th Edition (2007)
5	Herbal drug industry	R.D. Choudhary	Eastern Publisher, New Delhi.	I st Edn (1996),
6	Essentials of Pharmacognosy	Dr.SH.Ansari	Birla publications, New Delhi,	II nd edition (2007)
7	Textbook of Industrial Pharmacognosy	A.N. Kalia,	CBS Publishers, New Delhi	2005
8	Pharmacognosy & Pharmaceutical biotechnology.	James Bobbers, Marilyn KS, VE Tylor.	Baltimore: Williams and wilkins.	9th Edition (1988)
9	Text Book of Biotechnology	Vyas and Dixit.	CBS Publishers, New Delhi.	2009.
10	Text Book of Biotechnology	R.C. Dubey.	S. Chand Publishers.	1993.

**Curriculum Development Team:**

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**Course Outcome, Program Specific Outcome& Program Outcome Mapping**

**Course Code: BP405T/BP409P**

**Course Name: Pharmacognosy and Phytochemistry-I**

Course Outcome	Program Outcome											Program Specific outcome			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
	Pharmacy knowledge	Planning Abilities	Problem analysis	Modern tool usage	Leadership skills	Professional Identity	Pharmaceutical Ethics	Communication	The pharmacist and society	Environment and sustainability	Life-long learning	Knowledge of drug discovery	Quality Analysis of API's	MOA of Drug	Biological evaluation of drug
<b>CO-1:</b> Techniques in the cultivation and production of crude drugs.	3	2	3	1	3	2	1	2	3	2	3	1	3	1	2
<b>CO-2:</b> To know the crude drugs, their uses and chemical nature.	2	3	1	3	1	2	1	1	2	3	3	3	2	1	3
<b>CO-3:</b> To know the evaluation techniques for the herbal drugs.	3	2	3	2	1	1	2	1	2	2	3	3	2	1	3
<b>CO-4:</b> To carry out the microscopic and morphological evaluation of crude drugs.	2	3	2	3	1	3	2	2	3	3	3	3	2	1	3
<b>CO-5:</b> To modern methods of extraction, application.	3	3	1	1	1	3	1	3	1	2	3	2	2	2	2

**Legend: 1- Low, 2-Medium, 3-High**



### Course Curriculum Mapping

Pos& PSOs No	Cos No&	Title	SOs No	Class Room Instructions	Laboratory Instructions	Self learning
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	CO-BP405-1	To know the techniques in the cultivation and production of crude drugs.	SO1.1 SO1.2 SO1.3	1.1,1.2,1.3,1.4,1.5,1.6,1.7,1.8,1.9,1.10	LI-1.1	SI-1.1 SI-1.2 SI-1.3
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	CO-BP405-2	To know the crude drugs, their uses and chemical nature.	SO-2.1 SO-2.2	2.1,2.2,2.3,2.4,2.5,2.6,2.7, 2.8,2.9,2.10	LI-2.1	SI-2.1 SI-2.2
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	CO-BP405-3	To know the evaluation techniques for the herbal drugs.	SO-3.1 SO-3.2	3.1,3.2,3.3,3.4,3.5,3.6,3.7	LI-3.1 LI-3.2 LI-3.3	SI3.1 SI3.2
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	CO-BP405-4	To carry out the microscopic and morphological evaluation of crude drugs.	SO-4.1 SO-4.2	4.1,4.2,4.3,4.4,4.5,4.6,4.7, 4.8. 4.9. 4.10.	LI-4.1 LI-4.2	SI-4.1 SI-4.2
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	CO-BP405-5	To modern methods of extraction, application.	SO-5.1 SO-5.2 SO-5.3	5.1,5.2,5.3,5.4,5.5,5.6,5.7, 5.8	LI-5.1 LI-5.2	SI-5.1 SI-5.2





AKS University  
Faculty of Pharmaceutical Science & Technology  
Rajiv Gandhi Institute of Pharmacy  
Curriculum of B. Pharmacy (**Medicinal Chemistry – II**) Program  
(Revised as on 01August2023)  
Semester-V

**Course Code: BP501T**

**Course Title: MEDICINAL CHEMISTRY – II**

**Pre-requisite:** Students should have a basic knowledge of organic chemistry and pharmaceutical or biological sciences and physical chemistry with Chemical compounds.

**Rationale/Objectives:** Upon completion of the course the student shall be able to

1. Understand the chemistry of drugs with respect to their pharmacological activity
2. Understand the drug metabolic pathways, adverse effect and therapeutic value of drugs.
3. Know the Structural Activity Relationship of different class of drugs
4. Study the chemical synthesis of selected drugs

**Course Out comes:**

**CO-BP501-1:** To understand the structure, mechanism of action, Structure activity relationship, synthesis and uses of antihistaminic agent and anti-neoplastic agents.

**CO-BP501-2:** To understand the structure, mechanism of action, Structure activity relationship, synthesis and uses of Anti-anginal agents and Anti-hypertensive agents.

**CO-BP501-3:** To understand the structure, mechanism of action, Structure activity relationship, synthesis and uses of Anti-arrhythmic agents, Anti-hyperlipidemic agents, Coagulant & Anticoagulants, and Drugs used in Congestive Heart Failure agents.

**CO-BP501-4:** To understand the Drugs acting on Endocrine system and structure, mechanism of action, synthesis and uses of Sex hormones, Drugs for erectile dysfunction, Oral contraceptives, Corticosteroids and Thyroid and antithyroid drugs.

**CO-BP501-5:** To understand the structure, mechanism of action, Structure activity relationship, synthesis of Antidiabetic agents and Local Anesthetics with SAR of Local Anesthetics



## Curriculum of B. Pharmacy (Medicinal Chemistry-II (Theory))

### Scheme of Studies

Scheme of Studies									
Course code	Title of the course	Program Name	TOTAL Number of contact hours/Week						Credit
			Classroom Instruction (A)		Practical(P)	SW	SL	Total Hours (H)	
			Lecture	Tutorial					
BP501 T	Medicinal Chemistry- II (Theory)	B. Pharmacy	3	1	0	1	1	10	6

**Legend: CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and other,

**LI:** Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)

**SW:** Sessional Work (includes assignment, seminar, mini project etc.),

**SL:** Self Learning, Credits.

**Note:** SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning

### Theory Assessment

Board of Study	Course Code	Course Title	Scheme of Assessment ( Marks )						
			Progressive Assessment ( PRA)						
			Academic activity, Any three (Quiz/ Assignment, open book test, filed work and seminar)	Student teacher interaction	Class Attendance(AT)	Total Marks	(A) Exam (B) Sessional	EndSemester Assessment(C)	Total Marks(A+B+C)
Pharmacy	BP-501T	Medicinal Chemistry-II (Theory )	3	3	4	10	15	75	100

### Guidelines for the allotment of marks for attendance Percentage Attendance Theory/ Practical

Percentage of Attendance	Theory	Practical
95 – 100	4	2
90 – 94	3	1.5
85 – 89	2	1
80 – 84	1	0.5
Less than 80	0	0



**Course-Curriculum Detailing:**

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

**CO-BP501-1: To understand the structure, mechanism of action, Structure activity relationship, synthesis and uses of antihistaminic agents and Anti-neoplastic agents.**

Item	Approx Hrs
Lecture & Tutorial	10+3=13
Practical(P)	0
SW	1
SL	1
Total:	15

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
Theory <b>SO1.1:</b> Antihistaminic agents <b>SO1.2:</b> H <sub>1</sub> -antagonists <b>SO1.3:</b> H <sub>2</sub> -antagonists <b>SO1.4:</b> Gastric Proton pump inhibitors. <b>SO1.5:</b> Anti-neoplastic agents of all Plant products drugs. <b>SO1.6:</b> Alkylating agents. antagonists drugs. <b>SO1.7:</b> Antimetabolites. <b>SO1.8:</b> Antibiotics. <b>SO1.9:</b> Plant products. <b>SO1.10:</b> Miscellaneous.		<b>1.1</b> Detailed about Histamine, receptors and their distribution in the human body. <b>1.2</b> Synthesis, MOA & uses of all H <sub>1</sub> - antagonists drugs. <b>1.3</b> Synthesis, MOA & uses of all H <sub>2</sub> - Study of the Antihistaminic agents and Anti-neoplastic agents. <b>1T.1: Tutorial class</b> <b>1.4</b> Synthesis, MOA & uses of all Gastric Proton pump inhibitors drugs. <b>1.5</b> introduction, classification of Anti-neoplastic agents. <b>1.6</b> Synthesis, MOA & uses of all Alkylating agents drugs. <b>1.7</b> Synthesis, MOA & uses of all Antimetabolites drugs. <b>1T.2: Tutorial class</b> <b>1.8</b> Synthesis, MOA & uses of all Antibiotics drugs. <b>1.9</b> Synthesis, MOA & uses. <b>1.10</b> Synthesis, MOA & uses of all Miscellaneous drugs. <b>1T.3: Tutorial class</b>	1. Study of the Antihistaminic agents and Anti-neoplastic agents.

**Suggested Assignments:**

Synthesis of Di-phenhydramine hydrochloride, Cimetidine, Meclizine, Meclizine, Mercaptopurine, Methotrexate

Write the all structure, MOA and uses of GPPI (Gastric Proton pump inhibitors) drugs.

Write the all structure, MOA and uses of H<sub>1</sub>-antagonists.

Explain Anti-neoplastic agents with classification.



## Unit II

**CO-BP502-2:** To understand the structure, mechanism of action, Structure activity relationship, synthesis and uses of Anti-anginal agents and Anti-hypertensive agents.

Item	Approx Hrs
Lecture & Tutorial	10+3=13
Practical(P)	0
SW	2
SL	1
Total:	16

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
<b>SO2.1</b> Classification uses of Diuretics drugs. <b>SO2.2.</b> To understand brief introduction, structure, synthesis, mechanism of action, and uses of Anti-hypertensive Agents.		2.1 Structure, Synthesis, SAR, MOA & uses of Chlorthiazide, Hydrochlorothiazide, Hydroflumethiazide, Cyclothiazide, <b>2T.1: Tutorial class</b> <b>2.2 Loop diuretics:</b> Furosemide, Bumetanide, Ethacrynic acid. <b>2.3 Potassium sparing Diuretics:</b> Spironolactone, Triamterene, Amiloride. <b>2.4 Osmotic Diuretics:</b> Mannitol. Structure, Synthesis, SAR, MOA & uses of Timolol, Captopril, <b>2T.2: Tutorial class</b> Structure, Synthesis, SAR, MOA & uses of Lisinopril, Enalapril, Benazepril hydrochloride, Quinapril hydrochloride. 2.5 Structure, Synthesis, SAR, MOA & uses of Methyldopate hydrochloride, Clonidine hydrochloride, Guanethidine monosulphate, Structure, Synthesis, SAR, MOA & uses of Guanabenz acetate, Sodium nitroprusside, Diazoxide, Minoxidil, Reserpine, Hydralazine hydrochloride <b>2T.3: Tutorial class</b>	2.1: Various analytical procedures for drug analysis.

### Suggested Assignments:

Synthesis of Acetazolamide, Methyldopate hydrochloride, Furosemide, Nitroglycerin Explain Diuretics agents with structure, MOA, SAR and Uses.

Explain Anti-hypertensive Agents with structure, MOA, SAR and Uses



### Unit III

**CO-BP501-3:** To understand the structure, mechanism of action, Structure activity relationship, synthesis and uses of Anti-arrhythmic agents, Anti-hyperlipidemic agents, Coagulant & Anticoagulants, and Drugs used in Congestive Heart Failure agents.

Item	Approx Hrs
Lecture & Tutorial	10+3=13
Practical(P)	0
SW	1
SL	1
Total:	15

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
<p><b>SO3.1</b> To understand the structure, synthesis, mechanism of action, and uses of Anti- arrhythmic Drugs.</p> <p><b>SO3.2.</b> To understand the structure, synthesis, mechanism of action, and uses of Anti- hyperlipidemic agents.</p> <p><b>SO3.3</b> To understand the structure, synthesis, mechanism of action, SAR and uses of Coagulant &amp; Anticoagulants.</p> <p><b>SO3.4</b> To understand the structure, mechanism of action and uses Drugs used in Congestive Heart Failure.</p>		<p>3.1 Brief introduction of arrhythmia and</p> <p>3.2 Anti- arrhythmic Drugs with classification. Structure, Synthesis, SAR, MOA &amp; uses of Quinidine sulphate, Procainamide hydrochloride,</p> <p>3.2 Structure, Synthesis, SAR, MOA &amp; uses of Disopyramide phosphate,</p> <p>3.4 Phenytoin sodium, Lidocaine hydrochloride Structure, MOA &amp; uses of Tocainide hydrochloride</p> <p><b>3T.1: Tutorial class</b></p> <p>3.5: Mexiletine hydrochloride, Lorcanide hydrochloride, Amiodarone,</p> <p>3.6: Structure, SAR, MOA &amp; uses of Clofibrate, Lovastatin, Cholesteramine and Cholestipol.</p> <p>3.7: Brief introduction of Coagulant &amp; anticoagulants</p> <p>3.8: Introduction, Synthesis, SAR, MOA &amp; uses of Menadione</p> <p>3.9: Acetomenadione, Warfarin,</p> <p>3.10 Anisindione, clopidogrel.</p> <p><b>3T.2: Tutorial class</b></p> <p>3.11 Study of the Anti- arrhythmic Drugs, Anti-hyperlipidemic agents,</p> <p><b>3T.3: Tutorial class</b></p>	<p>3.1 Coagulant &amp; anticoagulants and drugs used in Congestive Heart Failure. Synthesis, SAR, MOA &amp; uses of Congestive Heart Failure drugs.</p> <p>Structure, MOA &amp; uses of Digoxin, Digitoxin,</p> <p>Structure, MOA uses of Nesiritide, Bosentan, Tezosentan.</p>

#### Suggested Assignments:

Synthesis, MOA and uses of disopyramide phosphate.

Explain Anti-hyperlipidemic agents with structure, MOA, SAR and Uses.

Explain congestive heart failure drugs with structure, MOA and uses.

Explain all coagulant & anticoagulant agents with structure, MOA, synthesis and uses.



**Unit IV:**

**CO-501.4: To understand the Drugs acting on Endocrine system and structure, mechanism of action, synthesis and uses of Sex hormones, Drugs for erectile dysfunction, Oral contraceptives, Corticosteroids and Thyroid and antithyroid drugs.**

Item	Approx Hrs
Lecture & Tutorial	8+3=11
Practical(P)	0
SW	1
SL	1
Total:	13

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
<b>SO4.1</b> To understand the Drugs acting on Endocrine system. <b>SO4.2.</b> To understand the Drugs of Sex hormones. <b>SO4.3</b> To understand the Drugs for erectile dysfunction. <b>SO4.4</b> To understand the Drugs of Oral contraceptives. <b>SO4.5</b> To understand the Drugs Thyroid and antithyroid drugs		<b>4.1</b> Brief introduction of Endocrine system with Nomenclature, Stereochemistry and metabolism of steroids <b>4.2</b> Structure, SAR, MOA & uses of Testosterone, Nandrolone, <b>4.3</b> Structure, SAR, MOA & uses of Progestrones, Oestrinol, Oestradiol, Oestrione, Diethyl stilbestrol. <b>4T.1: Tutorial class</b> <b>4.4</b> Structure, SAR, MOA & uses of Sildenafil, Tadalafil. <b>4.5</b> Structure, SAR, MOA & uses of Mifepristone, Norgestril, Levonorgestrol. <b>4T.2: Tutorial class</b> Structure, SAR, MOA & uses of Cortisone, Hydrocortisone, Prednisolone, Structure, SAR, MOA & uses Betamethasone, Dexamethasone. Structure, SAR, MOA & uses of L-Thyroxine, L- Thyronine, Propylthiouracil, Methimazole. <b>4T.3: Tutorial class</b>	Study of the Drugs acting on Endocrine system and Thyroid and antithyroid drugs.

**Suggested Assignments:**

- Write the detail about the Endocrine system with Nomenclature, Stereochemistry and metabolism of steroids.
- Explain the structure, SAR, MOA and uses of Sex hormones drugs.
- Explain all drugs of Corticosteroids with structure, SAR, MOA and uses.
- Write the Thyroid and anti-thyroid drugs with structure, Uses and MOA.



## Unit V

**CO-BP501-5:** To understand the structure, mechanism of action, Structure activity relationship, synthesis of Anti-diabetic agents and Local Anesthetics with SAR of local anesthetics.

Item	Approx Hrs
Lecture & Tutorial	7+3=10
Practical(P)	0
SW	1
SL	2
Total:	13

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
<b>SO5.1</b> To understand the Antidiabetic agents. <b>SO5.2.</b> To understand the SAR of Local anesthetics. <b>SO5.3</b> To understand the Benzoic Acid derivatives. <b>SO5.4</b> To understand the Benzoic Acid derivatives. <b>SO5.5</b> To understand the Lidocaine/Anilide derivatives. <b>SO5.6</b> To understand the Miscellaneous.		5.1 Brief introduction of Ant diabetic agent with Insulin and its preparations. 5.2 Structure, synthesis, SAR, MOA & uses of Sulfonyl urea agents. 5.3 Structure, SAR, MOA & uses of biguanides drugs. 5.4 Structure, SAR, MOA & uses of thiazolidinediones drugs. <b>5T.1 Tutorial Class</b> <b>5.5</b> Structure, SAR, MOA & uses of 5.6 Meglitinides. Structure, SAR, MOA & uses of Glucosidase inhibitors. 5.7 SAR of local anesthetics. Structure, SAR, MOA & uses of Benzoic Acid derivatives. <b>5T.2 Tutorial Class</b> <b>5.8</b> Structure, synthesis, SAR, MOA & uses of Amino Benzoic acid derivatives. <b>5.9</b> Structure, synthesis, SAR, MOA & uses of Lidocaine/Anilide derivatives. <b>5.10</b> Structure, synthesis, SAR, MOA & uses of Phenacaine, Dipiperodon, Dibucaine <b>5T.3 Tutorial Class</b>	5.1 Study of the antidiabetic agents and Local anesthetics agents.

### Suggested Sessional work Assignments:

1. Explain the structure, synthesis, SAR, MOA and uses of Anti-diabetic agent.
2. Short note about SAR of Local anesthetics.
3. Write the Benzoic Acid derivatives drugs with structure, Uses and MOA.



Brief of Hours suggested for the Course Outcome

<b>Course Out comes</b>	<b>Class Lecture (CI)</b>	<b>(LI)</b>	<b>Sessional Work (SW)</b>	<b>Self Learning (SI)</b>	<b>Total Hour (CI+SW+ SI+LI)</b>
<b>CO-BP501-1:</b> To understand the structure, mechanism of action, Structure activity relationship, synthesis and uses of Antihistaminic agents and Anti-neoplastic agents.	10	0	1	1	15
<b>CO-BP501-2:</b> To understand the structure, mechanism of action, Structure activity relationship, synthesis and uses of Anti-anginal agents and Anti-hypertensive agents.	10	0	2	1	16
<b>CO-BP501-3:</b> To understand the structure, mechanism of action, Structure activity relationship, synthesis and uses of Anti- arrhythmic agents, Anti-hyperlipidemic agents, Coagulant & Anticoagulants, and Drugs used in Congestive Heart Failure agents.	10	0	1	1	15
<b>CO-BP501-4:</b> To understand the Drugs acting on Endocrine system and structure, mechanism of action, synthesis and uses of Sex hormones, Drugs for erectile dysfunction, Oral contraceptives, Corticosteroids and Thyroid and antithyroid drugs.	08	0	1	1	13
<b>CO-BP501-5:</b> To understand the structure, mechanism of action, Structure activity relationship, synthesis of Antidiabetic agents and Local Anesthetics with SAR of Local Anesthetics.	07	0	1	2	13
<b>Total Hours</b>	45	0	6	5	56



**Suggestion for End Semester Assessment**  
Suggested Specification Table (For ESA)

Course Outcome	Unit Titles	Marks Distribution			Total Mark S
		R	U	A	
<b>CO-BP501-1:</b>	To understand the structure, mechanism of action, Structure activity relationship, synthesis and uses of Antihistaminic agents and Anti-neoplastic agents.	08	06	01	15
<b>CO-BP501-2:</b>	To understand the structure, mechanism of action, Structure activity relationship, synthesis and uses of Anti-anginal agents and Anti-hypertensive agents.	10	07	01	18
<b>CO-BP501-3:</b>	To understand the structure, mechanism of action, Structure activity relationship, synthesis and uses of Anti-anginal agents and Anti-hypertensive agents.	02	06	02	10
<b>CO-BP501-4:</b>	To understand the Drugs acting on Endocrine system and structure, mechanism of action, synthesis and uses of Sex hormones, Drugs for erectile dysfunction, Oral contraceptives, Corticosteroids and Thyroid and antithyroid drugs.	10	03	02	15
<b>CO-BP501-5:</b>	To understand the structure, mechanism of action, Structure activity relationship, synthesis of Antidiabetic agents and local Anesthetics with SAR of Local Anesthetics.	05	07	03	15
<b>Total</b>		<b>35</b>	<b>29</b>	<b>9</b>	<b>73</b>

Legend: R: Remember, U: Understand, A: Apply

The end of semester assessment for Medicinal Chemistry – II will be held with written examination of 75 marks

**Note.** Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks.

Teachers can also design different tasks as per requirement, for end semester assessment.

**Suggested Instructional/Implementation Strategies:**

Improved Lecture

Tutorial

Case Method

Group Discussion

Role Play

Demonstration

ICT Based Teaching Learning (Video Demonstration/Tutorials CBT, Blog, Face book, Twitter, Whatsapp,



## Suggested Learning Resources

S. No.	Title	Author	Publisher	Edition & Year
1	Organic medicinal and Pharmaceutical Chemistry	Wilson and Giswold's	Wolters Kluwer India Pvt.Ltd.	12 <sup>th</sup> edition 1 January 2010
2	Principles of Medicinal Chemistry	Foye's	Lippincott Williams & Wilkins	7 <sup>th</sup> edition 2012
3	Medicinal Chemistry	Burger's	Wiley_	8 <sup>th</sup> edition 22 April 2021
4	Introduction to principles of drugdesign	Smith and Williams	Taylor & Francis Ltd	4 <sup>th</sup> edition 2022
5	Pharmaceutical Sciences	Remington's	Elsevier excusive	23 <sup>rd</sup> edition 2021
6	extra pharmacopoeia	Martindale's	Pharmaceutical press	40 <sup>th</sup> edition May 2020
7	Organic Chemistry	I.L. Finar	Pearson Education India	6 <sup>th</sup> edition 2002
8	The Organic Chemistry of DrugSynthesis.	Lednicer	Wiley	4th editions 2007
9	Indian Pharmacopoeia.	-	-	9 <sup>th</sup> edition 2022
10	Text book of practical organic chemistry	A.I. Vogel	Pearson India	5 <sup>th</sup> edition 2003

### Curriculum Development Team:

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**Course Outcome, Program Specific Outcome& Program Outcome Mapping**

**Course Code: BP501T**

**Course Name: Medicinal chemistry-II**

Course Outcome	Program Outcome											Program Specific outcome			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
	Pharmacy knowledge	Planning Abilities	Problem analysis	Modern tool usage	Leadership skills	Professional Identity	Pharmaceutical Ethics	Communication	The pharmacist and society	Environment and sustainability	Life-long learning	Knowledge of drug discovery	Quality Analysis of API's	MOA of Drug	Biological evaluation of drug
<b>CO-1:</b> Antihistaminic agents and Anti-neoplastic agents.	3	2	3	1	3	2	1	2	3	2	3	1	3	1	2
<b>CO-2:</b> To understand the structure, mechanism of action uses of Anti-anginal agents and Anti-hypertensive agents.	2	3	1	3	1	2	2	1	2	3	3	3	2	1	3
<b>CO-3:</b> Anti-hyperlipidemic agents, Coagulant & Anticoagulants, and Drugs used in Congestive Heart Failure agents.	3	2	3	2	1	1	2	1	2	2	3	3	2	1	3
<b>CO-4:</b> Sex hormones, Drugs for erectile dysfunction, Oral contraceptives, Corticosteroids and Thyroid and antithyroid drugs	2	3	2	3	1	3	2	2	3	3	3	3	2	1	3
<b>CO-5:</b> Antidiabetic agents and Local Anesthetics with SAR of Local Anesthetics	3	3	1	1	1	3	0	3	1	2	3	2	2	2	2

**Legend: 1- Low, 2-Medium, 3-High**



## Course Curriculum Mapping

Pos& PSOs No	Cos No&	Title	SOs No	Class Room Instructions	Laboratory Instructions	Self learning
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	<b>CO-BP501T-1</b>	To understand the structure, mechanism of action, Structure activity relationship, synthesis and uses of Antihistaminic agents and Anti-neoplastic agents.	SO1.1 SO1.2 SO1.3 SO1.4 SO1.5 SO1.6 SO1.7 SO1.8 SO1.9 SO1.10	1.1,1.2,1.3,1.4,1.5,1.6,1.7,1.8,1.9,1.10	LI----	SI-1.1
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	<b>CO-BP501T-2</b>	To understand the structure, mechanism of action, Structure activity relationship, synthesis and uses of Anti-anginal agents and Anti-hypertensive agents.	SO-2.1 SO-2.2 SO-2.3 SO-2.4 SO-2.5	2.1,2.2,2.3,2.4,2.5,2.6,2.7,2.8,2.9,2.10	LI---	SI-2.1
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	<b>CO-BP501T-3</b>	To understand the structure, mechanism of action, Structure activity relationship, synthesis and uses of Anti-arrhythmic agents, Anti-hyperlipidemic agents, Coagulant & Anticoagulants, and Drugs used in Congestive Heart Failure agents.	SO-3.1 SO-3.2 SO-3.3 SO-3.4	3.1,3.2,3.3,3.4,3.5,3.6,3.7,3.8,3.9,3.10	LI----	SI-3.1
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	<b>CO-BP501T-4</b>	To understand the Drugs acting on Endocrine system and structure, mechanism of action, synthesis and uses of Sex hormones, Drugs for erectile dysfunction, Oral contraceptives, Corticosteroids and Thyroid and antithyroid drugs.	SO-4.1 SO-4.2 SO-4.3 SO-4.4 SO-4.5	4.1,4.2,4.3,4.4,4.5,4.6,4.7,4.8.	LI----	SI-4.1
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	<b>CO-BP501T-5</b>	To understand the structure, mechanism of action, Structure activity relationship, synthesis of Antidiabetic agents and Local Anesthetics with SAR of Local Anesthetics.	SO-5.1 SO-5.2 SO-5.3 SO-5.4 SO-5.5 SO-5.6	5.1,5.2,5.3,5.4,5.5,5.6,5.7,5.8,5.9,5.10,5.11.	LI---	SI-5.1





AKS University  
Faculty of Pharmaceutical Science & Technology  
Rajiv Gandhi Institute of Pharmacy  
Curriculum of B. Pharmacy (Industrial pharmacy-I) Program  
(Revised as on 01 August 2023)  
**Semester-V**

**Course Code:** BP502T/BP506P

**Course Title:** Industrial pharmacy-I

**Pre-requisite:** The Student should have basic knowledge of industrial pharmacy includes the research, production, packaging, quality control, marketing and sales of pharmaceutical goods.

**Rationale/Objective s:** Upon completion of the course the student shall be able to

1. Know the various pharmaceutical dosage forms and their Manufacturing techniques.
2. Know various considerations in development of pharmaceutical dosages forms.
3. Formulate solid, liquid and semisolid dosage forms and evaluate them for their quality.

**Course Out comes:**

**CO-BP502-1:** To understand the various pharmaceutical dosage forms and their manufacturing techniques

**CO-BP502-2:** To understand about various considerations in development of pharmaceutical dosage forms

**CO-BP502-3** To Formulate solid, liquid and semisolid dosage forms and evaluates them for their quality

**CO-BP502-4:** To prepare and evaluate the sterile product and perform some Quality control tests (Parenteral Products Ophthalmic Preparations).

**CO-BP502-5:** Formulation and evaluation of the cosmetic product and Pharmaceutical Aerosols and packaging of pharmaceutical products.



## Scheme of Studies

Course code	Title of the course	ProgramName	TOTAL Number of contact hours/Week						Credit
			Classroom Instruction (A)		Practical (P)	SW	SL	Total Hours(H)	
			Lecture	Tutorial					
BP502T	Industrial Pharmacy-I (Theory)	B. Pharmacy	3	1	4	1	1	10	6

**Legend: CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and other,

**LI: Laboratory Instruction** (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)

**SW: Sessional Work** (includes assignment, seminar, mini project etc.),

**SL:** Self Learning, Credits.

**Note:** SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

## Theory Assessment

Boardof Study	Course Code	CourseTitle	Scheme of Assessment ( Marks )						
			Progressive Assessment ( PRA)						
			Academic activity,Any three (Quiz/ Assignment, open book test, filed work and seminar)	Student teacher interaction	Class Attendant (AT)	(A)  Total Marks	SessionalExam (B)	End Semester Assessment(C)	Total Marks(A+B+C )
Pharmacy	BP- 502T	Industrial pharmacy cy-I	3	3	4	10	15	75	100



## Practical Assessment

Board of Study	Course Code	Course Title	Scheme of Assessment ( Marks )						
			Internal Assessment (A)			End Semester Examination(B)			Total Marks (A+B)
			Attendance	Record	Sessional Exam.	Synopsiss	Experimentt	Viva	
Pharmac y	BP-502 P	Industrial pharmacy-I	2	3	10	5	25	5	50

## Guidelines for the allotment of marks for attendance

Percentage of Attendance	Theory	Practical
95 – 100	4	2
90 – 94	3	1.5
85 – 89	2	1
80 – 84	1	0.5
Less than 80	0	0



**Course-Curriculum Detailing:**

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

**CO-BP502-1:** To understand the various pharmaceutical dosage forms and their manufacturing techniques.

Item	Approx Hrs
Lecture & Tutorial	10+3=13
Practical(P)	4
SW	1
SL	1
Total:	19

Session Outcomes(SOs)	Laboratory Instruction (LI)	Class room Instruction(CI)	Self Learning(SL)
<b>Theory</b> <b>SO1.1:</b> Introduction, goals and objectives, of Preformulation. <b>SO1.2:</b> To study the Physical properties of preformulation <b>SO1.3:</b> To study the chemical properties of preformulation <b>SO1.4:</b> BCS classification of drugs & its significant Application of preformulation with solid, liquid oral and Parenteral dosage forms and its impact on stability of dosage forms <b>Practical</b> <b>SO-P- 1.1</b> The preformulation parameter of the prepared granules were found to be done.	To preformulation studies on paracetamol/ aspirin/ or any other drugs.	1.1 Introduction and goal of preformulation studies 1.2 Objective of preformulation studies 1.3 Development of solid, liquid oral and Parenteral dosage forms <b>1T.1:</b> Tutorial 1.4 Physical properties of preformulation Chemical properties of Preformulation 1.6 BCS classification of drugs. <b>1T.2:</b> Tutorial 1.7 Impact on stability of solid dosage forms 1.8 Impact on stability of liquid oral dosage forms 1.9 Impact on stability of parenteral dosage forms 1.10 Application of preformulation study <b>1T.3:</b> Tutorial	<b>1.1</b> Study of Aim, Objective and importance of preformulation study in various dosage forms.

**Suggested Assignments:**

1. BCS classification of drugs & its significant.
2. Application of preformulation considerations in the development of dosage form.

**Mini Projects:**

- Projects report on solid dosage form such as Tablets.



## Unit II

**CO-BP502-2:** To understand about various considerations in development of pharmaceutical dosage forms.

Item	Approx Hrs
Lecture & Tutorial	10+3=13
Practical(P)	16
SW	1
SL	1
Total:	31

Session Outcomes(SOs)	Laboratory Instruction(LI)	Class room Instruction(CI)	Self Learning(SL)
<p><b>Theory</b></p> <p><b>SO2.1:</b> Tablets-Introduction, ideal characteristics and classification of tablets and Excipients, Formulation of tablets granulation methods, compression and processing problems. Equipments and tablet tooling.</p> <p><b>SO2.2:</b> Tablet coating: Types of coating, coating materials, formulation of coating Composition, methods of coating, equipment employed and defects in coating</p> <p><b>SO2.3:</b> Quality control tests: In process and finished product tests</p> <p><b>SO2.4:</b> Formulation and manufacturing of syrups, elixirs, suspensions and emulsions</p> <p><b>SO2.5:</b> Filling and packaging; evaluation of liquid orals official in pharmacopoeia</p> <p><b>Practical</b></p> <p><b>SO-P-2.1:</b> paracetamol tablets were prepared by wet granulation method and submitted.</p> <p><b>SO-P- 2.2:</b> Aspirin tablets were prepared by wet granulation method and submitted.</p> <p><b>SO-P-2.3</b> 10 tablets of paracetamol film coated tablets are prepared and submitted.</p> <p><b>SO-P-2.4</b> Quality control test of marketed tablets has been done</p>	<p>2.1 Preparation and Evaluation of paracetamol tablets.</p> <p>2.2 preparation and evaluation of aspirin tablets.</p> <p>2.3 prepare and submit of coating tablets.</p> <p>2.4 Quality control test of marketed tablets</p>	<p>2.1 to brief tablets and liquid orals</p> <p>2.2 Introduction and ideal characteristics of tablets</p> <p>2.3 Classification of tablets and Excipients</p> <p>2.4 Formulation of tablets and granulation methods</p> <p><b>2T.1:</b> Tutorial</p> <p>2.5 Tablets compression and its processing problems.</p> <p>2.6 Equipments and tablet tooling</p> <p>2.7 Types of coating materials and formulation of coating composition</p> <p>2.8 methods of coating equipment and defects in coating process</p> <p><b>2T.2:</b> Tutorial</p> <p>2.9 Quality control tests: In process And finished product tests</p> <p>2.10 Formulation and manufacturing consideration of syrups, elixirs, emulsion and suspension</p> <p>2.11 Filling, packaging and evaluation of liquid oral official in pharmacopoeia</p> <p><b>2T.3:</b> Tutorial</p>	<p>2.1: Study of solid and liquid dosage form such as formulation of tablets and liquid oral preparation</p>

### Suggested Assignments:

1. Formulation of tablets granulation methods and tablet coating processes.
2. Formulation and manufacturing consideration of syrups and elixirs.



## Unit II

**CO-BP502-3:** To Formulate solid, liquid and semisolid dosage forms and evaluates them for their quality

Item	Approx Hrs
Lecture & Tutorial	10+3=13
Practical(P)	8
SW	1
SL	2
Total:	24

Session Out comes(SOs)	Laboratory Instruction(LI)	Class room Instructions	Self Learning (SL)
<p>Theory</p> <p>SO3.1 Capsules- Hard gelatin capsules: Introduction, Production of hard gelatin capsule shells.</p> <p>SO3.2 Soft gelatin capsules: Nature of shell and capsule content, size of capsules,</p> <p>SO3.3 Pellets: Introduction, formulation requirements and pelletization process, equipments for manufacture of pellets</p> <p>Practical</p> <p>SO-P- 3.1: tetracycline hydrochloride hard gelatin capsule were prepared and evaluated.</p> <p>SO-P-3.2 Quality control test of marketed capsules has been done.</p>	<p>3.1 To preparation and evaluation of tetracycline capsule.</p> <p>3.2 Quality control test of marketed capsules.</p>	<p>1.1 To brief capsule and pellets</p> <p>1.2 Introduction of Hard gelatin capsules and soft gelatin capsule</p> <p>1.3 Production of hard gelatin capsule shell and size</p> <p>1.4 Filling, finishing and special techniques of hard gelatin Capsules. its manufacturing defects</p> <p><b>3T.1:</b> Tutorial Class</p> <p>1.5 In process and final product quality control tests for hard gelatin capsules</p> <p>1.6 Nature of shell and content of soft gelatin capsule</p> <p>1.7 Fillings and size of capsules</p> <p><b>3T.2:</b> Tutorial class</p> <p>1.8 In Process and final product quality control tests of soft gelatin capsule</p> <p>1.9 Packing, storage and stability testing of soft gelatin capsules and their applications</p> <p>1.10 Pellets: Introduction, formulation requirements, pelletization process, equipments for manufacture of pellets.</p> <p><b>3T3:</b> Tutorial class</p>	<p>3.1 Comparative study of capsule and pellets. production of hard gelatin capsule and soft gelatin capsule</p>

### Suggested Assignments:

Production of hard gelatin capsule and capsule shell their size.

**Mini Projects:** Projects report on filling of capsule shell.



#### Unit IV:

**CO-BP502-4:** To prepare and evaluate the sterile product and perform some Quality control tests (Parenteral Products Ophthalmic Preparations).

Item	Approx Hrs
Lecture & Tutorial	10+3=13
Practical(P)	16
SW	1
SL	2
Total:	32

Session Outcomes(SOs)	Laboratory Instruction (LI)	Class room Instruction(CI)	Self Learning (SL)
<p><b>Theory</b></p> <p><b>SO4.1: Parenteral Products:</b> Definition, types, advantages and limitations. Preformulation factors and essential requirements, vehicles, additives, importance of isotonicity</p> <p><b>SO4.2:</b> Production procedure, production facilities and controls, aseptic processing, Formulation of injections, sterile powders, large volume parenteral and lyophilized products</p> <p><b>SO4.3:</b> Containers and closures selection, filling and sealing of ampoules, vials and infusion</p> <p>Fluids</p> <p><b>SO4.4:</b> Ophthalmic Preparations: Introduction, formulation considerations; formulation of eye drops, eye ointments and eye lotions; methods of preparation; labeling, containers</p> <p><b>SO.5:</b> Quality control tests of parenteral products and ophthalmic preparations</p> <p><b>Practical</b></p> <p><b>SO-P- 4.1:</b> To preparation of calcium gluconate injection has been done.</p> <p><b>SO-P- 4.2:</b> To prepare of ascorbic acid injection has been done.</p> <p><b>SO-P-4.3:</b> To prepare of eye drop has been done.</p> <p><b>SO-P-4.4</b> To prepare of eye ointment injection has been done.</p>	<p>4.1 preparation of calcium gluconate injection</p> <p>4.2 preparation of ascorbic acid injection</p> <p>4.3 preparation of eyedrop</p> <p>preparation of eye ointments</p>	<p>4.1 To brief the Parenteral Products and Ophthalmic Preparations.</p> <p>4.2 Definition, types, advantages and limitations of parenteral product.</p> <p>4.3 Pre-formulation factors and essential requirements such as vehicles, additives and importance of isotonicity</p> <p><b>4T.1 Tutorial class</b></p> <p>4.4 Production procedure and facilities of aseptic processing</p> <p>4.5 Formulation of injections, sterile powders, large volume parenteral and lyophilized</p> <p>4.6 products Selection of Containers and closures, Filling and sealing of ampoules, vials and infusion Fluids.</p> <p><b>4T.2 Tutorial class</b></p> <p>4.7 Ophthalmic</p> <p>4.8: Preparations:- Introduction and formulation considerations formulation of eyedrops, eye ointments and eye lotions</p> <p>4.8 Methods of preparation labeling of containers</p> <p>4.9 Quality control tests of parenteral products and ophthalmic preparations</p> <p><b>4T.3:</b> Tutorial class</p>	<p><b>4.1</b> Comparative study of parenteral product and ophthalmic preparation</p> <p><b>4.2</b> Analyse formulation of parenteral product and ophthalmic product</p>

#### Suggested Assignments:

1. Definition and types of parenteral product.
2. Write Pre-formulation factors and essential requirements (vehicles, additive).

**Mini Projects:** To create the labeling of ophthalmic product on container



## Unit V

**CO-BP502-5:** Formulation and evaluation of the cosmetic product and Pharmaceutical Aerosols and packaging of pharmaceutical products.

Item	Approx Hrs
Lecture & Tutorial	10+3=13
Practical(P)	8
SW	1
SL	1
Total:	23

Session Outcomes(SOs)	Laboratory Instruction(LI)	Class room Instruction(CI)	Self Learning
<p><b>Theory</b> <b>SO5.1</b> Cosmetics:Formulationand preparation of thefollowing cosmetic preparations: Lipsticks, shampoos, cold cream and vanishing cream, toothpastes, hair dyes and sunscreens <b>SO5.2:</b> Pharmaceutical Aerosols: Definition, propellants, containers, valves, types of aerosol systems; formulation and manufacture of aerosols; Evaluation of aerosols; Quality control and stability studies <b>SO5.3:</b>Packaging materials Science: Materials used for packaging of pharmaceutical products, <b>SO5.4</b> Factorsinfluencing choice of containers, legal and official requirements for containers, Stability aspects ofpackaging materials,quality control tests.</p> <p><b>Practical:</b> <b>SO-P-5.1</b> To preparedcold cream has been done. <b>SO-P-5.2</b> To preparedvanishing cream has been done.</p>	<p>5.1 preparation of cold cream 5.2 preparation of vanishing cream</p>	<p>5.1 To brief introduction of theCosmetics Preparations. 5.2 Formulation and preparation of lipsticks and shampoo, cold cream, sunscreensand vanishing cream. 5.3 Formulation and preparation of hairdyes and tooth pastes. <b>5T.1:</b> Tutorial class 5.4Introduction anddefinition of pharmaceutical Aerosols. 5.5 types of aerosol systems and propellants, containers, valves 5.6 Formulation and manufacture of Aerosols.</p>	<p><b>5.1:</b> Study of cosmetic product, pharmaceutical aerosols and varioustypes of containers</p>

### **Suggested Sessional work**

#### **Assignments:**

1. Formulation and preparation of the following cosmetic preparations:
2. Lipsticks, shampoos, cold cream and vanishing cream, tooth pastes, hair dyes and sunscreens.



**Brief of Hours suggested for the Course Outcome**

<b>Course Out comes</b>	<b>Class Lecture (Cl)</b>	<b>(LI)</b>	<b>Sessional Work (SW)</b>	<b>Self Learning (Sl)</b>	<b>Total Hour (Cl+SW+Sl+LI)</b>
<b>CO-BP502-1:</b> To understand the various pharmaceutical dosage forms and their manufacturing techniques.	13	4	1	1	19
<b>CO-BP502-2:</b> To understand about various considerations in development of pharmaceutical dosage forms	13	16	1	1	31
<b>CO-BP503-3:</b> To Formulate solid, liquid and semisolid dosage forms and evaluates them for their quality.	13	8	1	2	24
<b>CO-BP504-4:</b> To prepare and evaluate the sterile product and perform some Quality control tests (Parenteral Products Ophthalmic Preparations).	13	16	1	2	32
<b>CO-BP505-5:</b> Formulation and evaluation of the cosmetic product and Pharmaceutical Aerosols and packaging of pharmaceutical products	13	8	1	1	23
<b>Total Hours</b>	65	52	5	7	129



## Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

Course Outcome	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
<b>CO-BP502-1:</b>	To understand the various pharmaceutical dosage forms and their manufacturing techniques	08	06	01	15
<b>CO-BP502-2:</b>	To understand about various considerations in development of pharmaceutical dosage Forms.	12	07	01	20
<b>CO-BP502-3:</b>	To Formulate solid, liquid and semisolid dosage forms and evaluates them for their Quality.	02	06	02	10
<b>CO-BP502-4:</b>	To prepare and evaluate the sterile product and perform some Quality control tests (Parenteral Products Ophthalmic Preparations).	10	02	03	15
<b>CO-BP502-5:</b>	Formulation and evaluation of the cosmetic product and Pharmaceutical Aerosols and packaging of pharmaceutical products.	05	07	03	15
<b>Total</b>		<b>37</b>	<b>28</b>	<b>10</b>	<b>75</b>

**Legend: R: Remember, U: Understand, A: Apply**

The end of semester assessment for Industrial pharmacy-I will be held with written examination of 75 marks

**Note.** Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks.

Teachers can also design different tasks as per requirement, for end semester assessment.

### **Suggested Instructional/Implementation Strategies:**

1. Improved Lecture
2. Tutorial
3. Case Method
4. Group Discussion
5. Role Play
6. Demonstration
7. ICT Based Teaching Learning (Video Demonstration/Tutorials CBT, Blog, Face book, Twitter, Whats app, Mobile, Online sources)
8. Brainstorming



### Suggested Learning Resources:

S. No.	Title	Author	Publisher	Edition & Year
1	Indian Pharmacopoeia	Indian Pharmacopoeia Commission (IPC), Govt. of India	Govt. of India	Eighth edition, 2018
2	Pharmaceutical dosage forms - Tablets	H.A. Liberman, Leon Lachman &	J.B.Schwartz publications	4 <sup>th</sup> edition, 2021
3	Pharmaceutical dosage form - Parenteral	Liberman & Lachman	CRS Publications, New delhi	2nd edition vol-1&2
4	Pharmaceutical dosage form disperse system	Liberman & Lachman	CRC Press; (May 16,)	2nd edition VOL-1
5	Modern Pharmaceutics	Gilbert S. Banker & C.T. Rhodes	Informa Healthcare; 4th edition	2002
6	The Science and Practice of Pharmacy	Remington	Pharmaceutical Science (RPS)	20th edition
7	Theory and Practice of Industrial Pharmacy	Liberman & Lachman	CBS Publishers & Distributors Pvt Ltd, India;	4th edition 2017
8	Pharmaceutics- The science of dosage form design	M.E.Aulton	Churchill livingstone,	Latest edition
9	Introduction to Pharmaceutical Dosage Forms	H. C. Ansel, Lea & Febiger	Philadelphia	5 <sup>th</sup> edition, 2005
10	Drug stability - Principles and practice	Cartensen & C.J. Rhodes,	Marcel Dekker Series	3rd Edition, Vol 107.

#### Curriculum Development Team:

1. **Prof. SP Gupta**, Director, RGIP, AKS University
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**Course Outcome, Program Specific Outcome & Program Outcome Mapping**

**Course Code: BP502T/BP506P**

**Course Name: Industrial pharmacy-I**

Course Outcome	Program Outcome											Program Specific outcome			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
	Pharmacy knowledge	Planning Abilities	Problem analysis	Modern tool usage	Leadership skills	Professional Identity	Pharmaceutical Ethics	Communication	The pharmacist and society	Environment and sustainability	Life-long learning	Knowledge of drug discovery	Quality Analysis of API's	MOA of Drug	Biological evaluation of drug
<b>CO-1:</b> Various Pharmaceutical dosage forms and their manufacturing	3	2	3	1	3	2	1	2	3	2	3	1	3	1	2
<b>CO-2:</b> Considerations in development of pharmaceutical dosage form	2	3	1	3	1	2	1	1	2	3	3	3	2	1	3
<b>CO-3:</b> Liquid and semisolid dosage forms and evaluates	3	2	3	2	1	1	2	1	2	2	3	3	2	1	3
<b>CO-4:</b> sterile product and perform some Quality control tests (Parenteral Products)	2	3	2	3	1	3	2	2	3	3	3	3	2	1	3
<b>CO-5:</b> cosmetic product and Pharmaceutical Aerosols and packaging of pharmaceutical products.	3	3	1	1	1	3	1	3	1	2	3	2	2	2	2

**Legend: 1- Low, 2-Medium, 3-High**



### Course Curriculum Mapping

Pos& PSOs No	Cos No&	Title	SOs No	Class Room Instructions	Laboratory Instructions	Self learning
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	<b>CO-BP50 2-1:</b>	To understand the various pharmaceutical dosage forms and their manufacturing techniques	SO1.1 SO1.2 SO1.3 SO1.4 SO1.5	1.1,1.2,1.3,1.4,1.5,1.6,1.7,1.8,1.9,1.10	LI-1.1	SI-1.1
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	<b>CO-BP50 2-2:</b>	To understand about various considerations in development of pharmaceutical dosage forms.	<b>SO-2.1</b> <b>SO-2.2</b> <b>SO-2.3</b> <b>SO-2.4</b> <b>SO-2.5</b>	2.1,2.2,2.3,2.4,2.5,2.6,2.7,2.8,2.9,2.10	LI-2.1 LI-2.2 LI-2.3 LI-2.4	SI-2.1
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	<b>CO-BP50 2-3:</b>	To Formulate solid, liquid and semisolid dosage forms and evaluates them for their quality.	SO-3.1 SO-3.2 SO-3.3 SO-3.4 SO-3.5	3.1,3.2,3.3,3.4,3.5,3.6,3.7,3.8,3.9,3.10	LI-3.1 LI-3.2	SI-3.1 SI-3.2
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	<b>CO-BP50 2-4:</b>	To prepare and evaluate the sterile product and perform some Quality control tests (Parenteral Products Ophthalmic Preparations).	SO-4.1 SO-4.2 SO-4.3 SO-4.4 SO-4.5	4.1,4.2,4.3,4.4,4.5,4.6,4.7,4.8,4.9,4.10	LI-4.1 LI-4.2 LI-4.3 LI-4.4	SI-4.1 SI-4.2
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	<b>CO-BP50 2-5:</b>	Formulation and evaluation of the cosmetic product and Pharmaceutical Aerosols and packaging of pharmaceutical products.	SO-5.1 SO-5.2 SO-5.3 SO-5.4 SO-5.5	5.1,5.2,5.3,5.4,5.5,5.6,5.7,5.8,5.9,5.10	LI-5.1 LI-5.2	SI-5.1





AKS University  
Faculty of Pharmaceutical Science & Technology  
Rajiv Gandhi Institute of Pharmacy  
Curriculum of B. Pharmacy (Pharmacology-II) Program  
(Revised as on 01August2023)Semester-V

**Course Code:** BP503T & BP507P

**Course Title:** Pharmacology-II

**Pre-requisite:** Student should have basic knowledge of General Pharmacology, Pharmacokinetics, Pharmacodynamics, Drug Interaction, Route of drug administration and Receptors.

**Rationale/Objective s:** Up on completion of the course student shall be able to

- To understand the mechanism of drug action and its relevance in the treatment of different diseases
- To demonstrate isolation of different organs/tissues from the laboratory animals by simulated experiments
- To demonstrate the various receptor actions using isolated tissue preparation
- To Appreciate correlation of pharmacology with related medical sciences

**Course Out comes:**

**CO-BP503-1:** To understand the mechanism of drug action and its relevance in the treatment of different diseases of cardio vascular system.

**CO-BP503-2:** To acquired the knowledge of mechanism of drug action and its relevance in the treatment of different diseases of cardio vascular system and urinary system.

**CO-BP503-3:** To understanding the various types of autacoids, their classification and related drugs.

**CO-BP503-4:** To familiarize with basic concept in endocrine pharmacology and action of drugs on endocrine system.

**CO-BP503-5:** To comprehend the basic concepts of bio-assay.

**Scheme of Studies**

Course code	Title of the course	Program Name	TOTAL Number of contact hours/Week						Credit
			Classroom Instruction (A)		Practical (P)	SW	SL	Total Hours (H)	
			Lecture	Tutorial					
BP503T	Pharmacology- II Theory	B. Pharmacy	3	1	4	1	1	10	6



**Legend: CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others),

**LI: Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)**

**SW: Sessional Work** (includes assignment, seminar, mini project etc.),

**SL:** Self Learning, Credits.

**Note:** SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

### Theory Assessment

Board of Study	Course Code	Course Title	Scheme of Assessment ( Marks )					End Semester	Total Marks(A+)
			Progressive Assessment ( PRA)						
			Academic activity, Any three (Quiz/ Assignment, open book test, filed work and seminar)	Studentteacher interaction	Class Attendn ce(AT)	(A) Total Marks	Ses sion		
Pharmacy	BP-503T	Pharmacology- II	3	3	4	10	15	75	100

### Practical Assessment

Board of Study	Course Code	Course Title	Scheme of Assessment ( Marks )						
			Internal Assessment (A)			End Semester Examination (B)			Total Marks (A+B)
			Attendance	Record	Sessional Exam.	Synopsis	Experiment	Viv	
Pharmacy	BP-507P	Pharmacology-II	2	3	10	5	25	5	50

### Guidelines for the allotment of marks for attendance

Percentage of Attendance	Theory	Practical
95 – 100	4	2
90 – 94	3	1.5
85 – 89	2	1
80 – 84	1	0.5
Less than 80	0	0



**Course-Curriculum Detailing:**

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

**Unit I**

**CO-BP503-1: To understand the mechanism of drug action and its relevance in the treatment of different diseases of cardio vascular system.**

Item	Approx Hrs
Lecture & Tutorial	10+3=13
Practical (P)	12
SW	1
SL	1
Total:	27

Session Outcomes(SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
<b>Theory</b> <b>SO1.1:</b> Introduction to Hemodynamic and electrophysiology of heart. <b>SO1.2:</b> Drugs used in congestive heart failure <b>SO1.3:</b> Anti-hypertensive drugs. <b>SO1.4:</b> Anti-anginal drugs. <b>SO1.5:</b> Anti-arrhythmic drugs. <b>SO1.6:</b> Anti-hyperlipidemic drugs. <b>Practical</b> <b>SO-P- 1.1:</b> Introduction to <i>in-vitro</i> pharmacology and physiological salt solutions. <b>SO-P- 1.2:</b> Effect of drugs on isolated frog heart. <b>SO-P- 1.3:</b> Effect of drugs on blood pressure and heart rate of dog	<b>1.1:</b> Introduction to <i>in-vitro</i> pharmacology and physiological salt solutions. <b>1.2:</b> To study the effect of drugs on isolated frog heart. <b>1.3:</b> To study the effect of drugs on blood pressure and heart rate of dog.	1.1 Introduction to hemodynamic. 1.2 Introduction to electrophysiology of heart. 1.3 Drugs used in congestive heart failure <b>1T.1</b> Tutorial Class 1.4 Classification and mechanism of action of drugs used in CHF. 1.5 Anti-hypertensive drugs. 1.6 Classification and mechanism of action of Anti-hypertensive drugs. <b>1T.2</b> Tutorial Class 1.7 Anti-anginal drugs. Classification and mechanism of action of Anti-anginal drugs. 1.9 Anti-arrhythmic drugs. 1.10 Anti- hyperlipidemic drugs. <b>1T.3</b> Tutorial Class	1.1: Introduction to hemodynamic.  1.2: Introduction to electrophysiology of heart.



**. Suggested Assignments:**

1. Anti-arrhythmic drugs.
2. Anti-hyperlipidemic drugs.
3. Drugs used in congestive heart failure.
4. Anti-hypertensive drugs.
5. Anti-anginal drugs.

**Unit II**

**CO-BP503-2: To acquired the knowledge of mechanism of drug action and its relevance in the treatment of different diseases of cardio vascular system and urinary system.**

Item	Approx Hrs
Lecture & Tutorial	10+3=13
Practical(P)	12
SW	1
SL	1
Total:	27

Session Outcomes(SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
<b>Theory</b> <b>SO2.1:</b> Drug used in the therapy of shock <b>SO2.2:</b> Hematinics, coagulants and anticoagulants <b>SO2.3:</b> Fibrinolytics and anti-platelet drugs <b>SO2.4:</b> Plasma volume expanders <b>SO2.5:</b> Diuretics <b>SO2.6:</b> Anti-diuretics <b>Practical</b> <b>SO-P-2.1:</b> Study of diuretic activity of drugs using rats/mice. <b>SO-P-2.2:</b> DRC of acetylcholine using frog rectus abdominis muscle. <b>SO-P-2.3:</b> Effect of physostigmine and atropine on DRC of acetylcholine using frog rectus abdominis muscle and rat ileum respectively.	<b>2.1:</b> To Study the diuretic activity of drugs using rats/mice. <b>2.2:</b> To study the DRC of acetylcholine using frog rectus abdominis muscle. <b>2.3:</b> To study the effect of physostigmine and atropine on DRC of acetylcholine using frog rectus abdominis muscle and rat ileum respectively.	2.1 Drug used in the therapy of shock 2.2 Hematinics 2.3 Coagulants and anticoagulants <b>2T.1</b> Tutorial Class 2.4 Classification and mechanism of action of Coagulants and anticoagulants 2.5 Fibrinolytics and anti-platelet drugs 2.6 Classification and mechanism of action of Fibrinolytics and anti-platelet drugs <b>2T.2</b> Tutorial Class 2.7 Plasma volume expanders Diuretics 2.9 Classification and mechanism of action of Diuretics 2.10 Anti-diuretics <b>2T.3</b> Tutorial Class	2.1: Hematinics 2.2: Plasma volume expanders

**Suggested Assignments:**

1. Drug used in the therapy of shock.
2. Hematinics.



3. Coagulants and anticoagulants.
4. Fibrinolytics and anti-platelet drugs.
5. Plasma volume expanders.

### Unit III

**CO-BP503-3: To understanding the various types of autacoids, their classification and related drugs.**

Item	Approx Hrs
Lecture & Tutorial	10+3=13
Practical(P)	12
SW	1
SL	1
Total:	27

Session Outcomes(SOs)	Laboratory Instruction (LI)	Self Instruction (CI)	Self Learning (SL)
<b>Theory</b> <b>SO3.1:</b> Introduction to autacoids and classification <b>SO3.2:</b> Histamine, 5-HT and their antagonists. <b>SO3.3:</b> Prostaglandins, Thromboxanes and Leukotrienes. <b>SO3.4:</b> Angiotensin, Bradykinin and Substance P. <b>SO3.5:</b> Non-steroidal anti-inflammatory agents <b>SO3.6:</b> Anti-gout drugs <b>SO3.7:</b> Anti-rheumatic drugs <b>Practical</b> <b>SO-P-3.1 :</b> Effect of spasmogens and Spasmolytics using rabbit jejunum. <b>SO-P- 3.2:</b> Anti-inflammatory activity of drugs using carrageenan induced paw-edema model. <b>SO-P-3.3:</b> Analgesic activity of drug using central and peripheral methods.	<b>3.1:</b> To study the effect of spasmogens and spasmolytics using rabbit jejunum. <b>3.2:</b> To study the Anti-inflammatory activity of drugs using carrageenan induced paw-edema model <b>3.3:</b> To study the analgesic activity of drug using central and peripheral methods.	3.1 Introduction to autacoids and classification 3.2 Histamine and their antagonists. 3.3 5-HT and their antagonists. <b>3T.1</b> Tutorial Class 3.4 Prostaglandins 3.5 Thromboxanes and Leukotrienes. 3.6 Angiotensin <b>3T.2</b> Tutorial Class 3.7 Bradykinin and Substance P. 3.8 Non-steroidal anti-inflammatory agents 3.9 Anti-gout drugs 3.10 Anti-rheumatic drugs <b>3T.3</b> Tutorial Class	<b>3.1:</b> Introduction to autacoids  <b>3.2:</b> Non-steroidal anti-inflammatory agents

**Suggested Assignments:** 1. Histamine and their antagonists, 2. 5-HT and their antagonists, 3. Prostaglandins, 4. Angiotensin, 5. Anti-gout drugs.



**Unit IV**

**CO-BP503-4: To familiarize with basic concept in endocrine pharmacology and action of drugs on endocrine system.**

Item	Approx Hrs
Lecture & Tutorial	08+3=11
Practical(P)	0
SW	1
SL	1
Total:	13

Session Outcomes(SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
<b>Theory</b> <b>SO4.1:</b> Basic concepts in endocrine pharmacology. <b>SO4.2:</b> Anterior Pituitary hormones- analogues and their inhibitors. <b>SO4.3:</b> Thyroid hormones- analogues and their inhibitors. <b>SO4.4:</b> Hormones regulating plasma calcium level- Parathormone, Calcitonin and Vitamin-D. <b>SO4.5:</b> Insulin, Oral Hypoglycemic agents and glucagon. <b>SO4.6:</b> ACTH and corticosteroids.	NA	4.1 Basic concepts in endocrine pharmacology. 4.2 Anterior Pituitary hormones- analogues and their inhibitors. 4.3 Thyroid hormones- analogues and their inhibitors. <b>4T.1</b> Tutorial Class 4.4 Hormones regulating plasma calcium level 4.5 Parathormone, Calcitonin and Vitamin-D. 4.6 Insulin and glucagon. <b>4T.2</b> Tutorial Class 4.7 Oral Hypoglycemic agents. 4.8 ACTH and corticosteroids. <b>4T.3</b> Tutorial Class	<b>4.1:</b> Basic concepts in endocrine pharmacology.  <b>4.2:</b> Anterior Pituitary hormones

**Suggested Assignments:** 1. Thyroid hormones, 2. Hormones regulating plasma calcium level, 3. Oral Hypoglycemic agents, 4. Insulin and glucagon, 5. ACTH and corticosteroids.



## Unit V

### CO-BP503-5: To comprehend the basic concepts of bio-assay

Item	Approx Hrs
Lecture & Tutorial	07+03=10
Practical(P)	16
SW	1
SL	1
Total:	28

Session Outcomes(SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
<b>Theory</b> <b>SO5.1:</b> Androgens and Anabolic steroids. <b>SO5.2:</b> Estrogens, progesterone and oral contraceptives. <b>SO5.3:</b> Drugs acting on the uterus. <b>SO5.4:</b> Principles and applications of bioassay. <b>SO5.5:</b> Types of bioassay. <b>SO5.6:</b> Bioassay of insulin, oxytocin, vasopressin, ACTH. <b>Practical</b> <b>SO-P-5.1:</b> Bioassay of histamine using guinea pig ileum by matching method. <b>SO-P- 5.2:</b> Bioassay of oxytocin using rat uterine Horn by interpolation method. <b>SO-P-5.3:</b> Bioassay of serotonin using rat fundus strip by three point bioassay. <b>SO-P-5.4:</b> Bioassay of acetylcholine using rat ileum/colon by four point bioassay.	5.1: To study the bioassay of histamine using guinea pig ileum by matching method. 5.2: To study the bioassay of oxytocin using rat uterine horn by interpolation method. 5.3: To study the bioassay of serotonin using rat fundus strip by three Point bioassay. 5.4: To study the bioassay of acetylcholine using Rat ileum/colon by four Point bioassay.	5.1 Androgens and Anabolic steroids. 5.2 Estrogens, progesterone and oral contraceptives. <b>5T.1</b> Tutorial Class 5.3 Drugs acting on the uterus. 5.4 Principles and applications of bioassay. 5.5 Types of bioassay <b>5T.2</b> Tutorial Class 5.6 Bioassay of insulin, oxytocin, vasopressin, ACTH. 5.7 Bioassay of d-tubocurarine, digitalis, histamine and 5-HT. <b>5T.3</b> Tutorial Class	<b>5.1:</b> Basic concepts in endocrine pharmacology. <b>5.2:</b> Bioassay

**Suggested Assignments:** 1.Principles and applications of bioassay, 2.Types of bioassay, 3. Bioassay of oxytocin, 4.Bioassay of digitalis, 5.Bioassay of 5-HT.



### Brief of Hours suggested for the Course Outcome

Course Out comes	Class Lecture (Cl)	(LI)	Session a 1 Work (SW)	Self Learning (Sl)	Total Hour (Cl+SW+ Sl+LI)
<b>CO-BP503-1:</b> To understand the mechanism of drug action and its relevance in the treatment of different diseases of cardio vascular system.	13	12	1	1	27
<b>CO-BP503-2:</b> To acquired the knowledge of mechanism of drug action and its relevance in the treatment of different diseases of cardio vascular system and urinary system.	13	12	1	1	27
<b>CO-BP503-3:</b> To understanding the various types of autocoids, their classification and related drugs.	13	12	1	1	27
<b>CO-BP503-4:</b> To familiarize with basic concept in endocrine pharmacology and action of drugs on endocrine system.	11	0	1	1	13
<b>CO-BP503-5:</b> To comprehend the basic concepts of bio-assay.	10	16	1	1	28
<b>Total Hours</b>	60	52	5	5	122



**Suggestion for End Semester Assessment**  
Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		A	C	E	
CO-1	To understand the mechanism of drug action and its relevance in the treatment of different diseases of cardio vascular system.	08	06	01	15
CO-2	To acquired the knowledge of mechanism of drug action and its relevance in the treatment of different diseases of cardio vascular system and urinary system.	08	07	01	16
CO-3	To understanding the various types of autocoids, their classification and related drugs.	08	07	01	16
CO-4	To familiarize with basic concept in endocrine pharmacology and action of drugs on endocrine system.	07	06	01	14
CO-5	To comprehend the basic concepts of bio-assay	08	07	01	16
Total		39	33	05	77

**Legend: A: Analyze, C: Create, E: Evaluate**

The end of semester assessment for Pharmacology-II will be held with written examination of 75 marks

**Note.** Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks. Teachers can also design different tasks as per requirement, for end semester assessment.

**Suggested Instructional/Implementation Strategies:**

1. Improved Lecture
2. Tutorial
3. Case Method
4. Group Discussion
5. Role Play
6. Demonstration
7. ICT Based Teaching Learning(Video Demonstration/Tutorials CBT, Blog, Face book, Twitter, WhatsApp, Mobile, Online sources)
8. Brainstorming



### Suggested Learning Resources:

S. No.	Title	Author	Publisher	Edition & Year
1	Rang and Dale's Pharmacology	Rang H. P., Dale M. M., Ritter J. M., Flower R. J.	Churchil Livingstone Elsevier	10 <sup>th</sup> Edition, 2023
2	Basic and clinical pharmacology	Katzung B. G., Masters S. B., Trevor A. J.	Tata Mc Graw-Hill	12 <sup>th</sup> Edition, 2011
3	The Pharmacological Basis of Therapeutics	Goodman and Gilman's	Tata McGraw- Hill	14 <sup>th</sup> Edition, 2017
4	Applied Therapeutics, The Clinical use of Drugs, The Point	Marry Anne K. K., Lloyd Yee Y., Brian K. A., Robbin L.C., Joseph G. B., Wayne A.K., Bradley R.W.	Lippincott Williams & Wilkins	9 <sup>th</sup> Edition, 2008
5	Lippincott's Illustrated Reviews- Pharmacology	Mycek M.J, Gelnet S.B and Perper M.M.	Lippincott Williams & Wilkins	4 <sup>th</sup> Edition, 2009
6	Essentials of Medical Pharmacology	K.D.Tripathi	JAYPEE Brothers Medical Publishers (P) Ltd, New Delhi.	8 <sup>th</sup> Edition, 2021
7	Handbook of experimental pharmacology	Kulkarni SK	Vallabh Prakashan	3 <sup>rd</sup> Edition, 2007

#### Curriculum Development Team:

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**Course Outcome, Program Specific Outcome & Program Outcome Mapping**

**Course Code: BP503T/BP507P**

**Course Name: Pharmacology II**

Course Outcome	Program Outcome											Program Specific outcome			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
	Pharmacy knowledge	Planning Abilities	Problem analysis	Modern tool usage	Leadership skills	Professional Identity	Pharmaceutical Ethics	Communication	The pharmacist and society	Environment and sustainability	Life-long learning	Knowledge of drug discovery	Quality Analysis of API's	MOA of Drug	Biological evaluation of drug
<b>CO-1:</b> Cardiovascular drugs	3	2	3	1	3	2	1	2	3	2	3	1	3	1	2
<b>CO-2:</b> Urinary system drugs	2	3	1	3	1	2	1	1	2	3	3	3	2	1	3
<b>CO-3:</b> Autacoids with their classification & related drugs.	3	2	3	2	1	1	2	1	2	2	3	3	2	1	3
<b>CO-4:</b> Autacoids, their classification and related drugs.	2	3	2	3	1	3	2	2	3	3	3	3	2	1	3
<b>CO-5:</b> Basic concepts of bio-assay.	3	3	1	1	1	3	1	3	1	2	3	2	2	2	2



### Course Curriculum Mapping

Pos& PSOs No	Cos No	Cos Title	SOs No	Class Room Instructions	Laboratory Instructions	Self learning
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	<b>BP503-1</b>	To understand the mechanism of drug action and its relevance in the treatment of different diseases of cardio vascular system.	<b>SO1.1</b> <b>SO1.2</b> <b>SO1.3</b> <b>SO1.4</b> <b>SO1.5</b> <b>SO1.6</b>	1.1,1.2,1.3,1.4,1.5,1.6,1.7,1.8,1.9,1.10	LI-1.1 LI-1.2 LI-1.3	SL-1.1 SL-1.2
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	<b>BP503-2</b>	To acquired the knowledge of mechanism of drug action and its relevance in the treatment of different diseases of cardio vascular system and urinary system.	<b>SO2.1</b> <b>SO2.2</b> <b>SO2.3</b> <b>SO2.4</b> <b>SO2.5</b> <b>SO2.6</b>	2.1,2.2,2.3,2.4,2.5,2.6,2.7,2.8,2.9,2.10	LI-2.1 LI-2.2 LI-2.3	SL-2.1 SL-2.2
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	<b>BP503-3</b>	To understanding the various types of autacoids, their classification and related drugs.	<b>SO-3.1</b> <b>SO-3.2</b> <b>SO-3.3</b> <b>SO-3.4</b> <b>SO-3.5</b> <b>SO-3.6</b> <b>SO-3.7</b>	3.1,3.2,3.3,3.4,3.5,3.6,3.7,3.8,3.9,3.10	LI-3.1 LI-3.2 LI-3.3	SL-3.1 SL-3.2
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	<b>BP503-4</b>	To familiarize with basic concept in endocrine pharmacology and action of drugs on endocrine system.	<b>SO-4.1</b> <b>SO-4.2</b> <b>SO-4.3</b> <b>SO-4.4</b> <b>SO-4.5</b> <b>SO-4.6</b>	4.1,4.2,4.3,4.4,4.5,4.6,4.7,4.8.		SL-4.1 SL-4.2
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	<b>BP503-5</b>	To comprehend the basic concepts of bio-assay.	<b>SO-5.1</b> <b>SO-5.2</b> <b>SO-5.3</b> <b>SO-5.4</b> <b>SO-5.5</b> <b>SO-5.6</b>	5.1,5.2,5.3,5.4,5.5,5.6,5.7	LI-5.1 LI-5.2 LI-5.3 LI-5.4	SL-5.1 SL-5.2





AKS University  
Faculty of Pharmaceutical Science & Technology  
Rajiv Gandhi Institute of Pharmacy

Curriculum of B. Pharmacy (Pharmacognosy and Phyto-chemistry-II) Program  
**Semester-V**

**Course Code:** BP504T/BP508P

**Course Title:** Pharmacognosy and Phyto-chemistry-II

**Pre-requisite:** The main purpose of subject is to impart the students the knowledge of how the secondary metabolites are produced in the crude drugs, how to isolate and identify and produce them industrially.

**Rationale/Objectives:**

Upon completion of the course student shall be able:  
To know Also this subject involves the study of producing the plants and phytochemical through plant tissue culture, drug interactions and basic principles of traditional system of medicine

**Course Outcomes:**

- CO-BP504-1:** Discuss the general technique of biosynthesis of phytoconstituents in plants.
- CO-BP504-2:** Apprehended the composition, chemistry & chemical classes, bio-sources, therapeutic uses and commercial applications of different plants secondary metabolites.
- CO-BP504- 3:** Accomplished in the Isolation, Identification and Analysis of Phyto-constituents.
- CO-BP504-4:** Accomplished in the production estimation and utilization of  
Phyto-constituents in industrial scale.
- CO-BP504-5:** Accomplished in the estimation and analysis of the different phytoconstituents with help of Instrument based on chromatography and spectroscopy.



## Scheme of Studies

Course code	Title of the course	Program Name	TOTAL Number of contact hours/Week						Credit
			Classroom Instruction(A)		Practical I(P)	SW	SL	Total Hours (H)	
			Lecture	Tutorial					
BP504T	Pharmacognosy and Phyto chemistry-II (Theory)	B. Pharmacy	3	1	4	1	1	10	6

**Legend: CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others),

**LI:** Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)

**SW:** Sessional Work (includes assignment, seminar, mini project etc.),

**SL:** Self Learning,

**C:** Credits

**Note:** SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning

## Theory Assessment

Board of Study	Course Code	Course Title	Scheme of Assessment(Marks)						
			Progressive Assessment (PRA)						
			Academic activity, Any three (Quiz/ Assignment, open book test, filed work and seminar)	Student teacher interaction	Class Attendance(AT)	(A) Total Marks	Sessional Exam(B)		
Pharmacy	BP-504T	Pharmacognosy and Phyto chemistry-II	3	3	4	10	15	75	100



## Practical Assessment

Board of Study	Course Code	Course Title	Scheme of Assessment(Marks)						
			Internal Assessment(A)			End Semester Examination(B)			Total Marks (A+B)
			Attendance	Record	Sessional Exam.	Synopsis	Experiment	Viva	
Pharmacy	BP- 504P	Pharmacognosy and Phyto chemistry-II	2	3	10	5	25	5	50

## Guidelines for the allotment of marks for attendance

Percentage of Attendance	Theory	Practical
95–100	4	2
90–94	3	1.5
85–89	2	1
80–84	1	0.5
Lessthan80	0	0



**Course-Curriculum Detailing:**

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

**CO-BP504-1:** Discuss the general technique of biosynthesis of phytoconstituents in plants.

Item	Approx Hrs
Lecture & Tutorial	10+3=13
Practical(P)	4
SW	1
SL	1
Total:	19

Session Outcomes(SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
<b>SO1.1</b> Brief study of basic metabolic pathways and formation of different secondary metabolites <b>SO1.2.</b> Study of utilization of radioactive isotopes in the investigation of Biogenetic studies <b>Practical</b> <b>SO-P-</b> Morphology, histology and powder characteristics & extraction & detection of: Cinchona, Cinnamon, Senna, Clove, Ephedra, Fennel and Coriander	1.1 Morphology, histology and powder characteristics & extraction & detection of: Cinchona, Cinnamon, Senna, Clove, Ephedra, Fennel and Coriander	Brief study of basic metabolic pathways. formation of different secondary metabolites. Shikimic acid pathway. Acetate pathways. Amino acid pathway. Study of utilization of radioactive isotopes in the investigation of Biogenetic stud. Study of utilization of radioactive isotopes in the investigation of Biogenetic stud. <b>Tutorial</b> Acetate pathways 1.2 Study of utilization of radioactive isotopes in the investigation of Biogenetic studies	1.1 Metabolic pathways in higher plants and their determination. 1.2 Study of utilization of radioactive isotopes

**Suggested Assignments:** formation of different secondary metabolites & Study of utilization of radioactive isotopes in the investigation of Biogenetic studies



## Unit II

**CO-BP504-2: Apprehended the composition, chemistry & chemical classes, bio-sources, therapeutic uses and commercial applications of different plants secondary metabolites**

Item	Approx Hrs
Lecture & Tutorial	10+3=13
Practical(P)	16
SW	1
SL	1
Total:	31

Session Outcomes(SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
<p>Theory</p> <p><b>SO2.1</b> General introduction, composition, chemistry &amp; chemical classes, biosources, therapeutic uses and commercial applications of Alkaloids, Phenyl propanoids and Flavonoids, Steroids, Cardiac Glycosides &amp; Triterpenoids, Volatile oils, Tannins, Resins, Glycosides, Iridoids, Other terpenoids &amp; Naphthaquinones</p> <p><b>SO-P- 2.2:</b> Exercise involving isolation &amp; detection of active principles</p> <p>b. Diosgenin from Dioscorea</p> <p><b>SO-P-2.3</b> Exercise involving isolation &amp; detection of active principles Atropine from Belladonna</p> <p>SO-P-2.4.Exercise involving isolation &amp; detection of active principles Sennosides from Senna</p>	<p>Exercise involving isolation &amp; detection of active principles</p> <p>2.1. Caffeine - from tea dust.</p> <p>2.2. Diosgenin from Dioscorea.</p> <p>2.3. Atropine from Belladonna.</p> <p>2.4 Sennosides from Senna.</p>	<p>.1 Alkaloids: Vinca, Rauwolfia.</p> <p>2.2 Belladonna, Opium</p> <p>2.3 Phenylpropanoids : Lignans</p> <p>2.4. Flavonoids: Tea, Ruta</p> <p>2.5. Steroids: Liquorice,</p> <p>2.6 Cardiac Glycosides: , Dioscorea,</p> <p>2.7 Triterpenoids: Digitalis</p> <p>2.8 Volatile oils: Mentha, Clove.</p> <p>2.9 Cinnamon, Fennel, Coriander.</p> <p>2.10 Tannins: Catechu, Pterocarpus</p> <p>2.11 Tannins: Catechu, Pterocarpus</p> <p>2.12 Resins: Benzoin, Guggul, Ginger Asafoetida, Myrrh, Colophony</p> <p>2.13 Glycosides: Senna, Aloes, Bitter Almond</p> <p>2.14 Iridoids, Other terpenoids &amp; aphtha quinones: Gentian, Artemisia, taxus, carotenoids</p>	<p>1 knowledge on the general introduction, composition, chemistry &amp; chemical classes, biosources, therapeutic uses and commercial applications.</p> <p>2.2. Resins: Benzoin, Guggul, Ginger Asafoetida, Myrrh, Colophony.</p>

### Suggested Assignments:

- General introduction, composition, chemistry & chemical classes, biosources, therapeutic uses and commercial applications of Alkaloids.



### Unit III

**CO-BP504-3:** Accomplished in the Isolation, Identification and Analysis of Phytoconstituents.

Item	Approx Hrs
Lecture & Tutorial	10+3=13
Practical(P)	8
SW	1
SL	1
Total:	23

Session Outcomes(SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
<b>Theory</b> <b>SO3.1</b> Glycosides: Glycyrrhetic acid & Rutin. <b>SO3.2</b> Alkaloids: Reserpine, Caffeine. <b>Practical</b> <b>SO-P- 3.1:</b> Separation of sugars by Paper chromatography.	3.1 Separation of sugars by Paper chromatography.	3.1 Terpenoids: Menthol, Citral, 3.2 Terpenoids: Artemisin 3.3 Glycosides: Glycyrrhetic acid & Rutin. 3.4 Alkaloids: Atropine, Quinine Alkaloids: Reserpine, Caffeine 3.6 Resins: Podophyllotoxin, Curcumin. <b>Tutorial</b> Terpenoids: Artemisin	3.1 Isolation, Identification and Analysis of Phytoconstituents.

**Suggested Assignments:** Terpenoids, Artemisin, Glycosides: Glycyrrhetic acid, Alkaloids: Reserpine, Resins:, Curcumin.



**Unit IV:**

**CO-BP504-4:** Accomplished in the production estimation and utilization of phytoconstituents in industrial scale.

Item	Approx Hrs
Lecture & Tutorial	10+3
Practical(P)	16
SW	1
SL	1
Total:	31

Session Outcomes(SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
<b>SO4.1.</b> Pharmacognosy in various systems of medicine. <b>SO4.2.</b> Introduction to secondary metabolites. <b>Practical</b> SO-P- 1. Determination of Ash value. SO-P- 2. Determination of Extractive values of crude drugs.	4.1 Determination of Ash value. 4.2 Determination of Extractive values of crude drugs.	4.1 Role of Pharmacognosy in allopathy and traditional systems of medicine namely, Ayurveda, systems of medicine. 4.2 Role of Pharmacognosy in allopathy and traditional systems of medicine namely, Unani, systems of medicine. 4.3 Role of Pharmacognosy in allopathy and traditional systems of medicine namely Siddha, systems of medicine. <b>4T1: Tutorial Class</b> 4.4. Role of Pharmacognosy in allopathy and traditional systems of medicine namely, Homeopathy and systems of medicine. 4.5. Role of Pharmacognosy in allopathy and traditional systems of medicine namely, Chinese systems of medicine. <b>4T2: Tutorial Class</b> 4.6 Definition, classification, properties and test for identification of Alkaloids. 4.7 Definition, classification, properties and test for identification of Glycosides. 4.8 Definition, classification, properties and test for identification of Flavonoids. 4.9 Definition, classification, properties and test for identification of Tannins. 4.10 Definition, classification, properties and test for identification of Volatile oil and Resins. <b>4T3: Tutorial Class</b> Role of pharmacognosy in allopathy and traditional systems of medicine.	4.1 Ayurveda, Unani, Siddha, Homeopathy and Chinese systems of medicine. 4.2 Definition, classification, properties and test for identification of secondary metabolites.

**Suggested Assignments:** Industrial production, estimation and utilization of the following phytoconstituents: Sennoside Diosgenin, Podophyllotoxin.



**Unit V**

**CO-BP504-5:** Accomplished in the estimation and analysis of the different phytoconstituents with help of instrument based on chromatography and spectroscopy.

Item	Approx Hrs
Lecture & Tutorial	10+3
Practical(P)	8
SW	1
SL	1
Total:	23

Session Outcomes(SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self Learning (SL)
<b>Theory</b> <b>SO5.1</b> Modern methods of extraction, application of latest techniques like Spectroscopy, <b>5.2</b> Chromatography and electrophoresis in the isolation, purification and identification of crude Drugs. <b>Practical:</b> <b>SO-P-5.</b> Analysis of crude drugs by chemical tests: (i) Asafetida (ii) Benzoin (iii) Colophony (iv) Aloes (v) Myrrh	5.1 Analysis of crude drugs by chemical tests: Asafetida Benzoin Colophony Aloes Myrrh	5.1. Modern methods of extraction. 5.2 Modern methods of extraction. 5.3 application of latest techniques Spectroscopy. 5.4 application of latest techniques Spectroscopy. <b>5T1 Tutorial Class</b> 5.5 application of latest techniques chromatography. 5.6. application of latest techniques electrophoresis. 5.7 purification and identification of crude drugs. <b>5T2 Tutorial Class</b> 5.8 purification and identification of crude drugs. <b>5T3: Tutorial</b> application of latest techniques electrophoresis in the isolation	5.1 Basics of Phyto chemistry Modern methods of extraction, application of latest techniques. 5.2 purification and identification of crude Drugs.

**Suggested Assignments:** Purification and identification of Crude drugs .



### Brief of Hours suggested for the Course Outcome

<b>Course Outcomes</b>	<b>Class Lecture (Cl)</b>	<b>(L)</b>	<b>Sessionl Work (SW)</b>	<b>Self Learning (Sl)</b>	<b>Total Hour (Cl+SW+ Sl+LI)</b>
<b>CO-BP504-1:</b> Discuss the general technique of biosynthesis of phytoconstituents in plants.	13	4	1	1	19
<b>CO-BP504-2:</b> Apprehended the composition, chemistry & chemical classes, bio-sources, therapeutic uses and commercial applications of different plants secondary metabolites.	13	16	1	1	31
<b>CO-BP504-3:</b> Accomplished in the Isolation, Identification and Analysis of Phytoconstituents.	13	8	1	1	23
<b>CO-BP504-4:</b> Accomplished in the production estimation and utilization of phytoconstituents in industrial scale..	13	16	1	1	31
<b>CO-BP504-5:</b> Accomplished in the estimation and analysis of the different phytoconstituents with help of instrument based on chromatography and spectroscopy.	13	8	1	1	23
<b>Total Hours</b>	65	52	5	5	127



## Suggestion for End Semester Assessment

Suggested Specification Table(For ESA)

Course Outcome	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-BP504-1:	Discuss the general technique of biosynthesis of phytoconstituents in plants.	08	06	01	15
CO-BP504-2:	Apprehended the composition, chemistry & chemical classes, bio-sources, therapeutic uses and commercial applications of different plants secondary metabolites.	12	07	01	20
CO-BP504- 3:	Accomplished in the Isolation, Identification and Analysis of Phytoconstituents.	02	06	02	10
CO-BP504- 4:	Accomplished in the production estimation and utilization of phytoconstituents in industrial scale.	10	02	03	15
CO-BP504- 5:	Accomplished in the estimation and analysis of the different phytoconstituents with help of instrument based on chromatography and spectroscopy.	05	07	03	15
<b>Total</b>		<b>37</b>	<b>28</b>	<b>10</b>	<b>75</b>

**Legend:**R: Remember,U: Understand, A:Apply

The end of semester assessment for Pharmacognosy and Phyto-chemistry-II will be held with written examination of 75 marks

**Note.** Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks.

Teachers can also design different tasks as per requirement, for end semester assessment.

### Suggested Instructional /Implementation Strategies:

1. Improved Lecture
2. Tutorial
3. Case Method
4. Group Discussion
5. Role Play
6. Demonstration
7. ICT Based Teaching Learning (Video Demonstration /Tutorials CBT, Blog, Face book, Twitter, Whats app, Mobile, Online sources)
8. Brainstorming



### Suggested Learning Resources:

S.No.	Title	Author	Publisher	Addition & Year
1	Indian Pharmacopoeia	Indian Pharmacopoeia Commission (IPC), Govt. of India	Govt. of India	Eighth edition, 2018
2	Pharmacognosy	W.C. Evans, Trease and Evans	W.B. Saunders & Co.,	16th edition London, 2009.
3	Pharmacognosy and Phyto chemistry	Mohammad Ali	CBS Publishers & Distribution, New Delhi.	7th Edition (2007)
4	Text book of Pharmacognosy	CK Kokate	Nirali Prakashan, New Delhi.	37th Edition (2007)
5	Herbal drug industry	R.D. Choudhary	Eastern Publisher, New Delhi.	Ist Edn (1996),
6	Essentials of Pharmacognosy	Dr.SH. Ansari	Birla publications, New Delhi,	IIInd edition (2007)
7	Textbook of Industrial Pharmacognosy	A.N. Kalia	CBS Publishers, New Delhi	4th Edition (2005)
8	Pharmacognosy & Pharmaceutical biotechnology.	James Bobbers, Marilyn KS, VE Tylor.	Publisher Williams & Wilkin	1996 Fifth editions
9	Text Book of Biotechnology	Vyas and Dixit. Dubey.	CBS Publication AND DISTRIBUTORS PVT LTD	2007, Eight editions

#### Curriculum Development Team:

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**Course Outcome, Program Specific Outcome& Program Outcome Mapping**

**Course Code: BP504T/BP508P**

**Course Name: Pharmacognosy and Phyto-chemistry-II**

Course Outcome	Program Outcome											Program Specific outcome			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
	Pharmacy knowledge	Planning Abilities	Problem analysis	Modern tool usage	Leadership skills	Professional Identity	Pharmaceutical Ethics	Communication	The pharmacist and society	Environment and sustainability	Life-long learning	Knowledge of drug discovery	Quality Analysis of API's	MOA of Drug	Biological evaluation of drug
<b>CO-1:</b> general technique of biosynthesis of phyto-constituents in plants.	3	2	3	1	3	2	1	2	3	2	3	1	3	1	2
<b>CO-2:</b> Chemistry & chemical classes, bio-sources, therapeutic uses and commercial	2	3	1	3	1	2	1	1	2	3	3	3	2	1	3
<b>CO-3:</b> Accomplished in the Isolation & Identification and Analysis of Phytoconstituents	3	2	3	2	1	1	2	1	2	2	3	3	2	1	3
<b>CO-4:</b> Utilization of phytoconstituents in industrial scale.	2	3	2	3	1	3	2	2	3	3	3	3	2	1	3
<b>CO-5:</b> Analysis of the different phytoconstituents with help of instrument	3	3	1	1	1	3	2	3	1	2	3	2	2	2	2

**Legend: 1- Low, 2-Medium, 3-High**



## Course Curriculum Mapping

Pos& PSOs No	Cos No&	Title	SOs No	Class Room Instructions	Laboratory Instructions	Self learning
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	CO-BP50 4-1	Discuss the general technique of biosynthesis of phytoconstituents in plants.	SO1.1 SO1.2	1.1,1.2,1.3,1.4,1.5,1.6,1.7	LI-1.1	SI-1.1 SI-1.2
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	CO-BP50 4-2	Apprehended the composition, chemistry & chemical classes, bio-sources, therapeutic uses and commercial applications of different plants secondary metabolites.	SO-2.1	2.1,2.2,2.3,2.4,2.5,2.6,2.7, 2.8, 2.9, 2.10, 2.11, 2.12, 2.13,2.14	LI-2.1 LI-2.2 LI-2.3 LI-2.4	SI-2.1 SI-2.2
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	CO-BP50 4-3	Accomplished in the Isolation, Identification and Analysis of Phytoconstituents.	SO-3.1 SO-3.2	3.1,3.2,3.3,3.4,3.5,3.6	LI-3.1	SI3.1
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	CO-BP50 4-4	Accomplished in the production estimation and utilization of phytoconstituents in industrial scale.	SO-4.1 SO-4.2	4.1,4.2,4.3,4.4,4.5,4.6,4.7,4.8. 4.9. 4.10.	LI-4.1 LI-4.2 LI-4.3	SI-4.1
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	CO-BP50 4-5	Accomplished in the estimation and analysis of the different phytoconstituents with help of instrument based on chromatography and spectroscopy.	SO-5.1 SO-5.2	5.1,5.2,5.3,5.4,5.5,5.6,5.7, 5.8	LI-5.1	SI-5.1 SI-5.2





AKS University  
Faculty of Pharmaceutical Science & Technology  
Rajiv Gandhi Institute of Pharmacy  
Curriculum of B. Pharmacy (Pharmaceutical Jurisprudence) Program  
**Semester-V**

**Course Code:** BP505T

**Course Title:** PHARMACEUTICAL JURISPRUDENCE

**Pre-requisite:** Students should have a basic knowledge of important legislations related to the profession of pharmacy in India

**Rationale/Objective s:** Upon completion of the course, the student shall be able to understand:

1. The Pharmaceutical legislations and their implications in the development and marketing of pharmaceuticals.
2. Various Indian pharmaceutical Acts and Laws.
3. The regulatory authorities and agencies governing the manufacture and sale of pharmaceuticals.
4. The code of ethics during the pharmaceutical practice.

**Course Out comes:**

**CO- BP 505.1:** To understand about the Pharmaceutical legislations and their implications in the development and marketing of pharmaceuticals.

**CO- BP 505.2:** To understand about the Various Indian pharmaceutical Acts and Laws.

**CO- BP 505.3:** To understand about the regulatory authorities and agencies governing the manufacture and sale of pharmaceuticals.

**CO- BP 505.4:** To understand about the code of ethics during the pharmaceutical practice.

**CO- BP 505.5:** To understand about the Medical Termination of Pregnancy Act and rights.



## Scheme of Studies

Course code	Title of the course	Program Name	TOTAL Number of contact hours/Week						Credit
			Classroom Instruction (A)		Practical (P)	SW	SL	Total Hours (H)	
			Lecture	Tutorial					
BP505T	Pharmaceutical jurisprudence (Theory)	B. Pharmacy	3	1	0	1	1	6	4

**Legend: CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and dx

**LI:** Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)

**SW:** Sessional Work (includes assignment, seminar, mini project etc.),

**SL:** Self Learning, Credits.

**Note:** SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

## Theory Assessment

Board of Study	Course Code	Course Title	Scheme of Assessment ( Marks )						
			Progressive Assessment ( PRA)						
			Academic activity, Any three (Quiz/ Assignment, open book test, filed work and seminar)	Student teacher interaction	Class Attendance (AT)	(A)  Total Marks	Sessional Exam (B)	End Semester Assessment(C)	Total Marks(A+B+C)
Pharmacy	BP-505T	Pharmaceutical jurisprudence (Theory)	3	3	4	10	15	75	100

## Guidelines for the allotment of marks for attendance

Percentage of Attendance	Theory	Practical
95 – 100	4	2
90 – 94	3	1.5
85 – 89	2	1
80 – 84	1	0.5
Less than 80	0	0



**Course-Curriculum Detailing:**

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

**Unit-1**

**CO-BP505-1: To understand about the Pharmaceutical legislations and their implications in the development and marketing of pharmaceuticals.**

Item	Approx Hrs
Lecture & Tutorial	10+3=13
Practical(P)	0
SW	1
SL	2
Total:	16

Session Outcomes(SOs)	Laboratory Instruction (LI)	Class room Instruction(CI)	Self Learning (SL)
<b>Theory</b> <b>SO1.1:</b> Drugs and Cosmetics Act, 1940 and its rules 1945. <b>SO1.2:</b> Import of drugs – Classes of drugs and cosmetics prohibited from import, Import under License or permit. Offences and penalties. <b>SO1.3:</b> Manufacture of drugs– Prohibition of manufacture and sale of certain drugs, <b>SO1.4:</b> Conditions for grant of license and conditions of license for manufacture of drugs, Manufacture of drugs for test, examination and analysis, manufacture of new drug, loan License and repacking license.	NA	<b>1.1</b> Introduction of Drugs and Cosmetics Act, 1940 and its rules 1945. <b>1.2</b> Objectives and Definitions of Drugs and Cosmetics Act. <b>1.3</b> Legal definitions of schedules to the drug and cosmetics Act and Rules <b>1T.1:</b> Tutorial <b>1.4</b> brief discuss in Import of drugs <b>1.5</b> Classes of drugs and cosmetics prohibited from import, Import under license or permit. <b>1.6</b> Discuss in detail Offences and penalties <b>1T.2:</b> Tutorial <b>1.7</b> Manufacture of drugs and Prohibition of manufacture and sale of certain drugs <b>1.8</b> Conditions for grant of license and conditions of license for manufacture of drugs. <b>1.9</b> Manufacture of drugs for test, examination and analysis. <b>1.10</b> manufacture of new drug, loan license and repacking license <b>1T.3:</b> Tutorial	<b>1.1</b> Drugs and Cosmetics Act, 1940 and its rules 1945 <b>1.2</b> Import of drugs of Offences and penalties.

**Suggested Assignments:**

- Write a note on Conditions for grant of license for manufacture of drugs.



## Unit II

### CO-BP505.2: To understand about the Various Indian pharmaceutical Acts and Laws.

Item	Approx Hrs
Lecture & Tutorial	10+3=13
Practical(P)	0
SW	1
SL	2
Total:	16

Session Outcomes(SOs)	Laboratory Instruction (LI)	Class room Instruction(CI)	Self Learning (SL)
<b>Theory</b> <b>SO2.1:</b> Drugs and Cosmetics Act, 1940 and its rules 1945 <b>SO2.2:</b> Detailed study of Schedule G, H, M, N, P, T, U, V, X, Y, Part XII B, Sch F & DMR (OA) <b>SO2.3:</b> Sale of Drugs – Wholesale, Retail sale and Restricted license. Offences and penalties  <b>SO2.4:</b> Labeling & Packing of drugs- General labeling requirements and specimen labels for Drugs and cosmetics, List of permitted colors. Offences and penalties. <b>SO2.5:</b> Administration of the Act and Rules – Drugs Technical Advisory Board, Central drugs Laboratory, Drugs Consultative Committee, Government drug analysts, Licensing authorities, controlling authorities, Drugs Inspectors	NA	<b>2.1</b> brief introduction of Drugs and Cosmetics Act, 1940 and its rules 1945 <b>2.2</b> Detailed study of Schedule G, H and M <b>2.3</b> Detailed study of Schedule N, P and T <b>2T.1:</b> Tutorial class <b>2.4</b> Detailed study of Schedule U, V, X, Y, Part XII B, Sch F & DMR (OA) <b>2.5</b> Discuss in Sale of Drugs – Wholesale, Retail sale and restricted license. <b>2.6</b> Explain about the Offences and penalties of schedules. <b>2T.2:</b> Tutorial class <b>2.7</b> Labeling & Packing of drugs- General labeling requirements and specimen labels for Drugs and cosmetics. <b>2.8</b> Explain the List of permitted colors of Labeling & Packing of drugs and Offences and penalties. <b>2.9</b> Administration of the Act and Rules – Drugs Technical Advisory Board, Central drugs <b>2.10</b> Laboratory, Drugs Consultative Committee, Government drug analysts, licensing authorities, controlling authorities, Drugs Inspectors. <b>2T.3:</b> Tutorial class	<b>2.1</b> Detailed study of Schedule – H. <b>2.2</b> Detailed study of Schedule M.

### Suggested Assignments:

1. Slandered design of Labeling & Packing of drugs and cosmetic product.



### Unit III

**CO-- BP 505.3:** To understand about the regulatory authorities and agencies governing the manufacture and sale of pharmaceuticals.

Item	Approx Hrs
Lecture & Tutorial	11+3=14
Practical(P)	0
SW	1
SL	2
Total:	17

Session Outcomes(SOs)	Laboratory Instruction (LI)	Class room Instruction(CI)	Self Learning(SL)
<b>Theory</b> <b>SO3.1 Pharmacy Act –1948:</b> Objectives, Definitions, Pharmacy Council of India; its constitution and functions, <b>SO3.2 Medicinal and Toilet Preparation Act – 1955:</b> Objectives, , Licensing, Manufacture In bond and Outside bond, <b>SO3.3 Narcotic Drugs and Psychotropic substances Act-1985 and Rules:</b> Objectives, Definitions, Authorities and Officers, Constitution and Functions of narcotic & Psychotropic	NA	3.1 Brief introduction of Pharmacy Act –1948 3.2 Objectives and Definitions of Pharmacy Council of India. 3.3 Its constitution and functions, Education Regulations, State and Joint state pharmacy councils. 3.4 Constitution and functions, Registration of Pharmacists, Offences and Penalties. <b>3T.1:</b> Tutorial class 3.5 Brief introduction of Medicinal and Toilet Preparation Act –1955 3.6 Objectives and Definitions of Licensing and Manufacture In bond and Outside bond 3.7 Export of alcoholic preparations and Manufacture of Ayurvedic and Homeopathic product. <b>3T.2:</b> Tutorial class 3.8 Explain the Patent & Proprietary Preparations. 3.9 Narcotic Drugs and Psychotropic substances Act- 1985 and Rules. 3.10 Objectives, Definitions, Authorities and Officers, Constitution and Functions of narcotic & Psychotropic Consultative Committee. 3.11 National Fund for Controlling the Drug Abuse, Prohibition, Control and Regulation, opium poppy cultivation and production of poppy straw, manufacture, sale and export of opium, Offences and Penalties. <b>3T.3 :</b> Tutorial class	3.1 Learn about <b>Pharmacy Act – 1948 and Registration</b> of Pharmacists.  3.2 Learn about <b>Narcotic Drugs and Psychotropic substances Act-1985 and Rules.</b>

### Suggested Assignments:

1. Definitions, Authorities and function of narcotic & psychotropic preparation.



**Unit IV:****CO- BP 505.4:** To understand about the code of ethics during the pharmaceutical practice

Item	Approx Hrs
Lecture & Tutorial	10+3=13
Practical(P)	0
SW	1
SL	2
Total:	16

Session Outcomes(SOs)	Laboratory Instruction (LI)	Class room Instruction(CI)	Self Learning (SL)
<b>Theory</b> <b>SO4.1: Study of Salient Features of Drugs and Magic Remedies Act and its rules:</b> Objectives, Definitions, Prohibition of certain advertisements, <b>SO4.2: Prevention of Cruelty to animals Act-1960:</b> Objectives, Definitions, Institutional Animal Ethics Committee, CPCSEA guidelines <b>SO4.3: National Pharmaceutical Pricing Authority:</b> Drugs Price Control Order (DPCO)- 2013. Objectives, Sale prices of bulk drugs	NA	<b>4.1</b> To Study of Salient Features of Drugs and Magic Remedies Act and its rules. <b>4.2</b> Objectives, Definitions and Prohibition of certain of Drugs and Magic Remedies Act. <b>4.3</b> explain the Prevention of Cruelty to animals Act- 1960. <b>4T.1:</b> Tutorial class <b>4.4 :</b> Objectives, Definitions, Institutional Animal Ethics Committee <b>4.5</b> CPCSEA guidelines for Breeding and Stocking of Animals, Performance of Experiments. <b>4.6</b> Transfer and acquisition of animals for Experiment, Records, Power to suspend or revoke registration. <b>4.7</b> National Pharmaceutical Pricing Authority of Drugs Price Control Order (DPCO) <b>4T.2:</b> Tutorial class <b>4.8</b> Objectives and Definitions of Sale prices of bulk drugs. <b>4.9</b> Retail price of formulations and ceiling price of scheduled formulations. <b>4.10</b> discuss in detail about National List of Essential Medicines (NLEM). <b>4T.3:</b> Tutorial class	<b>4.1</b> To detail the Study of Salient Features of Drugs and Magic Remedies Act and its Rules. <b>4.2</b> discuss in detail National Pharmaceutical Pricing Authority of Drugs Price Control Order (DPCO).

**Suggested Assignments:**

1. Write notes on National List of Essential Medicines (NLEM).
2. Write notes on CPCSEA guidelines for Breeding and Stocking of Animals.



## Unit-5

**CO- BP 505.5:** To understand about the Medical Termination of Pregnancy Act and rights.

Item	Approx Hrs
Lecture & Tutorial	10+3=13
Practical(P)	0
SW	1
SL	2
Total:	16

Session Outcomes(SOs)	Laboratory Instruction (LI)	Class room Instruction(CI)	Self Learning(SL)
<b>Theory</b> <b>SO5.1: Pharmaceutical Legislations</b> – A brief review, Introduction, Study of drugs enquiry Committee. <b>SO5.2: Code of Pharmaceutical ethics</b> Definition, Pharmacist in relation to his job, profession, Pharmacist's oath <b>SO5.3: Medical Termination of Pregnancy Act</b> <b>SO5.4: Right to Information Act</b> <b>SO5.5: Introduction to Intellectual Property Rights (IPR)</b>	NA	<b>5.1</b> brief introduction Pharmaceutical Legislations. <b>5.2</b> A brief review, Introduction, Study of drugs enquiry committee. <b>5.3</b> Health survey and development committee. <b>5T.1:</b> Tutorial class <b>5.4</b> Hathi committee and Mudaliar committee. <b>5.5</b> Code of Pharmaceutical ethics. <b>5.6</b> Definition of Pharmacist in relation to his job, trade, medical profession and his profession. <b>5T.2:</b> Tutorial class <b>5.7</b> Pharmacist's oath <b>5.8</b> Medical Termination of Pregnancy Act <b>5.9</b> Right to Information Act <b>5.10</b> Introduction to Intellectual Property Rights (IPR) <b>5T.3:</b> Tutorial class	<b>5.1</b> Introduction to Intellectual Property Rights (IPR). <b>5.2</b> To understand about the Medical Termination of Pregnancy Act.

### Suggested Sessional work

**Assignments:** 1. Write a notes on Medical Termination of Pregnancy Act.



### Brief of Hours suggested for the Course Outcome

Course Out comes	Class Lecture (CI)	(LI)	Sessional Work (SW)	Self Learning (SI)	Total Hour (CI+SW+ SI+LI)
<b>CO-BP501</b> To understand about the Pharmaceutical legislations and their implications in the development and marketing of pharmaceuticals.	13	0	1	2	16
<b>CO BP 505.2</b> To understand about the Various Indian pharmaceutical Acts and Laws.	14	0	1	2	17
<b>CO- BP 505.3</b> To understand about the regulatory authorities and agencies governing the manufacture and sale of pharmaceuticals	13	0	1	2	16
<b>CO- BP 505.4</b> To understand about the code of ethics during the pharmaceutical practice.	13	0	1	2	16
<b>CO- BP 505.5</b> To understand about the Medical Termination of Pregnancy Act and rights	13	0	1	2	16
<b>Total Hours</b>	66	0	5	10	81



**Suggestion for End Semester Assessment**  
Suggested Specification Table (For ESA)

Course Outcome	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
<b>CO-BP505.1</b>	To understand about the Pharmaceutical legislations and their implications in the development and marketing of pharmaceuticals	08	06	01	15
<b>CO-BP505.2</b>	To understand about the Various Indian pharmaceutical Acts and Laws.	12	07	01	20
<b>CO-BP505.3</b>	To understand about the regulatory authorities and agencies governing the manufacture and sale of pharmaceuticals	02	06	02	10
<b>CO-BP505.4</b>	To understand about the code of ethics during the pharmaceutical practice.	10	02	03	15
<b>CO-BP505.5</b>	To understand about the Medical Termination of Pregnancy Act and rights	05	07	03	15
<b>Total</b>		<b>37</b>	<b>28</b>	<b>10</b>	<b>75</b>

**Legend: R: Remember, U: Understand, A: Apply**

The end of semester assessment for will be pharmaceutical jurisprudence held with written examination of 75 marks.

**Note.** Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks.

Teachers can also design different tasks as per requirement, for end semester assessment.

**Suggested Instructional/Implementation Strategies:**

1. Improved Lecture
2. Tutorial
3. Case Method
4. Group Discussion
5. Role Play
6. Demonstration
7. ICT Based Teaching Learning (Video Demonstration/Tutorials CBT, Blog, Face book, Twitter, Whats app, Mobile, Online sources)
8. Brainstorming



### Suggested Learning Resources:

S. No.	Title	Author	Publisher	Edition & Year
1	Forensic Pharmacy	DR. B. Suresh	Birla publication	4 <sup>th</sup> edition 1 January 2017
2	Text book of Forensic Pharmacy	B.M. Mithal	Vallabh prakashn, New Delhi	2 <sup>nd</sup> edition 1988
3	Hand book of drug law	M.L. Mehra	Lea & Febiger; Subsequent edition _	3 <sup>rd</sup> editions June 1992
4	A text book of Forensic Pharmacy	N.K. Jain	Vallabh prakashan	edition 2017
5	Drugs and Cosmetics Act/Rules	Govt. of India	Govt. of India publications	31 december 2016
6	Medicinal and Toilet preparations act 1955	Dr LN prasanthi	Govt. of India publications.	Six rdion4 october 2018
7	Narcotic drugs and psychotropic substances act	Bidyut kumar banerjee	Govt. of India publications	3 <sup>rd</sup> edition Reprint 2023
8	Drugs and Magic Remedies act	Govt. of India publication	Govt. of India publication	2024
9	Bare Acts of the said laws	Government. Reference books	Government. Reference books	2024

### Curriculum Development Team:

1. **Prof. SP Gupta**, Director, RGIP, AKS University
2. **Mr. Satyendra Garg** , Assistant professor, RGIP, AKS University
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**Course Outcome, Program Specific Outcome& Program Outcome Mapping**

**Course Code: BP505T**

**Course Name: Pharmaceutical jurisprudence**

Course Outcome	Program Outcome											Program Specific outcome			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
	Pharmacy knowledge	Planning Abilities	Problem analysis	Modern tool usage	Leadership skills	Professional Identity	Pharmaceutical Ethics	Communication	The pharmacist and society	Environment and sustainability	Life-long learning	Knowledge of drug discovery	Quality Analysis of API's	MOA of Drug	Biological evaluation of drug
<b>CO-1:</b> Pharmaceutical legislations implications in the development and marketing	3	2	3	1	3	2	1	2	3	2	3	1	3	1	2
<b>CO-2:</b> Various Indian pharmaceutical Acts and Laws.	2	3	1	3	1	2	1	1	2	3	3	3	2	1	3
<b>CO-3:</b> The regulatory authorities and agencies governing the manufacture and sale of pharmaceuticals.	3	2	3	2	1	1	2	1	2	2	3	3	2	1	3
<b>CO-4:</b> The code of ethics during the pharmaceutical practice.	2	3	2	3	1	3	2	2	3	3	3	3	2	1	3
<b>CO-5:</b> Medical Termination of Pregnancy Act and rights.	3	3	1	1	1	3	1	3	1	2	3	2	2	2	2



### Course Curriculum Mapping

Pos& PSOs No	Cos No&	Title	SOs No	Class Room Instructions	Laboratory Instructions	Self learning
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	<b>CO-BP50 5-1:</b>	To understand about the Pharmaceutical legislations and their implications in the development and marketing of pharmaceuticals.	SO1.1 SO1.2 SO1.3 SO1.4	1.1,1.2,1.3,1.4,1.5,1.6,1.7,1.8,1.9,1.10	-	SI-1.1 SI-1.2
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	<b>CO-BP50 5-2:</b>	To understand about the Various Indian pharmaceutical Acts and Laws.	SO-2.1 SO-2.2 SO-2.3 SO-2.4 SO-2.5	2.1,2.2,2.3,2.4,2.5,2.6,2.7,2.8,2.9,2.10	-	SI-2.1 SI-2.2
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	<b>CO-BP50 5-3:</b>	To understand about the regulatory authorities and agencies governing the manufacture and sale of pharmaceuticals.	SO-3.1 SO-3.2 SO-3.3 SO-3.4	3.1,3.2,3.3,3.4,3.5,3.6,3.7,3.8,3.9,3.10	-	SI-3.1 SI-3.2
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	<b>CO-BP50 5-4:</b>	To understand about the code of ethics during the pharmaceutical practice.	SO-4.1 SO-4.2 SO-4.3	4.1,4.2,4.3,4.4,4.5,4.6,4.7,4.8, 4.9, 4.10	-	SI-4.1 SI-4.2
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	<b>CO-BP505 -5:</b>	To understand about the Medical Termination of Pregnancy Act and rights.	SO-5.1 SO-5.2 SO-5.3 SO-5.4 SO-5.5	5.1,5.2,5.3,5.4,5.5,5.6,5.7,5.8,5.9,5.10	-	SI-5.1 SI-5.2





AKS University  
Faculty of Pharmaceutical Science & Technology  
Rajiv Gandhi Institute of Pharmacy  
Curriculum of B. Pharmacy Medicinal Chemistry-III) Program  
(Revised as on 01August2023)

**Semester-VI**

**Course Code:** BP601T/ BP607P

**Course Title:** Medicinal Chemistry-III

**Pre-requisite:** Student should have basic knowledge about medicinal & synthetic chemistry.

**Rationale/Objectives:**

Up on completion of the course student shall be able to

- 1 Understand the importance of drug design and different techniques of drug design.
- 2 Understand the chemistry of drugs with respect to their biological activity.
- 3 Know the metabolism, adverse effects and therapeutic value of drugs.
- 4 Know the importance of SAR of drugs.

**Course Outcomes:**

**CO-BP601.1.** To recall the classification and nomenclature of drugs of natural and synthetic origin

**COBP601.2:** To explain the concept of pro-drugs and their importance

**CO-BP601.3:** To identify the mechanism of action and therapeutic uses of drugs

**CO-BP601.4:** To understand the relationship between structure of compound and its biological activity and to choose the synthetic out for selected category of drugs

**CO-BP 601.5:** To discuss the approaches in drug design including QSAR, pharmacophore modeling, docking and combinatorial chemistry.



### Scheme of Studies

:Course code	Title of the course	Program Name	TOTAL Number of contact hours/Week						Credit
			Classroom Instruction(A)		Practica l(P)	SW	SL	Total Hours (H)	
			Lecture	Tutorial					
BP601T	Medicinal Chemistry -III	B. Pharmacy	3	1	4	1	1	10	6

**Legend CI:** Class room Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial(T) and other,

**LI: Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other location using different instructional strategies)**

**SW: Sessional Work** (includes assignment, seminar, mini-project etc.),

**SL:** Self Learning, Credits.

**Note:** SW&SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

### Theory Assessment

Board of Study	Course Code	Course Title	Scheme of Assessment(Marks)						
			Progressive Assessment(PRA)						
			Academic activity, Any three (Quiz/Assignment, open book test, filed work and seminar)	Studentteacherinteraction	Class Attendance(AT)	(A) Total Marks	SessionalExam(B)	EndSemesterAssessment(C)	Total Marks(A+B+C)
Pharmacy	BP601T	Medicinal-Chemistry-III	3	3	4	10	15	75	100



## Practical Assessment

Board of Study	Course Code	Course Title	Scheme of Assessment(Marks )						
			Internal Assessment (A)			End Semester Examination(B)			Total Marks (A+B)
			Attendance	Record	Sessional Exam.	Synopsis	Experiment	Viva	
Pharmacy	BP601T	Medicinal Chemistry-III	2	3	10	5	25	5	50

### Guidelines for the allotment of marks for attendance

Percentage of Attendance	Theory	Practical
95–100	4	2
90–94	3	1.5
85–89	2	1
80–84	1	0.5
Less than 80	0	0



**Course-Curriculum Detailing:**

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) up on the course's conclusion.

**CO-BP601.1.** To recall the classification and nomenclature of drugs of natural and synthetic origin

Item	Approx Hrs
Lecture & Tutorial	10+3=13
Practical(P)	1
SW	1
SL	1
Total:	16

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction(CI)	Self Learning (SL)
<b>Theory</b> <b>SO1.1</b> Understand the Historical background & Nomenclature of antibiotics <b>SO1.2</b> Learn about the Structure activity relationship. <b>SO1.3</b> learn about the Chemical degradation classification of antibiotics. <b>SO1.4</b> Understand about the $\beta$ - Lactam antibiotics: <b>SO1.5</b> underst and about the Amino-glycosides. <b>Practical</b> <b>SO-P-2.1 :-</b> To prepare and submit Sulphanilamide.	<b>1.1</b> To prepare and submit Sulphanila mide.	1.1 Historical background & Nomenclature of antibiotics 1.2 Basic concept of SAR 1.3 classifications of antibiotics. 1T1 Tutorial Class 1.4 Beta- Lactum antibiotics Concept 1.5 Mono- Lactum antibiotics Concept 1.6. Amino Glycosides 1T2 Tutorial Class 1.7 Tetracycline's & Oxytetracyclines 1.8 Hetrocyclines & Aminocyclines 1.9 Sulphonamides 1T3 Tutorial Class 1.10 Doxycyclines & Mino cyclones	<b>1.1</b> Historical development of antibiotic Historical background, <b>1.2</b> Nomenclature.

**Suggested Assignments:**

1. What are antibiotics ? Classify them.
2. What are  $\beta$ -Lactam antibiotics ? Discuss about the Penicillin in detail.
3. What are  $\beta$ -Lactam antibiotics? Discuss about the cephalosporin's in detail.

**Mini-Projects:**

- Write in short about  $\beta$ -Lactamase inhibitors.



## Unit-II

**CO-BP601.2.** To explain the concept of pro-drugs and their importance.

Item	Approx Hrs
Lecture & Tutorial	10+3=13
Practical(P)	4
SW	1
SL	1
Total:	19

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
<b>Theory</b> <b>SO2.1:</b> Understand about the concept of malaria & its treatments  <b>SO2.2:</b> Understand about the concept of prodrugs & its applications <b>Practical</b> <b>SO-P-2.1:</b> 7-Hydroxy, 4-methyl coumarin. <b>SO-P-2.2:</b> Drawing structures and reactions using chem. draw®. <b>SO-P-2.3:</b> Assay of drugs Dapsone, Chlorpheniramine, maleate, Benzyl penicillin.	2.1 Preparation of 7-Hydroxy, 4-methyl coumarin 2.2 Drawing structures and reactions using chem draw. 2.3 Assay of drugs Dapsone, Chlorpheniramine, maleate, Benzyl penicillin.	<b>2.1 Antibiotics</b> Historical background, Nomenclature, Stereo-chemistry, Structure activity relation-ship, Chemical degradation classification and important products of the following classes <b>2.2 Macrolide:</b> Erythromycin, Clarithromycin, Azithromycin. <b>2.3 Miscellaneous:</b> Chloramphenicol, Clindamycin. <b>2.4 Prodrugs:</b> Basic concepts and application of prodrugs design. <b>2T.1:</b> Tutorial Class <b>2.5 Antimalarials-</b> Etiology of malaria. <b>2.6 Quinolines:</b> SAR, Quinine sulphate, Chloroquine* <b>2.7 Amodiaquine,</b> Primaquine phosphate, <b>2T.2:</b> Tutorial <b>2.8 Pamaquine*,</b> Quinacrine hydrochloride, Mefloquine. <b>2.9 Biguanides and dihydro triazines:</b> Cycloguanil pamoate, Proguanil. <b>2.10 Miscellaneous:</b> Pyrimethamine, Artesunate, Artemether, Atovaquone. <b>2T.3:</b> Tutorial	2.1 Concept of malarial & its cycle  2.2 Prodrugs concept



### Suggested Assignments:

1. Discuss about the Macrolide: Erythromycin Clarithromycin, Azithromycin.
2. Explain Pro-drugs: Basic concepts and application of prodrugs design.

### Unit-III

**CO-BP601.3:** To identify the mechanism of action and the therapeutic uses of drugs.

Item	Approx Hrs
Lecture & Tutorial	10+3=13
Practical(P)	4
SW	1
SL	2
Total:	20

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self Learning (S)
<b>Theory</b> <b>SO3.1</b> Understand about the Tuberculosis & its treatments. <b>SO3.2</b> Learn about the synthesis of anti-tubercular agents. <b>SO3.3</b> Learn about the Urinary-tract anti-infective <b>SO3.4</b> Understand about the virus, life-cycle & anti-viral Agents. <b>Practical</b> <b>SO-P-3.1:</b> Preparation of Chlorobutanol.	3.1 To prepare and submit Chlorobutanol.	<b>3.1 Antitubercular Agents-</b> Synthetic anti tubercular agents: Isoniazid*. <b>3.2</b> Ethionamide, Ethambutol, Pyrazinamide, Para amino salicylic acid. <b>3.3</b> Anti tubercular antibiotics: Rifampicin, Rifabutin, Cycloserine Streptomycin, Capreomycin sulphate. <b>3T.1:</b> Tutorial <b>3.4</b> Urinary tract anti-infective agents Quinolones: SAR of quinolones, Nalidixic Acid, Norfloxacin, Enoxacin, Ciprofloxacin*, <b>3.5</b> Ofloxacin, Lomefloxacin, Sparfloxacin, Gatifloxacin, Moxifloxacin <b>3.6</b> Miscellaneous: Furazolidine, Nitrofurantoin*, Methanamine. <b>3T.2:</b> Tutorial <b>3.7</b> Antiviral agents: Amantadine hydrochloride, Rimantadine hydrochloride, <b>3.8</b> Idoxuridine trifluoride, Acyclovir*, <b>3.9</b> Gancyclovir, Zidovudine, Didanosine, Zalcitabine, Lamivudine, Zalcitabine, Zalcitabine, Zalcitabine, <b>3.10</b> Delavirdine, Ribavirin, Saquinavir, Indinavir, Ritonavir. <b>3T.3:</b> Tutorial	1 Comparative study of capsule and tablets. 2 production of hard gelatin capsule and soft gelatin capsule

### Suggested Assignments:

1. Production of hard gelatin capsule and capsule shell their size



**Unit IV: CO-BP601.4.** To understand the relationship between structure of compound and its biological activity and to choose the synthetic route for selected category of drugs.

Item	Approx Hrs
Lecture & Tutorial	10+3=13
Practical(P)	4
SW	1
SL	2
Total:	20

Session Outcomes(SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
<b>Theory</b> <b>SO4.1:</b> Learn about the antifungal antibiotics. <b>SO4.2:</b> Understand about the chemical structures & synthesis of antifungal agents. <b>SO4.3:</b> Learn about the protozoals & its treatments. <b>SO4.4:</b> Understand about the anthelmintics. <b>Practical</b> <b>SO-P-4.1:</b> Preparation of Triphenyl imidazole. <b>SO-P-4.2:</b> Assay of Is nicotinic acid hydrazine.	4.1 To prepare and submit of Triphenyl imidazole. <b>4.2:</b> Assay of Is nicotinic acid hydrazine.	4.1 Antifungal agents: Antifungal antibiotics: Amphotericin-B, Misstating, Natamycin, Griseofulvin. 4.2 Synthetic Antifungal agents: Clotrimazole, Econazole, Butoconazole, Oxiconazole Tioconazole, Miconazole*, Ketoconazole, Terconazole, Itraconazole, Fluconazole, Naftifine hydrochloride, Tolnaftate*. 4.3 Anti-protozoal Agents: Metronidazole*, Tinidazole, Ornidazole, Diloxanide, Iodoquinol, Pentamidine Isethionate, Atovaquone, Eflornithine. <b>4T.1:</b> Tutorial 4.4 Anthelmintics: Diethylcarbamazine citrate*, Thiabendazole, Mebendazole*, Albendazole, Niclosamide, Oxamniquine, Praziquantal, Ivermectin. Sulphonamides and Sulfones Historical development, chemistry, classification and SAR of 4.5 Sulfonamides: Sulphamethizole, Sulfisoxazole, Sulphamethizine, Sulfacetamide*, Sulphapyridine, Sulfamethoxazole*, <b>4T.2:</b> Tutorial 4.6 Sulphadiazine, Mefenide acetate, Sulfasalazine. 4.7 Folate reductase inhibitors: Trimethoprim*, Cotrimoxazole. 4.8 Sulfones: Dapsone*. <b>4T.3:</b> Tutorial	<b>4.1</b> Learn about fungal & its treatments <b>4.2</b> About-anthelmintics.

### Suggested Assignments

1. Discuss about the anti-fungal agents with their chemical structures.
2. Classify anti-protozoal agents with their chemical structures & give the synthesis of anyone.
3. Classify anthelmintics with their chemical structures & give the synthesis of anyone.



## Unit V

**CO-BP 601.5.** To discuss the approaches in drug design including QSAR, pharmacophore modeling, docking and combinatorial chemistry.

Item	Approx Hrs
Lecture & Tutorial	10+3=13
Practical(P)	4
SW	1
SL	1
Total:	19

Session Outcomes(SOs)	Laboratory Instruction(LI)	Class room Instruction(CI)	Self Learning(SL)
<b>Theory</b> <b>SO5.1:</b> Understand about the basic concepts of drug design <b>SO5.2:</b> Understand about the combinatorial chemistry  <b>Practical</b> <b>SO-P-5.1:</b> Preparation of Tolbutamide, Hexamine.  <b>SO-P-5.2:</b> Assay of Chloroquine, Metronidazole.	.1 preparation of Triphenyl imidazole preparation of nicotinic acid hydrazine	Introduction to Drug Design Various approaches used in drug design. Physicochemical parameters used in quantitative structure activity relationship (QSAR) such as partition coefficient, <b>5T.1:</b> Tutorial Hammer's electronic parameter, Tafts steric parameter and Hansch analysis. Pharmacophore modeling and docking techniques. <b>5T.2:</b> Tutorial Combinatorial Chemistry: Concept and applications of combinatorial chemistry: solid phase solution phase synthesis. <b>5T.3:</b> Tutorial	<b>5.1:</b> Physico-chemical parameters used in quantitative structure activity relationship(QSAR) <b>5.2 Combinatorial Chemistry:</b> Concept and applications chemistry.

### **Suggested Sessional work Assignments:**

1. Various approaches used in drug design.
2. Discuss about the concept of combinatorial chemistry with its applications.



### Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture(CI)	(L)	Sessional Work (SW)	Self Learning (SI)	Total Hour (CI+SW+ SI+LI)
<b>COBP601.1.</b> To recall the classification and nomenclature of drugs of natural and synthetic origin	13	1	1	1	16
<b>COBP601.2.</b> To explain the concept of prodrugs and the importance.	13	2	1	1	18
<b>CO-BP601.3.</b> To identify the Mechanism of action and therapeutic uses of drugs	13	1	1	2	17
<b>COBP601.4.</b> To understand the relationship between structure of compound and its biological activity and to choose the synthetic route for selected category of drugs.	13	3	1	2	18
<b>CO-BP 601.5.</b> To discuss the approaches in drug design including QSAR, pharmacophore modeling, docking and combinatorial chemistry.	13	2	1	1	17
<b>Total Hours</b>	65	11	5	7	88



**Suggestion for End Semester Assessment**  
Suggested Specification Table (For ESA)

Course Outcome	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
<b>CO-BP502-1:</b>	To recall the classification and nomenclature of drugs of natural and synthetic origin	08	06	01	15
<b>CO-BP502-2</b>	To explain the concept of pro-drugs and their importance.	12	07	01	20
<b>CO-BP502-3</b>	To identify the mechanism of action and therapeutic uses of drugs.	02	06	02	10
<b>CO-BP502-4:</b>	To understand the relationship between structure of compound and its biological activity and to choose the synthetic route for selected category of drugs.	10	02	03	15
<b>CO-BP502-5:</b>	To discuss the approaches in drug design including QSAR, pharmacophore modeling, docking and combinatorial chemistry.	05	07	03	15
<b>Total</b>		<b>37</b>	<b>28</b>	<b>10</b>	<b>75</b>

**Legend: R: Remember, U: Understand, A: Apply**

The end of semester assessment for Medicinal Chemistry-III will be held with written examination of 75 marks

**Note.** Detailed assessment rubric need to be prepared by the course wise teachers for above tasks. Teachers can also design different tasks as per requirement, for end semester assessment.

**Suggested Instructional/Implementation Strategies:**

1. Improved Lecture
2. Tutorial
3. Case Method
4. Group Discussion
5. Role Play
6. Demonstration
7. ICT Based Teaching Learning (Video Demonstration/Tutorials CBT, Blog, Face book, Twitter, Whats app, Mobile, Online sources)
8. Brainstorming



## Suggested Learning Resources:

S.No.	Title	Author	Publisher	Edition & Year
1	Organic medicinal and Pharmaceutical Chemistry	Wilson and Giswold's	Wolters Kluwer India Pvt.Ltd.	12 <sup>th</sup> edition 1 January 2010
2	Principles of Medicinal Chemistry	Foye's	Lippincott Williams & Wilkins	7 <sup>th</sup> edition 2012
3	Medicinal Chemistry	Burger's	Wiley_	8 <sup>th</sup> edition 22 April 2021
4	Introduction to principles of drug design	Smith and Williams	Taylor & Francis Ltd	4 <sup>th</sup> edition 2022
5	Pharmaceutical Sciences	Remington's	Elsevier excusive	23 <sup>rd</sup> edition 2021
6	Extra pharmacopoeia	Martindale's	Pharmaceutical press	40 <sup>th</sup> edition May 2020
7	Organic Chemistry	I.L.Finar	Pearson Education India	6 <sup>th</sup> edition 2002
8	The Organic Chemistry of Drug Synthesis.	Lednicer	Wiley	2007
9	Indian Pharmacopoeia.	-	-	9 <sup>th</sup> edition 2022
10	Text book of practical organic chemistry	A.I.Vogel	Pearson India	5 <sup>th</sup> edition 2003

### Curriculum Development Team:

1. **Prof. SP Gupta**, Director, RGIP, AKS University
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**Course Outcome, Program Specific Outcome& Program Outcome Mapping**

Course Code: BP601T/ BP607P

Course Name: Medicinal Chemistry-III

Course Outcome	Program Outcome											Program Specific outcome			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
	Pharmacy knowledge	Planning Abilities	Problem analysis	Modern tool usage	Leadership skills	Professional Identity	Pharmaceutical Ethics	Communication	The pharmacist and society	Environment and sustainability	Life-long learning	Knowledge of drug discovery	Quality Analysis of API's	MOA of Drug	Biological evaluation of drug
<b>CO-1:</b> Drugs of natural and synthetic origin	3	2	3	1	3	2	1	2	3	2	3	1	3	1	2
<b>CO-2:</b> Pro-drugs and their importance	2	3	1	3	1	2	1	1	2	3	3	3	2	1	3
<b>CO-3:</b> To identify the mechanism of action and therapeutic uses of drugs	3	2	3	2	1	1	2	1	2	2	3	3	2	1	3
<b>CO-4:</b> Synthetic route for selected category of drugs.	2	3	2	3	1	3	2	2	3	3	3	3	2	1	3
<b>CO-5:</b> QSAR, pharmacophore modeling, docking	3	3	1	1	1	3	1	3	1	2	3	2	2	2	2

**Legend: 1- Low, 2-Medium, 3-High**



### Course Curriculum Mapping

Pos& PSOs No	Cos No&	Title	SOs No	Class Room Instructions	Laboratory Instructions	Self learning
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	<b>CO-BP60 1.1</b>	To recall the classification and nomenclature of drugs of natural and synthetic origin	SO1.1 SO1.2 SO1.3 SO1.4 SO1.5	1.1,1.2,1.3,1.4,1.5,1.6,1.7,1.8,1.9,1.10	LI-1.1	SI-1.1
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	<b>CO-BP60 1.2</b>	To explain the concept to pro-drugs and their importance.	SO-2.1 SO-2.2 SO-2.3 SO-2.4 SO-2.5	2.1,2.2,2.3,2.4,2.5,2.6,2.7,2.8,2.9,2.10	LI-2.1 LI-2.2 LI-2.3	SI-2.1 SI-2.2
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	<b>CO-BP60 1.3</b>	To identify the mechanism of action and therapeutic uses of drugs.	SO-3.1 SO-3.2 SO-3.3 SO-3.4 SO-3.5	3.1,3.2,3.3,3.4,3.5,3.6,3.7,3.8,3.9,3.10	LI-3.1	SI-3.1 SI-3.2
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	<b>CO-BP60 1.4</b>	To understand the relationship between structure of compound and its biological activity and to choose the synthetic route for selected category of drugs.	SO-4.1 SO-4.2 SO-4.3 SO-4.4 SO-4.5	4.1,4.2,4.3,4.4,4.5,4.6,4.7,4.8.	LI-4.1 LI-4.2	SI-4.1 SI-4.2
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	<b>CO-BP60 1.5</b>	To discuss the approaches in drug design including QSAR, pharmacophore modeling, docking and combinatorial chemistry.	SO-5.1 SO-5.2 SO-5.3 SO-5.4 SO-5.5	5.1,5.2,5.3,5.4,5.5,5.6,5.7.	LI-5.1 LI-5.2	SI-5.1 SI-5.2





AKS University  
Faculty of Pharmaceutical Science & Technology  
Rajiv Gandhi Institute of Pharmacy  
Curriculum of B. Pharmacy (Pharmacology III) Program  
(Revised as on 01August2023)

**Semester-VI**

**Course Code:** BP602T & BP608P

**Course Title:** Pharmacology III

**Pre-requisite:** The Student should have basic knowledge on various aspects of drugs acting on respiratory and gastrointestinal system,

**Rationale/ Objectives:**

1. Understand the mechanism of drug action and its relevance in the treatment of different infectious diseases.
2. comprehend the principles of toxicology and treatment of various poisonings
3. Appreciate correlation of pharmacology with related medical sciences.

**Course Out comes:**

**CO- BP602-1:** To understand the Pharmacology of drugs acting on Respiratory system& Gastrointestinal Tract

**CO- BP602-2:** To know the various principles of chemotherapy& various drugs used for the treatment of bacterial infections.

**CO- BP602-3:** To know the various chemotherapeutics agents for treatment of tuberculosis, leprotic, viral, fungal infections & malignancy along with Immune pharmacology of drugs.

**CO- BP602-4:** To know the drugs used for the treatment of urinary tract infections, sexually transmitted diseases.

**CO- BP602-5:** To understand the Principles of toxicology &Chrono pharmacology.



## Scheme of Studies

Cour se code	Title of the course	Program Name	TOTAL Number of contact hours/Week						Credit
			Classroom Instruction (A)		Practical  (P)	SW	SL	Total Hours (H)	
			Lectu re	Tuto rial					
BP60 2	Pharmacol ogy III (Theory)	B. Pharmacy	3	1	4	1	1	10	6

### Legend:

**CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others),

**LI:** Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)

**SW:** Sessional Work (includes assignment, seminar, mini project etc.),

**SL:** Self Learning, Credits.

**Note:** SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

### Theory Assessment

Board of Study	Course Code	Course Title	Scheme of Assessment ( Marks )						
			Progressive Assessment ( PRA)						
			Academic activity, Any three (Quiz/ Assignment, open book test, filed work and seminar)	Student teacher interaction	Class Attendance(AT)	(A)  Total Marks	Sessional Exam (B)	End Semester Assessment (C)	Total Marks(A+B+C)
Pharmacy	BP602	Pharmacology III (Theory)	3	3	4	10	15	75	100



### Practical Assessment

Board of Study	Course Code	Course Title	Scheme of Assessment ( Marks )						
			Internal Assessment (A)			End Semester Examination(B)			Total Marks (A+B)
			Attendance	Record	Sessional Exam.	Synopsi s	Experimen t	Viva	
Pharmacy	BP608	Pharmacology III (Theory)	2	3	10	5	25	5	50

### Guidelines for the allotment of marks for attendance

Percentage of Attendance	Theory	Practical
95 – 100	4	2
90 – 94	3	1.5
85 – 89	2	1
80 – 84	1	0.5
Less than 80	0	0

### Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

### CO-BP602-1: To understand the Pharmacology of drugs acting on Respiratory system& Gastrointestinal Tract

Item	Approx Hrs
Lecture & Tutorial	10+3=13
Practical(P)	16
SW	1
SL	1
Total:	31



Session Outcomes(SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
<b>Theory</b> <b>SO1.1: 1.</b> Pharmacology of drugs acting on Respiratory system <b>SO1.2:</b> Pharmacology of drugs acting on the Gastrointestinal Tract <b>Practical</b> <b>SO-P- 1.1:</b> Comparison of ulcer index between study groups estimates the potency of antiulcer activity of test drug. <b>SO-P- 1.2:</b> Study of effect of drugs on gastrointestinal motility	<b>1.1:</b> Study of anti-ulcer activity of a drug using pylorus ligand (SHAY) rat model and NSAIDS induced ulcer model.  <b>1.2:</b> Study of effect of drugs on gastrointestinal motility	<b>1.1:</b> Anti -asthmatic drugs with Classifications <b>1.2</b> Drugs used in the management of COPD <b>1.3</b> Expectorants and antitussives <b>1.4:</b> Nasal Decongestants <b>1T1: Tutorial Class</b> <b>1.5</b> Respiratory stimulants <b>1.6</b> Antiulcer agents <b>1.7</b> Drugs for constipation and diarrhoea. <b>1.8:</b> Appetite stimulants and suppressants. <b>1T2: Tutorial Class</b> <b>1.9:</b> Digestants and carminatives <b>1.10:</b> Emetics and anti-emetics. <b>1T3: Tutorial Class</b>	<b>1.1:</b> Pathophysiology Asthama & COPD  <b>1.2:</b> Pathophysiology of Gastric Acid secretions

**Suggested Assignments:** Drugs on gastrointestinal motility, Drugs acting on Respiratory system

## Unit II

**CO- BP602-2: To know the various principles of chemotherapy& various drugs used for the treatment of bacterial infections.**

Item	Approx Hrs
Lecture & Tutorial	10+3=13
Practical(P)	8
SW	1
SL	1
Total:	23



Session Outcomes(SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
<b>Theory</b> <b>SO1.1 Chemotherapy</b> <b>Practical</b> <b>SO-P- 2.1</b> Dose calculation in pharmacological experiments <b>SO-P- 2.2:</b> Pre-treatment of animals with standard drugs stabilizes mast cell membrane and generates nitric oxide as defensive mechanism that inhibits the release of chemokines, which are responsible for vasoconstriction.	<b>2.1</b> Dose calculation in pharmacological experiments <b>2.2:</b> Antiallergic activity by mast cell stabilization assay	<b>Chemotherapy</b> <b>2.1:</b> General principles of chemotherapy. <b>2.2:</b> Sulfonamides and cotrimoxazole <b>2.3</b> Antibiotics- Penicillins <b>2.4:</b> Cephalosporins, <b>2T.1: Tutorial Class</b> <b>2.5:</b> Chloramphenicol <b>2.6:</b> Macrolides, <b>2.7:</b> Quinolones <b>2.8:</b> Tetracycline <b>2T.2: Tutorial class</b> <b>2.9:</b> aminoglycosides <b>2.10:</b> fluoroquinolins	<b>2.1:</b> Study the General principles of chemotherapy.

**Suggested Assignments:** Acids, Bases and Buffers, Major extra and intracellular electrolytes, Dental products



### Unit III

**CO-BP602-3:** To know the various chemotherapeutics agents for treatment of tuberculosis, leprotic, viral, fungal infections & malignancy along with Immune pharmacology of drugs.

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Item	Approx Hrs
Lecture & Tutorial	10+3=13
Practical(P)	12
SW	1
SL	1
Total:	27

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self - Learning (SL)
<b>Theory</b> <b>SO3.1: Chemotherapy</b> <b>Practical</b> <b>SO-P- 3.1</b> Effect of agonist and antagonists on guinea pig ileum was study. <b>SO-P- 3.2:</b> Estimation of serum biochemical parameters by using semi- autoanalyser	<b>3.1.</b> Effect of agonist and antagonists on guinea pig ileum <b>3.2:</b> Estimation of serum biochemical parameters by using semi- autoanalyser	<b>3.1</b> Antitubercular agents <b>3.2:</b> Antileprotic agents <b>3.3:</b> Antifungal agents <b>3.4:</b> Antiviral drugs <b>3T.1: Tutorial Class</b> <b>3.5:</b> Anthelmintic drugs <b>3.6:</b> Antimalarial drugs, <b>3.7:</b> Antiamoebic agents	<b>3.1:</b> Study about tuberculosis, leprotic, viral, fungal infections.

**Suggested Assignments:** Antacid, Gastrointestinal agents Acidifiers, Antimicrobials: Mechanism, classification, Potassium permanganate, Boric acid, Hydrogen peroxide.



#### Unit IV

**CO- BP602-4: To know the drugs used for the treatment of urinary tract infections, sexually transmitted diseases.**

Item	Approx Hrs
Lecture & Tutorial	10
Practical (P)	8
SW	1
SL	1
Total:	20

Session Outcomes(SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
<b>Theory</b> <b>SO4.1</b> Chemotherapy <b>SO4.2:</b> Immunopharmacology <b>Practical</b> <b>SO-P-4.1:</b> Mean percentage decrease of blood glucose levels at different time intervals determines the effect of insulin. <b>SO-P-4.2</b> Hypotonic solution causes the fluid to move from lumen into circulation by process osmosis thereby shrinks the tissue.	<b>4.1</b> Insulin hypoglycemic effect in rabbit <b>4.2:</b> Effect of saline purgative on frog intestine	<b>4.1:</b> Urinary tract infections and sexually transmitted diseases. <b>4.2</b> Chemotherapy of malignancy <b>4.3:</b> Immunostimulants <b>4.4:</b> Immunosuppressant <b>4T1: Tutorial Class</b> <b>4.5</b> Protein drugs <b>4.6:</b> monoclonal antibodies <b>4.7:</b> target drugs to antigen <b>4.8</b> biosimilars <b>3T.2: Tutorial class</b>	<b>4.1:</b> Study the various causes of Urinary tract infections and sexually transmitted diseases.

**Suggested Assignments:** Expectorants, Emetics, Haematinics, Poison and Antidote



## Unit V

**CO-BP104-5: Understand the medicinal and pharmaceutical importance of radiopharmaceuticals.**

Item	Approx Hrs
Lecture & Tutorial	7+3=10
Practical(P)	0
SW	1
SL	1
Total:	20

Session Outcomes(SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
<b>Theory</b> <b>SO5.1: Principles of toxicology</b> <b>SO5.2:</b> To know about the Chronopharmacology <b>Practical</b> <b>SO-P- 5.1</b> Student would be know the Dose calculation in pharmacological experiments <b>SO-P- 5.2</b> Student would be know the Determination of acute oral toxicity (LD50) of a drug from a given data	<b>5.1</b> Dose calculation in pharmacological experiments <b>5.2</b> Determination of acute oral toxicity (LD50) of a drug from a given data	<b>5.1:</b> Definition and basic knowledge of acute, subacute and chronic toxicity. <b>5.2:</b> Definition and basic knowledge of genotoxicity, carcinogenicity, teratogenicity and mutagenicity <b>5.3:</b> General principles of treatment of poisoning <b>5.4:</b> Clinical symptoms and management of barbiturates, morphine, Organophosphorus compound and lead, mercury and arsenic poisoning. <b>5T1:</b> Tutorial class <b>5.5:</b> Definition of rhythm and cycles. <b>5.6:</b> Biological clock and their significance leading to chronotherapy. <b>5.7:</b> Clinical symptoms and management of organophosphorus compound and lead, mercury and arsenic poisoning. <b>5T.2:</b> Tutorial class <b>T.3:</b> Tutorial class	<b>5.1:</b> Importance of toxicity in dose calculation.



### Brief of Hours suggested for the Course Outcomes

Course Out comes	Class Lecture (Cl)	(LI)	Sessional Work (SW)	Self Learning (Sl)	Total Hour (Cl+SW+ Sl+LI)
<b>Course Out comes:</b> <b>CO- BP602-1:</b> To understand the Pharmacology of drugs acting on Respiratory system & Gastrointestinal Tract	13	16	1	1	31
<b>CO- BP602-2:</b> To know the various principles of chemotherapy & various drugs used for the treatment of bacterial infections.	13	8	1	1	23
<b>CO- BP602-3:</b> To know the various chemotherapeutics agents for treatment of tuberculosis, leprotic, viral, fungal infections & malignancy along with Immune pharmacology of drugs.	13	12	1	1	27
<b>CO- BP602-4:</b> To know the drugs used for the treatment of urinary tract infections, sexually transmitted diseases.	10	8	1	1	20
<b>CO- BP602-5:</b> To understand the Principles of toxicology & Chrono pharmacology	10	0	1	1	12
<b>Total Hours</b>	59	44	5	5	113



**Suggestion for End Semester Assessment**  
Suggested Specification Table (For ESA)

Course Outcom	Unit Titles	Marks Distribution			Total Marks
		A	C	I	
<b>CO- BP602-1::</b>	<b>Course Out comes:</b> To understand the Pharmacology of drugs acting on Respiratory system & Gastrointestinal Tract	08	06	01	15
<b>CO- BP602-2:</b>	To know the various principles of chemotherapy & various drugs used for the treatment of bacterial infections.	12	07	01	20
<b>CO- BP602-3:</b>	To know the various chemotherapeutics agents for treatment of tuberculosis, leprotic, viral, fungal infections & malignancy along with Immune pharmacology of drugs.	02	06	02	10
<b>CO- BP602-4:</b>	To know the drugs used for the treatment of urinary tract infections, sexually transmitted diseases.	10	02	03	15
<b>CO- BP602-5:</b>	To understand the Principles of toxicology & Chrono pharmacology	05	07	03	15
<b>Total</b>		<b>37</b>	<b>28</b>	<b>10</b>	<b>75</b>

**Legend: A: Analyze, C: Create, I: Interpret**

The end of semester assessment for Pharmacology-III will be held with written examination of 75 marks

**Note.** Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks.

Teachers can also design different tasks as per requirement, for end semester assessment.

**Suggested Instructional/Implementation Strategies:**

**Improved Lecture**

1. Tutorial
2. Case Method
3. Group Discussion
4. Role Play
5. Demonstration
6. ICT Based Teaching Learning (Video Demonstration/Tutorials CBT, Blog, Face book, Twitter, What's app, Mobile, Online sources)
7. Brainstorming



### Suggested Learning Resources:

S. No.	Title	Author	Publisher	Edition & Year
1	Rang and Dale's Pharmacology	Rang H. P., Dale M. M., Ritter J. M., Flower R. J.,	Churchil Livingstone Elsevier	2018
2	Basic and clinical pharmacology	Katzung B. G., Masters S. B., Trevor A. J.,	Tata Mc Graw-Hill	Fifth edition 2022
3	The Pharmacological Basis of Therapeutics	Goodman and Gilman's	The Point Lippincott Williams & Wilkins	Eighth Edition 2020
4	Applied Therapeutics, The Clinical use of Drugs.	Marry Anne K. K., Lloyd Yee Y., Brian K. A.	The Point Lippincott Williams & Wilkins	10 <sup>th</sup> edition 2012
5	Essentials of Medical Pharmacology,	K.D.Tripathi.	JAYPEE Brothers, Medical Publishers (P) Ltd, New Delhi.	2021
6	Fundamentals of Experimental Pharmacology	Ghosh MN.	Hilton & Company, Kolkata,	
7	Handbook of experimental pharmacology,	Kulkarni SK	Vallabh Prakashan -	4th edition.

### Curriculum Development Team:

1. **Dr S P Gupta**, Director, RGIP, AKS University
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3. **Ms. Neha Goel** Associate professor, RGIP, AKS University



**Course Outcome, Program Specific Outcome& Program Outcome Mapping**

Course Code: **BP602T & BP608P**

Course Name: **Pharmacology III**

Course Outcome	Program Outcome											Program Specific outcome			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
	Pharmacy knowledge	Planning Abilities	Problem analysis	Modern tool usage	Leadership skills	Professional Identity	Pharmaceutical Ethics	Communication	The pharmacist and society	Environment and sustainability	Life-long learning	Knowledge of drug discovery	Quality Analysis of API's	MOA of Drug	Biological evaluation of drug
<b>CO-1:</b> Pharmacology of drugs acting on Respiratory system& Gastrointestinal Tract	3	2	3	1	3	2	1	2	3	2	3	1	3	1	2
<b>CO-2:</b> various principles of chemotherapy& bacterial infections.	2	3	1	3	2	2	1	1	2	3	3	3	2	1	3
<b>CO-3:</b> drugs of tuberculosis, leprotic, viral, fungal infections & malignancy along with Immune pharmacology.	3	2	3	2	1	1	2	1	2	2	3	3	2	1	3
<b>CO-4:</b> UTI, sexually transmitted diseases.	2	3	2	3	1	3	2	2	3	3	3	3	2	1	3
<b>CO-5:</b> toxicology & Chrono pharmacology	3	3	1	1	1	3	1	3	1	2	3	2	2	2	2



### Course Curriculum Mapping

Pos& PSOs No	Cos No&	Title	SOs No	Class Room Instructions	Laboratory Instructions	Self learning
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	<b>CO-BP602-1</b>	To understand the Pharmacology of drugs acting on Respiratory system& Gastrointestinal Tract	SO1.1 SO1.2 SO1.3	1.1,1.2,1.3,1.4,1.5,1.6,1.7,1.8,1.9,1.10	1.1,1.2	SI-1.1
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	<b>CO-BP602-2</b>	To know the various principles of chemotherapy& various drugs used for the treatment of bacterial infections.	<b>SO-2.1</b> <b>SO-2.2</b> <b>SO-2.3</b>	2.1,2.2,2.3,2.4,2.5,2.6,2.7	2.1.,2.2	SI-2.1
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	<b>CO-BP602-3</b>	To know the various chemotherapeutic agents for treatment of tuberculosis, leprotic, viral, fungal infections & malignancy along with Immune pharmacology of drugs.	<b>SO-3.1</b> <b>SO-3.2</b> <b>SO-3.3</b>	3.1,3.2,3.3,3.4,3.5,3.6,3.7,3.8,3.9,3.10	3.1,3.2	SI-3.1
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	<b>CO-BP602-4</b>	To know the drugs used for the treatment of urinary tract infections, sexually transmitted diseases.	<b>SO-4.1</b> <b>SO-4.2</b> <b>SO-4.3</b>	4.1,4.2,4.3,4.4,4.5,4.6,4.7,4.8	4.1, 4.2.	SI-4.1
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	<b>CO-BP602-5</b>	To understand the Principles of toxicology & Chrono pharmacology	SO-5.1 SO-5.2 SO-5.3 SO-5.4	5.1,5.2,5.3,5.4,5.5,5.6,5.7	5.1,5.2	SI-5.1

4.





AKS University  
Faculty of Pharmaceutical Science & Technology  
Rajiv Gandhi Institute of Pharmacy  
Curriculum of B. Pharmacy (Herbal Drug Technology) Program  
(Revised as on 01August2023)  
**Semester-VI**

**Course Code:** BP603 T/BP609P

**Course Title:** Herbal Drug Technology

**Pre-requisite:** This subject gives the student the knowledge of basic understanding of herbal drug industry, the quality of raw material, guidelines for quality of herbal drugs, herbal cosmetics, natural sweeteners, nutraceutical etc. The subject also emphasizes on Good Manufacturing Practices (GMP), patenting and regulatory issues of herbal drugs.

**Rationale/Objectives:** Upon completion of this course the student should be able to:

1. Understand raw material as source of herbal drugs from cultivation to herbal drug product.
2. Know the WHO and ICH guidelines for evaluation of herbal drugs.
3. Know the herbal cosmetics, natural sweeteners, Nutraceuticals.
4. Appreciate patenting of herbal drugs, GMP.

**Course Outcomes:**

**CO-BP603 -1:** To understand raw material as source of herbal drugs from cultivation to herbal drug product.

**CO-BP603 -2:** To know the WHO and ICH guidelines for evaluation of herbal drugs.

**CO-BP603 - 3:** To know the herbal cosmetics, natural sweeteners, nutraceuticals.

**CO-BP603 -4:** To carry out the appreciate patenting of herbal drugs, GMP.

**CO-BP603 -5:** To know Good Manufacturing Practice of Indian systems of medicine.



## Scheme of Studies

Course code	Title of the course	Program Name	TOTAL Number of contact hours/Week						Credit	15 weeks (H)
			Classroom Instruction(A)		Practical (P)	SW	SL	Total Hours (H)		
			Lecture	Tutorial						
BP603 T	Herbal Drug Technology (Theory)	B. Pharmacy	3	1	4	1	1	10	6	150

**Legend: CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others),

**LI:** Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)

**SW:** Sessional Work (includes assignment, seminar, mini project etc.),

**SL:** Self Learning,

**C:** Credits

**Note:** SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning

## Theory Assessment

Board of Study	Course Code	Course Title	Scheme of Assessment(Marks)					EndSemester Assessment(C)	Total Marks(A+B+C)
			Progressive Assessment (PRA)						
			Academic activity, Any three (Quiz/ Assignment, open book test, filed work and seminar)	Student teacher interaction	Class Attendance(AT)	(A) Total Marks	Sessional Exam(B)		
Pharmacy	BP-603 T	herbal drug technology	3	3	4	10	15	75	100



## Practical Assessment

Board of Study	Course Code	Course Title	Scheme of Assessment(Marks)						
			Internal Assessment(A)			End Semester Examination(B)			Total Marks (A+B)
			Attendance	Record	Sessional Exam.	Synopsis	Experiment	Viva	
Pharmacy	BP-609 P	Herbal drug technology	2	3	10	5	25	5	50

## Guidelines for the allotment of marks for attendance

Percentage of Attendance	Theory	Practical
95–100	4	2
90–94	3	1.5
85–89	2	1
80–84	1	0.5
Lessthan80	0	0



**Course-Curriculum Detailing:**

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

**CO-BP603 -1:** To understand raw material as source of herbal drugs from cultivation to herbal drug product.

Item	Approx Hrs
Lecture & Tutorial	10+3=13
Practical (P)	4
SW	1
SL	1
Total:	19

Session Outcomes(SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
1.1 Herbs as raw materials.  1.2 Biodynamic Agriculture.  1.3 Indian Systems of Medicine.  <b>Practical</b> <b>SO-P-</b> To perform preliminary phytochemical screening of crude drugs. 2. Determination of the alcohol content of Asava and Arista	1.To perform preliminary phytochemical screening of crude drugs.  2. Determination of the alcohol content of Asava and Arista	1.1 Definition of herb, herbal medicine, herbal medicinal product, herbal drug preparation. 1.2 Source of Herbs. 1.3 Selection, identification and authentication of herbal materials. 1.4 Processing of herbal raw material. 1.5 Good agricultural practices in cultivation of medicinal plants. 1.6 Organic farming. 1.7 Pest and Pest management in medicinal plants. 1.8 Biopesticides/Bioinsecticides. 1.9 Basic principles involved in Ayurveda, Siddha, Unani and Homeopathy. 1.10 Preparation and standardization of Ayurvedic formulations. 1.11 Aristas and Asawas, Ghutika, Churna, Lehya and Bhasma.  <b>Tutorial</b> 1.1 herbal medicinal product, herbal drug preparation. 1.2 Pest and Pest management in medicinal plants. 1.3 Unani and Homeopathy.	understand raw material as source of herbal drugs from cultivation to herbal drug product

**Suggested Assignments:** Processing of herbal raw material Good agricultural practices in cultivation of medicinal plants including Organic farming



**Unit II. CO-BP603 -2:** To know the WHO and ICH guidelines for evaluation of herbal drugs.

Item	Approx Hrs
Lecture & Tutorial	10+3=13
Practical(P)	16
SW	1
SL	1
Total:	31

Session Outcomes(SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self Learning (SL)
<p><b>Theory</b>  <b>SO2.</b>            Cultivation, Collection, Processing and storage of drugs of natural origin &amp; Conservation of medicinal plants.</p> <p><b>Practical</b>  <b>SO-P-2.1:</b> Evaluation of excipients of natural origin.            2.2. Incorporation of prepared and standardized extract in cosmetic formulations like creams, lotions and shampoos and their evaluation.</p>	2.1 Evaluation of excipients of natural origin 2.2. Incorporation of prepared and standardized extract in cosmetic formulations like creams, lotions and shampoos and their evaluation.	2.1 General aspects, Market, growth, scope and types of products available in the market. 2.2 Health benefits and role of Nutraceuticals in ailments like Diabetes, CVS diseases, Cancer, Irritable. 2.3 Irritable bowel syndrome and various Gastro intestinal diseases. 2.4. Study of following herbs as health food: Alfaalfa, Chicory, Ginger, Fenugreek, Garlic. 2.5. Study of following herbs as health food Honey, Amla, Ginseng, Ashwagandha, Spirulina. 2.6 General introduction to interaction and classification. Study of following drugs and their possible side effects and interactions: Hypercium, kava-kava, Ginkobiloba 2.7 General introduction to interaction and classification. Study of following drugs and their possible side effects and interactions: Ginseng, Garlic, Pepper & Ephedra. <b>Tutorial</b> Plant hormones and their applications. Polyploidy, mutation and hybridization with reference to medicinal plants.	Study of following drugs and their possible side effects and interactions: Hypercium, kava-kava, Ginkobiloba

**Suggested Assignments:** Study of following herbs as health food, General introduction to interaction and classification.



### Unit III

**CO-BP603 -3:** To know the evaluation techniques for the herbal drugs.

Item	Approx Hrs
Lecture & Tutorial	10+3=13
Practical(P)	8
SW	1
SL	1
Total:	23

Session Outcomes(SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self Learning (SL)
<b>Theory</b> SO3.1. Herbal Cosmetics  3.2 Herbal excipients. 3.3 Herbal formulations.  <b>Practical SO-P-</b> <b>3.1:</b> Incorporation of prepared and standardized extract in formulations like syrups, mixtures and tablets and their evaluation as per Pharmacopoeial requirements S	Determination of size of starch grains, calcium oxalate crystals by eye piece micrometer Determination of Fiber length and width Determination of number of starch grains by Lycopodium spore method	3.1 Sources and description of raw materials of herbal origin used via, fixed oils, waxes, gums colours, perfumes. 3.2 protective agents, bleaching agents, antioxidants in product. 3.3. skin care, hair care and oral hygiene products. 3.4 Herbal Excipients – Significance of substances of natural origin as excipients – colorants. 3.5 sweeteners, binders, diluents, viscosity build. 3.6 disintegrants, flavors & perfume. 3.7 Conventional herbal formulations like syrup. 3.8 mixtures and tablet. 3.9 Novel dosage forms. 3.10 Phytosomes.  <b>Tutorial</b> Sources and description of raw materials of herbal origin. Significance of substances of natural origin. Conventional herbal formulations.	To know the Historical development of plant tissue culture technique.

**Suggested Assignments:** skin care, hair care and oral hygiene products, natural origin as excipients, Novel dosage forms like phytosomes.



**Unit IV:**

CO-BP603 -4: To carry out the appreciate patenting of herbal drugs, GMP.

Item	Approx Hrs
Lecture & Tutorial	10+3
Practical(P)	16
SW	1
SL	1
Total:	31

Session Outcomes(SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self Learning (SL)
SO3.1. Evaluation of Drugs.  3.2 Patenting and Regulatory requirements of natural products.  3.3 Regulatory Issue.  <b>Practical</b> 4.1 Monograph analysis of herbal drugs from recent Pharmacopoeias. 4.2 Determination of Aldehyde content.	4.1 Monograph analysis of herbal drugs from recent Pharmacopoeias. 4.2 Determination of Aldehyde content.	4.1 WHO guidelines for the assessment of herbal drugs. 4.2 ICH guidelines for the assessment of herbal drugs.  4.3 Stability testing of herbal drugs. 4.4 Definition of the terms: Patent, IPR, Farmers. 4.5. Breeder's right, Bioprospecting and Biopiracy. 4.6 Patenting aspects of Traditional Knowledge. 4.7 Natural Products. 4.8 Case study of Curcuma & Neem. 4.9 Regulations in India (ASU DTAB, ASU DCC). 4.10 Regulation of manufacture of ASU drugs.  <b>Tutorial</b> Assessment of herbal drugs Stability testing of herbal drugs. Patenting aspects of Traditional Knowledge. Schedule Z of Drugs	ICH guidelines for the assessment of herbal drugs. Breeder's right, Bioprospecting and Biopiracy. ASU, DTAB, ASU DCC.

**Suggested Assignments:** Stability testing of herbal drugs, Case study of Curcuma & Neem, Cosmetics Act for ASU drug.



**Unit V**

**CO-BP603 -5:** Study of biological source, chemical nature and uses of drugs of natural origin containing crude drugs.

Item	ApproxHrs
Lecture&Tutorial	10+3
Practical(P)	8
SW	1
SL	1
Total:	23

Session Outcomes(SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self Learning (SL)
<b>Theory</b> <b>SO5.1</b> General Introduction to Herbal Industry. 5.2 Schedule T – Good Manufacturing Practice of Indian systems of medicine <b>Practical:</b> Determination of Phenol content Determination of total alkaloids	Determination of Phenol content  Determination of total alkaloids	5.1. Herbal drugs industry: Present scope and future prospects. 5.2 A brief account of plant based industries. 5.3 institutions involved in work on medicinal and aromatic plants in India. 5.4 Components of GMP (Schedule – T) and its objectives. 5.5 Infrastructural requirements, working space, storage area, machinery 5.6 equipments, standard operating procedures. 5.7 health and hygiene, documentation and records. <b>Tutorial</b> Schedule – T and its objectives. Infrastructural requirements documentation and records.	Herbal drugs industry.  medicinal and aromatic plants in India.

**Suggested Assignments:** Institutions involved in work on medicinal and aromatic plants in India, Components of GMP (Schedule – T) and its objectives.



### Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (Cl)	(L)	Session a IWork (SW)	Self Learning (Sl)	Total Hour (Cl+SW+ Sl+LI)
CO-BP603 -1To understand raw material as source of herbal drugs from cultivation to herbal drug product.	13	4	1	1	19
CO-BP603 -2: To To know the WHO and ICH guidelines for evaluation of herbal drugs.	13	16	1	1	31
CO-BP603 -3: To know the herbal cosmetics, natural sweeteners, nutraceuticals.	13	8	1	1	23
CO-BP603 -4: To Carry out the appreciate patenting of herbal drugs, GMP..	13	16	1	1	31
CO-BP603-5:TO know Good Manufacturing Practice of Indian systems of medicine.	13	8	1	1	23
<b>Total Hours</b>	<b>65</b>	<b>52</b>	<b>5</b>	<b>5</b>	<b>127</b>



**Suggestion for End Semester Assessment**  
Suggested Specification Table (For ESA)

Course Outcome	Unit Titles	Marks Distribution			Total Marks
		A	C	I	
<b>CO-BP603-1:</b>	Herbs as raw materials, Biodynamic Agriculture & Indian Systems of Medicine.	08	06	01	15
<b>CO-BP603 - 2:</b>	Nutraceutical & Herbal-Drug and Herb-Food Interactions.	12	07	01	20
<b>CO-BP603 - 3:</b>	Herbal Cosmetics, Herbal excipients & Herbal formulations.	02	06	02	10
<b>CO-BP603 - 4:</b>	Evaluation of Drugs, Regulatory Issue & Patenting and Regulatory requirements of natural products.	10	02	03	15
<b>CO-BP603 - 5:</b>	General Introduction to Herbal Industry & Schedule T – Good Manufacturing Practice of Indian systems of medicine.	05	07	03	15
<b>Total</b>		<b>37</b>	<b>28</b>	<b>10</b>	<b>75</b>

**Legend A: Analyze, C: Create, I: Interpret**

The end of semester assessment for Herbal Drug Technology Will be held with written examination of 75 marks

**Note.** Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks. Teachers can also design different tasks as per requirement, for end semester assessment.

**Suggested Instructional /Implementation Strategies:**

1. Improved Lecture
2. Tutorial
3. Case Method
4. Group Discussion
5. Role Play
6. Demonstration
7. ICT Based Teaching Learning (Video Demonstration /Tutorials CBT, Blog, Face book,
8. Twitter, Whats app, Mobile, Online sources)  
Brainstorming



## Suggested Learning Resources:

S.No.	Title	Author	Publisher	Edition&Year
1	Indian Pharmacopoeia	Indian Pharmacopoeia Commission (IPC), Govt. of India	Govt.ofIndia	Eighth edition,2018
2	Pharmacognosy & Phytochemistry	W.C.Evans, Trease and Evans	W.B. Sounders & Co.,	16th edition London, 2009.
3	Pharmacognosy and Phytochemistry	Mohammad Ali	CBS Publishers & Distribution, New Delhi.	Jan2020
4	Text book of Pharmacognosy	C.K. Kokate, Purohit, Gokhlae	Nirali Prakashan, New Delhi.	37th Edition (2007)
5	Herbal drug industry	R.D. Choudhary	Eastern Publisher, New Delhi.	Ist Edn (1996),
6	Essentials of Pharmacognosy	Dr.SH. Ansari	Birla publications, New Delhi,	IInd edition (2007)
7	Textbook of Industrial Pharmacognosy		CBS Publishers, New Delhi	2005
8	Pharmacopoeal standards for Ayurvedic Formulation (Council of Research in Indian Medicine & Homeopathy)	Indian Pharmacopoeia Commission (IPC), Govt. of India	Govt.ofIndia	Eighth edition,2018
9	Quality Control of Herbal Drugs: An Approach to Evaluation of Botanicals. 2002.	kherjee, P.W	Business Horizons Publishers, New Delhi, India,	2002

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**Course Outcome, Program Specific Outcome& Program Outcome Mapping**

**Course Code: BP603 T/BP609P**

**Course Name: Herbal Drug Technology**

Course Outcome	Program Outcome											Program Specific outcome			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
	Pharmacy knowledge	Planning Abilities	Problem analysis	Modern tool usage	Leadership skills	Professional Identity	Pharmaceutical Ethics	Communication	The pharmacist and society	Environment and sustainability	Life-long learning	Knowledge of drug discovery	Quality Analysis of API's	MOA of Drug	Biological evaluation of drug
<b>CO-1:</b> Herbs as raw materials, Biodynamic Agriculture	3	2	3	1	3	2	1	2	3	2	3	1	3	1	2
<b>CO-2:</b> To Understand the Nutraceutical &Herbal-Drug and Herb-Food Interactions.	2	3	1	3	1	2	1	1	2	3	3	3	2	1	3
<b>CO-3:</b> Importance of Herbal Cosmetics, Herbal recipients	3	2	3	2	1	1	2	1	2	2	3	3	2	1	3
<b>CO-4:</b> Evaluation of Drugs, Regulatory Issue & Patenting and Regulatory requirements	2	3	2	3	1	3	2	2	3	3	3	3	2	1	3
<b>CO-5:</b> Schedule T – Good Manufacturing Practice of Indian systems of medicine.	3	3	1	1	1	3	1	3	1	2	3	2	2	2	2

**Legend: 1- Low, 2-Medium, 3-High**



### Course Curriculum Mapping

Pos& PSOs No	Cos No&	Title	SOs No	Class Room Instructions	Laboratory Instructions	Self learning
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	<b>CO-BP603-1</b>	To know the Herbs as raw materials, Biodynamic Agriculture & Indian Systems of Medicine.	SO1.1 SO1.2 SO1.3	1.1,1.2,1.3,1.4,1.5,1.6,1.7,1.8,1.9,1.10	1.1,1.2	SI-1.1
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	<b>CO-BP603-2</b>	To Understand the Nutraceutical & Herbal-Drug and Herb-Food Interactions.	<b>SO-2.1</b> <b>SO-2.2</b> <b>SO-2.3</b>	2.1,2.2,2.3,2.4,2.5,2.6,2.7	2.1.,2.2	SI-2.1
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	<b>CO-BP603-3</b>	To Understand the Importance of Herbal Cosmetics, Herbal recipients & Herbal formulations.	<b>SO-3.1</b> <b>SO-3.2</b> <b>SO-3.3</b>	3.1,3.2,3.3,3.4,3.5,3.6,3.7,3.8,3.9,3.10	3.1,3.2	SI-3.1
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	<b>CO-BP603-4</b>	To know the evaluation of Drugs, Regulatory Issue & Patenting and Regulatory requirements of natural products.	<b>SO-4.1</b> <b>SO-4.2</b> <b>SO-4.3</b>	4.1,4.2,4.3,4.4,4.5,4.6,4.7,4.8	4.1, 4.2.	SI-4.1
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	<b>CO-BP603-5</b>	To Understand the General Introduction to Herbal Industry & Schedule T – Good Manufacturing Practice of Indian systems of medicine.	SO-5.1 SO-5.2 SO-5.3 SO-5.4	5.1,5.2,5.3,5.4,5.5,5.6,5.7	5.1,5.2	<b>SI-5.1</b>

1.





AKS University  
Faculty of Pharmaceutical Science & Technology  
Rajiv Gandhi Institute of Pharmacy  
Curriculum of B. Pharmacy (Bio-pharmaceutics and Pharmacokinetic) Program  
(Revised as on 01August2023)

**Semester-VI**

**Course Code:** BP604

**Course Title:** Bio-pharmaceutics and Pharmacokinetic

**Pre-requisite:** The Student should have basic knowledge of solution, solute, solvent and their properties.

**Rationale/Objectives:** Understand the basic concepts in bio-pharmaceutics and pharmacokinetics and their significance. Use of plasma drug concentration-time data to calculate the pharmacokinetic parameters to describe the kinetics of drug absorption, distribution, metabolism, excretion, elimination.

**Course Outcomes:**

**CO-BP604.1:** To gain knowledge of drug absorption, distribution & protein binding with importance.

**CO-BP604.2:** Understand bio-availability & bioequivalence phenomenon as well as in-vivo & in-vitro correlations

**CO-BP604.3:** Understand definition & introduction of pharmacokinetics including their parameters.

**CO-BP604.4:** Study about the functioning construction & significance of multi-compartment model.

**CO-BP604.5:** Understand & learn about the nonlinear pharmacokinetics with factors causing nonlinearity.



## Scheme of studies

Course code	Title of the course	Program Name	TOTAL Number of contact hours/Week						Credit
			Classroom Instruction(A)		Practical (P)	S W	SL	Total Hours (H)	
			Lecture	Tutorial					
BP604T	Biopharmaceutics& Pharmacokinetics theory	B. Pharmacy	3	1	0	1	1	6	4

### Legend:

**CI:** Classroom Instruction (Include as different instructional strategies i.e. Lecture(L) and Tutorial(T) and others)

**LI:** Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)

**SW:** Sessional Work (includes assignment, seminar, mini-project etc.),

**SL:** Self Learning, Credits.

**Note:** SW&SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

### Theory Assessment

Board of Study	Course Code	Course Title	Scheme of Assessment (Marks)						
			Progressive Assessment (PRA)						
			Academic activity, Any three (Quiz/ Assignment, open book test, filed work and seminar)	Student teacher interaction	Class Attendance (AT)	(A) Total Marks	Sessional Exam (B)	End Semester Assessment (C)	Total Marks (A+B+C)
Pharmacy	BP604 T	Biopharmaceutics and pharmacokinetics theory	3	3	4	10	15	75	100



## Guidelines for the allotment of marks for attendance

Percentage of Attendance	Theory	Practical
95 – 100	4	2
90 – 94	3	1.5
85 – 89	2	1
80 – 84	1	0.5
Less than 80	0	0

### Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

**CO-BP604.1: To gain knowledge of drug absorption, distribution & protein binding with importance.**

Item	ApproxHrs
Lecture & Tutorial	10+3=13
Practical(P)	0
SW	1
SL	1
Total:	15

Session Outcomes(SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self Learning (SL)
<b>Theory</b> <b>SO1.1.</b> Mechanisms of drug absorption through GIT. <b>SO1.2</b> factors influencing drug absorption through GIT. <b>SO1.3</b> Tissue permeability of drugs. <b>SO1.4</b> plasma and tissue protein binding of drugs. Factors affecting protein-drug binding. <b>SO1.5</b> Clinical significance of protein binding of drugs.		<b>Introduction Bio-pharmaceutics</b> <b>1.1</b> Mechanisms of drug absorption through GIT <b>1.2</b> factors influencing drug absorption through GIT <b>1.3</b> absorption of drug from Non-peroral extra vascular routes. <b>Distribution</b> 1.4 Tissue permeability of drugs. 1.5 binding of drugs, Understand & classify the absorption rates of sustained released, control released & extended released tablets. <b>1.T-1:</b> Tutorial <b>1.6</b> Apparent volume of drug distribution <b>1.7</b> plasma and tissue protein binding of drugs. <b>1.T-2:</b> Tutorial <b>1.8</b> Factors affecting protein-drug binding. <b>1.9</b> Kinetics of protein binding. <b>1.10</b> Clinical significance of protein binding of drugs. <b>1.T-3:</b> Tutorial	<b>1.1</b> Can understand & Classify the absorption rates of sustained released, control released & extended released tablets.



**Suggested Sessional work**

**Assignments:** 1. Mechanisms of drug absorption through GIT,  
2. Factors influencing drug absorption through GIT.

**CO-BP604.2:** Understand bio-availability & bioequivalence phenomenon as well as in vivo & in-vitro correlations.

Item	Approx Hrs
Lecture & Tutorial	10+3=13
Practical(P)	0
SW	1
SL	1
Total:	15

Session Outcomes(SOs)	Laboratory Instruction (LI)	Classroom Instruction(CI)	Self Learning (SL)
<b>Theory</b> <b>SO2.1.</b> Drug metabolism and basic understanding metabolic pathways renal excretion of drugs. <b>SO2.2</b> renal clearance, Non renal routes of drug excretion of drugs <b>SO2.3</b> measurement of bioavailability. <b>SO2.4,</b> in-vitro drug dissolution models. <b>SO2.5</b> methods to enhance the dissolution rates and bioavailability of poorly soluble drugs.		<b>Elimination</b> <b>2.1:</b> Drug metabolism and basic understanding metabolic pathways renal excretion of drugs. <b>2.2:</b> Factor effecting renal excretion of drugs. <b>2.3</b> Renal clearance, Non renal routes of drug excretion of drugs. Bioavailability and Bioequivalence <b>2.4</b> Definition and objectives of bioavailability. <b>2.5</b> Absolute and relative bioavailability. <b>2.6</b> Measurement of bioavailability. <b>2.7</b> in-vitro drug dissolution models. <b>2.T-1:</b> Tutorial <b>2.8</b> Drug metabolism and basic understanding metabolic pathways renal excretion of drugs. <b>2.9</b> in-vitro-in-vivo correlations. <b>2.10</b> Bioequivalence studies. <b>2.11</b> Methods to enhance the dissolution rates and bioavailability of poorly soluble drugs. <b>2.T-2:</b> Tutorial	<b>2.1</b> Determine & calculate the percentage drug release of tablet formulation through dissolution apparatus.

**Suggested Assignments-** 1. Factors affecting renal excretion



**CO-BP604.3:** understand definition & introduction of pharmacokinetics including their parameters.

Item	Approx Hrs
Lecture & Tutorial	10+3=13
Practical(P)	0
SW	1
SL	1
Total:	15

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self learning (SL)
<b>Theory</b> <b>SO3.1.</b> Drug metabolism and basic understanding metabolic pathways renal excretion of drugs. <b>SO3.2</b> renal clearance, Non renal routes of drug excretion of drugs <b>SO3.3</b> measurement of bioavailability		<b>Pharmacokinetics</b> <b>3.1</b> Definition and introduction to Pharmacokinetics. <b>3.2</b> Compartment models. <b>3.3</b> Non compartment models <b>3.T-1 Tutorial</b> <b>3.4</b> One compartment open model. <b>3.5</b> (a). Intravenous Injection (Bolus)(b). Intravenous infusion. <b>3.6</b> Extra vascular administrations. Pharmacokinetics. <b>3.T-2 Tutorial</b> <b>3.7</b> parameters-KE, $t_{1/2}$ , Vd. <b>3.8</b> AUC, Ka, Clt and CLR- definitions methods of eliminations. <b>3.9</b> understanding of their significance and <b>3.10</b> application. <b>3.T-3 Tutorial</b>	<b>3.1:</b> Study the role of some newer inorganic salt in preparation of dental products

### Suggested Sessional work

**Assignments:** 1. Drug metabolism and basic understanding metabolic pathways renal excretion of drugs.

2. Non renal routes of drug excretion of drugs

**CO-BP604.4:** study about the functioning construction & significance of multi-compartment model.

Item	Approx Hrs
Lecture & Tutorial	8+3=11
Practical(P)	0
SW	1
SL	1
Total:	14



Session Outcomes(SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self Learning (SL)
<b>SO4.1</b> Two compartment open model. <b>SO4.2</b> steady statedrug levels. <b>SO4.3-</b> significance in clinical settings.		<b>Multi-compartment models</b> <b>4.1</b> Two compartment open model. <b>4.2</b> IV bolus. <b>4.3</b> Kinetics of multiple dosing. <b>4.T-Tutorial :</b> <b>4.4</b> steady state drug levels. <b>4.5</b> calculation of loading. <b>4.6</b> mainetnance doses. <b>4.T-Tutorial:</b> <b>4.7</b> significancein clinical settins. <b>4.8</b> significance in clinical settins. 4.T-3Tutorial	<b>4.1:</b> Two compartment open model functioning

### Suggested Sessional work

**Assignments:** 1.Twocompartmentopenmodel.

**CO-BP604.5:** understand & learn about the nonlinear pharmacokinetics with factors causing nonlinearity.

Item	Approx Hrs
Lecture &Tutorial	7+3=10
Practical(P)	0
SW	2
SL	1
Total:	13



Session Outcomes	Laboratory Instructions	Class Room Instructions	Self Learning(SL)
<b>Theory</b> <b>SO5.1</b> Introduction. <b>SO5.2</b> Factors causing Non-linearity. <b>SO5.3</b> Explanation with example of drugs.	NA	<b>Non-linearity.</b> <b>5.1 Introduction</b> <b>5.2</b> Factors causing Nonlinearity. <b>5.3</b> Michaelis-menton method of estimating parameters. <b>5.4</b> Types of nonlinearity. <b>5.T-1:</b> Tutorial <b>5.5</b> Michaelis-menton method <b>5.6</b> Example of drugs. <b>5.T-2:</b> Tutorial <b>5.7</b> Example of drugs. <b>5.T-3: Tutorial</b>	5.1 Read the significance of non-linearity in distribution & in excretion with drug example.

### Suggested Sessional work

**Assignments:** 1. Factors causing Non-linearity.

### Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (C)	(L)	Sessional Work (SW)	Self Learning (SL)	Total Hour (CI+SW+ SI+LI)
<b>BP604.1</b> To gain knowledge of drug absorption	13	0	1	1	15
<b>BP 604.2</b> To understand bio-availability & bioequivalence phenomenon as well as in-vivo & in- vitro correlations	13	0	1	1	15
<b>BP604.3:</b> Understand definition & introduction of pharmacokinetics including their parameters..	13	0	1	1	15
<b>BP604.4:</b> Study about the functioning construction & significance of multi-compartment model	11	0	1	1	13
<b>BP604.5:</b> TO Understand & learn about the non linear pharmacokinetics with factors causing nonlinearity.	10	0	2	1	13
<b>Total Hours</b>	60	0	6	5	71



**Suggestion for End Semester Assessment**  
Suggested Specification Table (For ESA)

Course Outcom	Unit Titles	MarksDistribution			Total Marks
		A	C	I	
<b>BP 604.1:</b>	To gain knowledge of drug absorption	08	06	01	15
<b>BP 604.2:</b>	To understand bio-availability & bioequivalence phenomena as well as in- vivo & in-vitro correlations	12	07	01	20
<b>BP 604.3:</b>	Understand definition & introduction of pharmacokinetics including their parameters.	02	06	02	10
<b>BP 604.4:</b>	Study about the functioning construction & significance of multi-compartment model	10	02	03	15
<b>BP 604.5:</b>	Understand & learn about the nonlinear pharmacokinetics with factors causing Non-linearity.	05	07	03	15
<b>Total</b>		<b>37</b>	<b>28</b>	<b>10</b>	<b>75</b>

**Legend: A: Analyse, C:Create, I:Interpret**

The end of semester assessment for Bio-pharmaceutics & Pharmacokinetics will be held with written examination of 75 marks

**Note.** Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks. Teachers can also design different tasks as per requirement, for end semester assessment

**Suggested Instructional/ImplementationStrategies:**

1. Improved Lecture
2. Tutorial
3. CaseMethod
4. GroupDiscussion
5. RolePlay
6. Demonstration
7. ICTBasedTeachingLearning(VideoDemonstration/TutorialsCBT,Blog, Face book, Twitter, Whats app, Mobile, Online sources)
8. Brain stormin



**Suggested Learning Resources:**

<b>S No.</b>	<b>Title</b>	<b>Author</b>	<b>Publisher</b>	<b>Edition&amp;Year</b>
1	Bio-pharmaceutics and Clinical Pharmacokinetics	Milo Gibaldi.	Govt.ofIndia	Eighth edition,2018
2	Biopharmaceuticsand Pharmacokinetics	Robert F Notari	Himalayanpublishing House Pvt Ltd	Fifteenth edition 2022
3	Appliedbiopharmaceuticsand pharmacokinetics	LeonShargeland AndrewB.C.YU	Oxford/BSP Books	4thedition
4	Bio-pharmaceutics and Pharmacokinetic	D. M. Brahmankar and Sunil B. Jaiswal	Vallabh Prakashan Pitampura, Delhi	10 <sup>th</sup> edition 2012
5	Pharmacokinetics:	MiloGibaldi Donald,	Wileypublication	2021
6	Hand Book of Clinical Pharmacokinetics	Milo Gibaldiand Laurie Prescottt	ADIS Health Science Press.	Eleventh edition2018
7	Biopharmaceutics ,	Swarbrick	Stahlone Press of University of London	4 <sup>th</sup> edition.2016

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## Course Outcome & Program Outcome Mapping

### Course Outcome, Program Specific Outcome& Program Outcome Mapping

Course Code: **BP604T**

Course Name: **Bio-pharmaceutics and Pharmacokinetic**

Course Outcome	Program Outcome											Program Specific outcome			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
	Pharmacy knowledge	Planning Abilities	Problem analysis	Modern tool usage	Leadership skills	Professional Identity	Pharmaceutical Ethics	Communication	The pharmacist and society	Environment and sustainability	Life-long learning	Knowledge of drug discovery	Quality Analysis of API's	MOA of Drug	Biological evaluation of drug
<b>CO-1:</b> To gain knowledge of drug absorption	3	2	3	1	3	2	1	2	3	2	3	1	3	1	2
<b>CO-2:</b> To know the bio-availability & bioequivalence phenomenon	2	3	1	3	1	2	1	1	2	3	3	3	2	1	3
<b>CO-3:</b> pharmacokinetics with their parameters	3	2	3	2	1	1	2	1	2	2	3	3	2	1	3
<b>CO-4:</b> compartment model	2	3	2	3	1	3	2	2	3	3	3	3	2	1	3
<b>CO-5:</b> Nonlinear pharmacokinetics with factors	3	3	1	1	1	3	1	3	1	2	3	2	2	2	2

**Legend: 1- Low, 2-Medium, 3-High**



## Course Curriculum Mapping

Pos& PSOs No	Cos No&	Title	SOs No	Class Room Instructions	Laboratory Instructions	Self learning
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	<b>CO-BP6 04-1</b>	To gain knowledge of drug absorption	SO1.1 SO1.2 SO1.3 SO1.4 SO1.5	1.1,1.2,1.3,1.4,1.5,1.6,1.7,1.8,1.9,1.10		SI-1.1
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	<b>CO-BP6 04-2</b>	understand bio-availability & bioequivalence phenomenon as well as in- vivo & in-vitro correlations	<b>SO-2.1</b> <b>SO-2.2</b> <b>SO-2.3</b> <b>SO-2.4</b> <b>SO-2.5</b>	2.1,2.2,2.3,2.4,2.5,2.6,2.7,2.8,2.9,2.10		SI-2.1
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	<b>CO-BP6 04-3</b>	Understand definition & introduction of pharmacokinetics including their parameters	<b>SO-3.1</b> <b>SO-3.2</b> <b>SO-3.3</b>	3.1,3.2,3.3,3.4,3.5,3.6,3.7,3.8,3.9,3.10		SI-3.1
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	<b>CO-BP4 04-4</b>	Study about the functioning construction& significance of multi compartment model.	<b>SO-4.1</b> <b>SO-4.2</b> <b>SO-4.3</b>	4.1,4.2,4.3,4.4,4.5,4.6,4.7,4.8		SI-4.1
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	<b>CO-BP6 04-5</b>	understand & learn about the nonlinear pharmacokinetics with factors causing nonlinearity..	SO-5.1 SO-5.2 SO-5.3	5.1,5.2,5.3,5.4,5.5,5.6,5.7		<b>SI-5.1</b>





AKS University  
Faculty of Pharmaceutical Science & Technology  
Rajiv Gandhi Institute of Pharmacy  
Curriculum of B. Pharmacy (Pharmaceutical Biotechnology) Program  
(Revised as on 01August2023)

**Semester-VI**

**Course Code:**

**BP605T**

**Course Title:**

**Pharmaceutical Biotechnology**

**Pre-requisite:**

Student should have basic knowledge of Biological Sciences and Microbiology

**Rationale/Objectives:**

Up on completion of the course student shall be able to

- Understanding the importance of Immobilized enzymes in Pharmaceutical Industries
- Genetic engineering applications in relation to production of pharmaceuticals
- Importance of Monoclonal antibodies in Industries
- Appreciate the use of microorganisms in fermentation technology

**Course Out comes:**

**CO-BP605-1:** To elaborate the basic theories that corelate pharmaceutical science with biotechnology

**CO- BP605-2:** To acquire the knowledge of basic microbiological sciences and genetic engineering

**CO- BP605-3:** To explain the various mechanisms of Immunological response

**CO- BP605-4:** To determine the immunological techniques and mutational study

**CO- BP605-5:** To comprehend the basic concepts of Fermentation technology



## Scheme of Studies

Course code	Title of the course	Program Name	TOTAL Number of contact hours/Week						Credit
			Classroom Instruction (A)		Practical (P)	SW	SL	Total Hours (H)	
			Lecture	Tutorial					
BP605T	Pharmaceutical Biotechnology	B. Pharmacy.	3	1	4	1	1	10	6

**Legend: CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others),

**LI: Laboratory Instruction** (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)

**SW: Sessional Work** (includes assignment, seminar, mini project etc.),

**SL:** Self Learning, Credits.

**Note:** SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

## Theory Assessment

Board of Study	Course Code	Course Title	Scheme of Assessment (Marks)					Sessional Exam (B)	EndSemester Assessment(C)	Total Marks(A+B+C)
			Academic activity, Any three (Quiz/ Assignment, open book test, filed work and seminar)	Student interaction	Class Attendance	ce(AT)	(A) Total Marks			
Pharmacy	BP 605T	Pharmaceutical Biotechnology	3	3	4		10	15	75	100



## Practical Assessment

Board of Study	Course Code	Course Title	Scheme of Assessment ( Marks )						
			Internal Assessment (A)			End Semester Examination(B)			Total Marks (A+B)
			Attendance	Record	Sessional Exam.	Synopsis	Experiment	Viva	
Pharmacy	BP605P	Pharmaceutical Biotechnology	2	3	10	5	25	5	50

### Guidelines for the allotment of marks for attendance

Percentage of Attendance	Theory	Practical
95 – 100	4	2
90–94	3	1.5
85–89	2	1
80–84	1	0.5
Less than 80	0	0

### Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.



## Unit I

**CO-BP605-1: To elaborate the basic theories that correlate pharmaceutical science**

**With biotechnology**

Item	Approx Hrs
Lecture & Tutorial	10+3=13
Practical(P)	20
SW	1
SL	1
Total:	35

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self - Learning (SL)
<b>SO1: Elaborate the Inter correlation of pharmaceutical sciences and Biotechnology.</b> SO2: Define the functions of Enzyme biotechnology SO3: Distinguishes among different functionalities of Biosensors SO4: Elucidate the mechanism behind Protein Engineering SO5: Interpret the functions of Microbial enzymes SO6: Determine the basic principles of genetic engineering		1.1: Brief introduction to Biotechnology with reference to Pharmaceutical Sciences. 1.2: Enzyme Biotechnology- Methods of enzyme immobilization and applications. 1.3: Biosensors- Working and applications of biosensors in Pharmaceutical Industries. 1.4: Brief introduction to Protein Engineering. 1.5: Use of microbes in industry. Production of Enzymes- General consideration - Amylase, Catalase, Peroxidase, Lipase, Protease, Penicillinase. 1.6: Basic principles of genetic engineering	SL1: Make a list of Indian Biopharmaceutical Companies and their unique Products. SL2: Write names of 10 Enzymes and their Biocatalyst role. SL3: Write down the basic steps used in Protein Engineering



## Unit II

**CO-BP605-2: To acquire the knowledge of basic microbiological sciences and genetic engineering**

Item	Approx Hrs
Lecture & Tutorial	10+3=13
Practical(P)	16
SW	1
SL	1
Total:	31

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO2.1: Elaborate the mechanism of Genetic Engineering SO2: Elucidate the mechanism of Recombinant DNA techniques SO3: Interpret the role of Genetic engineering in various biological Product development. SO4: Interpret the basic mechanism of Polymerase Chain Reaction (PCR)	.1: Study of cloning vectors, restriction endonucleases and DNA ligase 2.2: Recombinant DNA technology. Application of genetic engineering in medicine. 2.3 Application of DNA technology and genetic engineering in the production of: 1) Interferon 2) Vaccines:- B 3) Hormones- Insulin. 2.4 Brief introduction to PCR		SL1: List down the compounds and enzymes play role in Genetic engineering. SL2: Draw a diagram showing all steps used in rDNA technology. SL3: List down the applications of RDT in different sectors.

### Suggested Assignments:

1. Make a project on “Various products derive from r-DNA technology”
2. Make a PowerPoint presentation on “Different Steps of Genetic Engineering” with Plasmids



### Unit III

**CO- BP605-3: To explain the various mechanisms of Immunological response**

Item	Approx Hrs
Lecture & Tutorial	10+3=13
Practical(P)	12
SW	1
SL	1
Total	27

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO1: Determine the structure of Immunoglobulins SO2: Differentiate among different classes of MHCs SO3: Interpret the mechanism of Hypersensitivity SO4: Elaborate the storage and preparation mechanism for vaccines SO5: Elaborate the Storage conditions and stability of official vaccines SO6: Explain the Hybridoma technology- Production, Purification and Applications SO7: Elaborate the Blood products and Plasma Substitutes	. 3.1: Structure of Immuno globulins 3.2: Structure and Function of MHC 3.3: Hypersensitivity reactions, Immune stimulation and Immune suppressions. 3.4: General method of the preparation of bacterial vaccines, toxoids, viral vaccine, antitoxins, serum-immune blood derivatives and other products relative to immunity. 3.5: Storage conditions and stability of official vaccines 3.6: Hybridoma technology- Production, Purification and Applications 3.7: Blood products and Plasma Substitutes		SL1: Write down the mechanism of Innate and Adaptive immunity SL2: Draw and label the diagrams of MHC class I, II and III SL3: List down the different vaccines made by Indian companies.

**Suggested Assignments:** 1. Make a project on “Difference between Innate and Adaptive Immunity”  
2. Make a Powerpoint presentation on “Mechanism of Vaccines and their types”



**Unit IV****CO- BP605-4: To determine the immunological techniques and mutational study**

Item	Approx Hrs
Lecture & Tutorial	08+3=11
Practical(P)	08
SW	1
SL	1
Total:	21

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO1. Distinguished among Blotting techniques and ELISA SO2: Distinguished among Genetic organization of Eukaryotes and Prokaryotes SO3: Elaborate transformation, transduction, conjugation, plasmids and transposons. SO4: Elucidate Microbial biotransformation and applications. SO5: Interpret and distinguishes among Mutation: Types of mutation/mutants		. 4.1: Immuno blotting techniques- ELISA, Western blotting, Southern blotting 4.2: Genetic organization of Eukaryotes and Prokaryotes 4.3: Microbial genetics including transformation, transduction, conjugation, plasmids and transposons. 4.4: Introduction to Microbial biotransformation and applications. 4.5: Mutation: Types of mutation/mutants	SL1: Writ down the different types of ELISA and their applications. SL2: List down the role of Transformation, Conjugation and Transduction. SL3: Find out latest research papers on “Vaccines against COVID-19”

**Suggested Assignments:** 1. Make a project on “Role of ELISA in identifying different viral Infections”  
2. Make a Powerpoint presentation on “Different Types of Mutations”



## Unit V

**CO- BP605-5: To comprehend the basic concepts of Fermentation technology**

Item	Approx Hrs
Lecture & Tutorial	07+03=10
Practical(P)	0
SW	1
SL	1
Total:	28

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO1: Elaborate the mechanism of Fermentation process SO2: Elucidate the role of media, sterilization, aeration and stirrer process. SO3: Design the fermenter and explain its all parts SO4: Explain the production process of penicillin, citric acid, Vitamin B12 and Glutamic acid SO5: Elucidate the Collection and Storage of blood based products		5.1: Fermentation methods and general requirements 5.2: Study of media, equipment, sterilization methods, aeration process, stirring 5.3: Large scale production fermenter design and its various controls 5.4: Study of the production of - penicillin, citric acid, Vitamin B12 and Glutamic acid 5.5: Blood Products: Collection, Processing and Storage of whole human blood, dried human plasma, plasma Substitutes	SL1: List down different types of fermented products SL2: Make a table mentioning Bacteria, Yeast and Fungi and the products produced from them using fermentation. SL3: Write down the difference between Catabolic and Anabolic reactions

**Suggested Assignments:** 1. Make a project on “Role of Fermentation in Food and Pharmaceutical Sciences”  
2. Make a Powerpoint presentation on “Various Pharmaceutical products produced using Fermentation Technology”



### Brief of Hours suggested for the Course Outcome

Course Out comes	Class Lecture (Cl)	(LI)	Sessional Work(SW)	Self Learning(Sl )	Total Hour (Cl+SW+ Sl+LI)
<b>CO-BP605-1</b> To elaborate the basic theories that correlate pharmaceutical science	13	20	1	1	35
<b>CO-BP605-2</b> To acquire the knowledge of basic microbiological sciences and genetic engineering	13	16	1	1	31
<b>CO-BP605-3</b> To explain the various mechanisms of Immunological response	13	12	1	1	27
<b>CO- BP605-4</b> To determine the immunological techniques and mutational study	11	08	1	1	21
<b>CO- BP605-5</b> To comprehend the basic concepts of Fermentation technology	10	0	1	1	12
<b>Total Hours</b>	60	56	5	5	126



**Suggestion for End Semester Assessment**  
Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		A	C	E	
CO-1	<b>CO-BP605-1</b> To elaborate the basic theories that corelate pharmaceutical science	08	06	01	15
CO-2	<b>CO-BP605-2</b> To acquire the knowledge of basic microbiological sciences and genetic engineering	08	07	01	16
CO-3	<b>CO-BP605-3</b> To explain the various mechanisms of Immunological response	08	07	01	16
CO-4	<b>CO- BP605-4</b> To determine the immunological techniques and mutational study	07	06	01	14
CO-5	<b>CO- BP605-5</b> To comprehend the basic concepts of Fermentation technology	08	07	01	16
Total		39	33	05	77

The end of semester assessment for Pharmaceutical Biotechnology will be held with written examination of 75 marks

**Note.** Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks. Teachers can also design different tasks as per requirement, for end semester assessment.

**Suggested Instructional/Implementation Strategies:**

1. Improved Lecture
2. Tutorial
3. Case Method
4. Group Discussion
5. Role Play
6. Demonstration
7. ICT Based Teaching Learning (Video Demonstration/Tutorials CBT, Blog, Face book, Twitter, Whats app, Mobile, Online sources)
8. Brainstorming



### Suggested Learning Resources:

S. No.	Title	Author	Publisher	Edition & Year
1	Molecular Biotechnology: Principles and Applications of Recombinant DNA	B.R. Glick and J.J. Pasternak	ASM Press Washington D.C.	4 <sup>th</sup> , 2010
2	Biotechnology – Questioning the Reasons	A. Srivastava	Book Rivers Publication	1&2, 2020/24
3	Text book of Pharmaceutical Analysis	Kenneth A. Connors	Wiley	3rd, 2007
4	Kuby immunology	Judith A. Owen, Jenni Punt, Sharon A. Stranford	Macmillan Education, New York	8 <sup>th</sup> , 2019
5	Principles of Fermentation Technology	Peter F Stanbury, Allan Whitaker, Stephen J Hal	Butterworth-Heinemann	3 <sup>rd</sup> , 2016
6	Pharmaceutical Biotechnology	Rehan Uddin, Mukesh Kumar Pathak, Rahul Dev	IP Innovative Publication Pvt. Ltd., New Delhi	1 <sup>st</sup> , 2021

#### Curriculum Development Team:

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**Course Outcome, Program Specific Outcome& Program Outcome Mapping**

Course Code: BP605T

Course Name : Pharmaceutical Biotechnology

Course Outcome	Program Outcome											Program Specific outcome			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	SO2	PSO3	PSO4
	Pharmacy knowledge	Planning abilities	Problem analysis	Modern tool usage	Leadership skills	Professional Identity	Pharmaceutical Ethics	Communication	The pharmacist and society	Environment and sustainability	Life-long learning	Knowledge of drug discovery	Quality Analysis of API's	MOA of Drug	Biological evaluation of drug
<b>CO-1:</b> The basic theories that correlate pharmaceutical science	3	2	3	1	3	2	1	2	3	2	3	1	3	1	2
<b>CO-2:</b> Basic microbiological sciences and genetic engineering	2	3	1	3	1	2	1	1	2	3	3	3	2	1	3
<b>CO-3:</b> various mechanisms of Immunological response	3	2	3	2	1	1	2	1	2	2	3	3	2	1	3
<b>CO-4:</b> To determine the immunological techniques and mutational study	2	3	2	3	1	3	2	2	3	3	3	3	2	1	3
<b>CO-5:</b> To comprehend the basic concepts of Fermentation	3	3	1	1	1	3	1	3	1	2	3	2	2	2	2



## Course Curriculum Mapping

Pos& PSOs No	Cos No	Co Title	SOs No	Class Room Instructions	Laboratory Instructions	Self Learning
Pos:1,2,3,4,5,6,7,8, 9,10,11 PSOs:1,2,3,4,5,6	<b>CO- BP605-1</b>	To elaborate the basic theories that corelate pharmaceutical science	SO1.1 SO1.2 SO1.3 SO1.4 SO1.5 SO1.6	1.1,1.2,1.3,1.4,1.5,1.6	NA	SL-1.1 SL-1.2 SL- 1.3
Pos:1,2,3,4,5,6,7,8, 9,10,11 PSOs:1,2,3,4,5,6	<b>CO- BP605-2</b>	To acquire the knowledge of basic microbiological sciences and genetic engineering	SO2.1 SO2.2 SO2.3 SO2.4	2.1,2.2,2.3,2.4	NA	SL-1.1 SL-1.2 SL- 1.3
Pos:1,2,3,4,5,6,7,8, 9,10,11 PSOs:1,2,3,4,5,6	<b>CO- BP605-3</b>	<b>CO-BP605-3</b> To explain the various mechanisms of Immunological response	SO3.1 SO3.2 SO3.3 SO3.4 SO3.5 SO3.6 SO3.7	3.1,3.2,3.3,3.4,3.5,3.3 .6,3.7	NA	SL-1.1 SL-1.2 SL- 1.3
Pos:1,2,3,4,5,6,7,8, 9,10,11 PSOs:1,2,3,4,5,6	<b>CO- BP605-4</b>	<b>CO- BP605-4</b> To determine the immunological techniques and mutational study	SO-4.1 SO-4.2 SO4.3 SO4.4 SO4.5	4.1,4.2,4.3,4.4,4.5	NA	SL-1.1 SL-1.2 SL- 1.3
Pos:1,2,3,4,5,6,7,8, 9,10,11 PSOs:1,2,3,4,5,6	<b>CO- BP605-5</b>	<b>CO- BP605-5</b> To comprehend the basic concepts of Fermentation technology	SO5.1 SO5.2 SO5.3 SO5.4 SO5.5	5.1,5.2,5.3,5.4,5.5	NA	SL-1.1 SL-1.2 SL- 1.3





AKS University  
Faculty of Pharmaceutical Science & Technology  
Rajiv Gandhi Institute of Pharmacy  
Curriculum of B. Pharmacy (Pharmaceutical Quality assurance) Program  
(Revised as on 01August2023)  
**Semester-VI**

**Course Code: BP-606T**

**Course Title: Pharmaceutical Quality assurance (theory)**

**Pre-requisite:** The Student should have basic knowledge of manufacturing process, their quality control as well as procedure involved in quality assurance.

**Rationale/Objectives:** Upon completion of the course student shall be able to

- Understand the cGMP aspects in a pharmaceutical industry appreciate the importance of documentation
- Understand the scope of quality certifications applicable to pharmaceutical
- Understand the responsibilities of QA industries & QC department

**Course Outcomes:**

**CO-BP 606.1:** To gain knowledge of ICH guidelines, Quality control processes.

**CO-BP 606.2:** Understanding the concept of Hygiene, premises and equipments and raw materials.

**CO-BP 606.3:** To understand about good Laboratories practices.

**CO-BP 606.4:** To gain knowledge about the complaints and their resolutions.

**CO-BP606.5:** To gain knowledge of different calibration and validation techniques.



## Scheme of Studies

Course code	Title of the course	Program Name	TOTAL Number of contact hours/Week						Credit
			Classroom Instruction(A)		Practical (P)	SW	SL	Total Hours (H)	
			Lecture	Tutorial					
BP606T	Pharmaceutical Quality Assurance	B. Pharmacy	3	1	0	1	1	6	6

### Legend:

**CI:** Class room Instruction (Includes different instructional strategies i.e. Lecture(L)and Tutorial(T)and others),

**LI:** Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)

**SW:** Sessional Work (includes assignment, seminar, mini project etc.),

**SL:** Self Learning, Credits.

**Note:** SW& SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

### Theory Assessment

Board of Study	Course Code	Course Title	Scheme of Assessment(Marks)					End Semester	Total Marks
			Progressive Assessment(PRA)						
			Academicactivity, Any three (Quiz/ Assignment, open book test, filed workandseminar)	Student teach	Class Attend ane(AT	(A) Total Marks	Ses		
Pharmacy	BP606T	Pharmaceutical Quality Assurance	3	3	4	10	15	75	100

### Guidelines for the allotment of marks for attendance

Percentage of Attendance	Theory	Practical
95 – 100	4	2
90 – 94	3	1.5
85 – 89	2	1
80 – 84	1	0.5
Lessthan80	0	0



**Course-Curriculum Detailing:**

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

**CO-BP606T -1:** To gain knowledge of ICH guidelines, Quality control processes.

Item	Approx Hrs
Lecture & Tutorial	10+3=13
Practical(P)	0
SW	1
SL	1
Total:	15

Session Outcomes(SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self Learning (SL)
<b>Theory</b> <b>SO1.1:</b> Definition and concept of Quality control, Quality assurance and GMP <b>SO1.2:</b> Quality by design <b>SO1.3:</b> steps for registration NABL accreditation	N/A	Quality Assurance and Quality Management concepts: <b>1.1</b> Definition and concept of Quality control, Quality assurance and GMP <b>1.2</b> Total Quality Management (TQM): Definition, elements, philosophies <b>1.3</b> ICH Guidelines: purpose, participants, process of harmonization, <b>1.4</b> Brief overview of QSEM, with special emphasis on Q-series guidelines, ICH stability testing guidelines <b>1T-1: Tutorial</b> <b>1.5</b> Quality by design (QbD): Definition, overview <b>1.6</b> elements of Qb D program <b>1.7</b> tools ISO 9000& ISO14000: Overview, Benefits <b>1T-2: Tutorial</b> <b>1.8</b> Elements <b>1.9</b> steps for registration NABL accreditation Principles and <b>1.10</b> procedures <b>1.T-3: Tutorial</b>	<b>1.1</b> Can understand about two different products quality assurance process.

**Suggested Sessional work**

**Assignments:** Definition and concept of Quality control, Quality assurance and GMP



## Unit-II

**CO-BP606-2: Understanding the concept of Hygiene, premises and equipments and raw materials.**

Item	Approx Hrs
Lecture & Tutorial	10+3=13
Practical(P)	0
SW	1
SL	1
Total:	15

Session Outcomes(SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self Learning (SL)
<b>Theory</b> <b>SO2.1:</b> Organization and personnel: Personnel responsibilities, training <b>SO2.2:</b> Premises. <b>SO2.3:</b> purchase specifications and maintenance of stores for raw materials	.	<b>2.1</b> Organization and personnel: Personnel responsibilities, training <b>2.2</b> hygiene and personal records. <b>2.3</b> Premises: Design, construction and plant layout <b>2.4</b> maintenance, sanitation, <b>2.T-1: Tutorial</b> <b>2.5</b> environmental control <b>2.6</b> utilities and maintenance of sterile areas <b>2.7</b> control of contamination. <b>2.T-2: Tutorial</b> <b>2.8</b> Equipments and raw materials: Equipment selection, <b>2.9</b> purchase specifications, maintenance <b>2.10</b> purchase specifications and maintenance of stores for raw materials. <b>2.T-3: Tutorial</b>	<b>2.1</b> Comparative study of two different dosage form design and construction

**Suggested Sessional Work Assignments:** hygiene and personal records



### Unit III

**CO-BP606-3:** To understand about good Laboratories practices

Item	Approx Hrs.
Lecture & Tutorial	10+3=13
Practical(P)	0
SW	1
SL	1
Total:	15

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self Learning (SL)
<b>Theory</b> <b>SO3.1:</b> Quality Control: Quality control test for containers <b>SO3.2:</b> Organization and Personnel.  <b>SO3.3:</b> Records		<b>3.1</b> Quality Control: Quality control test for containers <b>3.2</b> rubber closures and <b>3.3</b> secondary packing materials. <b>3.T-Tutorial</b> <b>3.4</b> Good Laboratory Practices: General Provisions <b>3.5</b> Organization and Personnel <b>3.6</b> Facilities, <b>3.T-Tutorial</b> <b>3.7</b> Equipment, Testing Facilities Operation, <b>3.8</b> Test and Control Articles <b>3.9</b> Protocol for Conduct of a Nonclinical Laboratory Study <b>3.10</b> Records and Reports, Disqualification of Testing Facilities <b>3.T-3 Tutorial</b>	<b>3.1</b> Can read about some more manufacturing process.

#### Suggested Sessional Work

**Assignments:**1. Records and Reports

2. Disqualification of Testing Facilities



**Unit-IV****CO-BP606-4: To gain knowledge about the complaints and their resolutions.**

Item	Approx Hrs.
Lecture & Tutorial	8+3=11
Practical(P)	0
SW	2
SL	1
Total:	14

Session Out comes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self Learning (SL)
<b>Theory</b> <b>SO4.1:</b> Complaints <b>SO4.2:</b> Document maintenance in pharmaceutical industry <b>SO4.3:</b> distribution records.		<b>4.1</b> Complaints: Complaints <b>4.2</b> evaluation of complaints <b>4.3</b> Handling of return good <b>4.4</b> recalling and waste disposal <b>4.T-1 Tutorial</b> <b>4.5</b> Document maintenance in pharmaceutical industry, Batch Formula Record, Master Formula Record <b>4.T-2 Tutorial</b> <b>4.6</b> SOP, Quality audit, Quality Review <b>4.7</b> Quality documentation <b>4.8</b> Reports and documents, distribution records. <b>4.T-3 Tutorial</b>	<b>4.1:</b> Can read about the importance of documents maintenance. .

**Suggested Sessional work****Assignments:** Record, Master Formula Record



## Unit-5

**CO-BP606-5:**To gain knowledge of different calibration and validation techniques

Item	Approx Hrs.
Lecture & Tutorial	7+3=10
Practical(P)	0
SW	2
SL	1
Total:	13

Session Outcomes(SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning(SL)
<b>Theory</b> <b>SO5.1:</b> Sorensen's pH scale. <b>SO5.2:</b> pH determination (electrometric& calorimetric). <b>SO5.3:</b> Application of buffers. <b>SO5.4:</b> Buffered isotonic solution.		<b>5.1</b> Calibration and Validation: Introduction, definition <b>5.2</b> general principles of calibration, <b>5T-1. Tutorial</b> <b>5.3</b> qualification and validation, importance and scope of validation types of validation, validation master plan. <b>5.4</b> Calibration of pH meter, <b>5.5</b> Qualification of UV-Visible spectrophotometer, General <b>5T-2 Tutorial</b> <b>5.6</b> principles of Analytical method Validation <b>5.7</b> Warehousing: Good warehousing practice, materials management <b>5T-3 Tutorial</b>	<b>5.1:</b> Look at different body fluids pH & understand what effect they will have if their pH changes.

### Suggested Sessional Work

**Assignments:** principles of Analytical method Validation.



### Brief of Hours suggested for the Course Outcome

	Course Outcomes	Class Lecture (CI)	(LI)	Sessional Work (SW)	Self Learning (SI)	Total Hour (CI+SW+SI+LI)
<b>CO-BP606-1:</b>	To gain knowledge of ICH guidelines, Quality control processes.	13	0	1	1	15
<b>CO- BP606-2:</b>	Understanding the concept of Hygiene, premises and equipments and raw materials.	13	0	1	1	15
<b>CO-BP606-3</b>	: To understand about good Laboratories practices	13	0	1	1	15
<b>CO- BP606-4</b>	To gain knowledge about the complaints and their resolutions	11	0	2	1	14
<b>CO-BP606-5</b>	To gain knowledge of different calibration and validation techniques	10	0	2	1	13
<b>Total Hours</b>		60	0	7	5	72

### Suggestion for End Semester Assessment Suggested Specification Table(For ESA)

Course Outcome	Unit Titles	Marks Distribution			Total Marks
		A	C	I	
<b>CO-BP606-1:</b>	To gain knowledge of ICH guidelines, Quality control processes.	08	06	01	15
<b>CO-BP606-2:</b>	Understanding the concept of Hygiene, premises and equipments and raw materials.	12	07	01	20
<b>CO-BP606-3:</b>	To understand about good Laboratories practices.	02	06	02	10
<b>CO-BP606-4:</b>	gain knowledge about the complaints and their resolutions.	10	02	03	15
<b>CO-BP606-5:</b>	To gain knowledge of different calibration and validation techniques	05	07	03	15
<b>Total</b>		<b>37</b>	<b>28</b>	<b>10</b>	<b>75</b>

**Legend:** A: Analyze, C: Create, I: Interpret



The end of semester assessment for Pharmaceutical quality assurance will be held with written examination of 75 marks

**Note.** Detailed assessment rubric need to be prepared by the course wise teachers for above tasks. Teachers can also design different tasks as per requirement, for end semester assessment.

**Suggested Instructional/Implementation Strategies:**

1. Improved Lecture
2. Tutorial
3. Case Method
4. Group Discussion
5. Role Play
6. Demonstration
7. ICT Based Teaching Learning (Video Demonstration/Tutorials CBT, Blog, Face book, Twitter, Whats app, Mobile, Online sources)
8. Brainstorming

**Suggested Learning Resources:**

S. No.	Title	Author	Publisher	Edition & Year
1	A guide to Total Quality Management	Kaushik Maitra and Sedhan K Ghosh	Standard publisher	2020, Webpage baased
2	How to Practice GMP's	PP Sharma	Vandana Publication	7 <sup>th</sup> edition 2015
3	Tutorial Pharmacy	Cooper and Gunn.	Arjun Publication	2018 edition
4	Quality Assurance of Pharmaceuticals- A compendium of Guide lines and Related materials	WHO organisation	WHO Publication	Vol. 1
5	Good Laboratory Practice Regulations	Sandy Weinberg	CRC Press	4 <sup>th</sup> Edition 2007

**Curriculum Development Team:**

1. **Prof. SP Gupta** ,Director, RGIP, AKS University
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**Course Outcome, Program Specific Outcome& Program Outcome Mapping**

**Course Code: BP-606T**

**Course Name: Pharmaceutical Quality assurance (theory)**

Course Outcome	Program Outcome											Program Specific outcome			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
	Pharmacy knowledge	Planning Abilities	Problem analysis	Modern tool usage	Leadership skills	Professional Identity	Pharmaceutical Ethics	Communication	The pharmacist and society	Environment and sustainability	Life-long learning	Knowledge of drug discovery	Quality Analysis of API's	MOA of Drug	Biological evaluation of drug
<b>CO-1:</b> ICH guidelines, Quality control processes	3	2	3	1	3	2	1	2	3	2	3	1	3	1	2
<b>CO-2:</b> Hygiene, premises and equipments and raw materials.	2	3	1	3	1	2	1	1	2	3	3	3	2	1	3
<b>CO-3:</b> To understand about good Laboratories practices	3	2	3	2	1	1	2	1	2	2	3	3	2	1	3
<b>CO-4:</b> To gain knowledge about the complaints and their resolutions.	2	3	2	3	1	3	2	2	3	3	3	3	2	1	3
<b>CO-5:</b> To gain knowledge of different calibration and validation techniques	3	3	1	1	1	3	1	3	1	2	3	2	2	2	2

**Legend: 1- Low, 2-Medium, 3-High**



### Course Curriculum Mapping

Pos& PSOs No	Cos No&	Title	SOs No	Class Room Instructions	Laboratory Instructions	Self learning
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	<b>CO-BP60 6-1</b>	To gain knowledge of ICH guidelines, Quality control processes	SO1.1 SO1.2 SO1.3	1.1,1.2,1.3,1.4,1.5,1.6,1.7,1.8,1.9,1.10		SI-1.1
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	<b>CO-BP60 6-2</b>	Understanding the concept of Hygiene, premises and equipments and raw materials.	<b>SO-2.1</b> <b>SO-2.2</b> <b>SO-2.3</b>	2.1,2.2,2.3,2.4,2.5,2.6,2.7		SI-2.1
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	<b>CO-BP60 6-3</b>	To understand about good Laboratories practices	<b>SO-3.1</b> <b>SO-3.2</b> <b>SO-3.3</b>	3.1,3.2,3.3,3.4,3.5,3.6,3.7,3.8,3.9,3.10		SI-3.1
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	<b>CO-BP60 6-4</b>	To gain knowledge about the complaints and their resolutions.	<b>SO-4.1</b> <b>SO-4.2</b> <b>SO-4.3</b>	4.1,4.2,4.3,4.4,4.5,4.6,4.7,4.8		SI-4.1
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	<b>CO-BP60 6-5</b>	To gain knowledge of different calibration and validation techniques.	SO-5.1 SO-5.2 SO-5.3 SO-5.4	5.1,5.2,5.3,5.4,5.5,5.6,5.7	-	<b>SI-5.1</b>





AKS University  
Faculty of Pharmaceutical Science & Technology  
Rajiv Gandhi Institute of Pharmacy  
Curriculum of B. Pharmacy (Instrumental Methods of Analysis) Program  
(Revised as on 01August2023)

**Semester-VII**

**Course Code:** BP701T & BP705P

**Course Title:** Instrumental Methods of Analysis

**Pre-requisite:** Student should have basic knowledge of Spectroscopy, Ultraviolet and Visible radiation, Infra red rays, Chromatography.

**Rationale/Objectives:** Up on completion of the course student shall be able to

- To understand the interaction of matter with electromagnetic radiations and its applications in drug analysis
- To understand the chromatographic separation and analysis of Drugs.
- To Perform quantitative & qualitative analysis of drugs using various analytical instruments.

**Course Out comes:**

**CO-BP701-1:** To understand the basic principle, instrumentation & application of UV Visible spectroscopy & Fluorimetry.

**CO-BP701-2:** To acquire the knowledge of principle, instrumentation & application of IR spectroscopy flame photometry, atomic absorption spectroscopy & nepheloturbidometry.

**CO-BP701-3:** To understanding the various types of chromatography like- Adsorption and partition column chromatography, Thin layer chromatography, Paper chromatography & Electrophoresis.

**CO-BP701-4:** To familiarize with basic concept of Gas chromatography & High performance liquid chromatography (HPLC).

**CO-BP701-5:** To comprehend the basic concepts of Ion exchange chromatography, Gel chromatography & Affinity chromatography.



## Scheme of Studies

Course code	Title of the course	Progra m Name	TOTAL Number of contact hours/Week						Credit	15 Week s(H)
			Classroom Instruction (A)		Practic al (P)	SW	SL	Total Hour s(H)		
			Lecture	Tutorial						
BP701T	Instrume ntal Methods of Analysis Theory	B. Pharmacy	3	1	4	1	1	10	6	150

**Legend: CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others),

**LI:** Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)

**SW: Sessional Work** (includes assignment, seminar, mini project etc.),

**SL:** Self Learning, Credits.

**Note:** SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

## Theory Assessment

Board of Study	Course Code	Course Title	Scheme of Assessment ( Marks )						
			Progressive Assessment ( PRA)						
			Academic activity, Any three (Quiz/ Assignment, open book test, filed work and seminar)	Student teacher interaction	Class Attendance(AT)	(A) Total Marks	Sessional Exam (B)		
Pharmacy	BP-701T	Instrumental method of Analysis	3	3	4	10	15	75	100



## Practical Assessment

Board of Study	Course Code	Course Title	Scheme of Assessment ( Marks )						
			Internal Assessment (A)			End Semester Examination(B)			Total Marks (A+B)
			Attendance	Recod	Sessiona l Exam.	Synopsi s	Experiment	Viva	
Pharmacy	BP-705P	Instrumental Methods of Analysis	2	3	10	5	25	5	50

### Guidelines for the allotment of marks for attendance

Percentage of Attendance	Theory	Practical
95 – 100	4	2
90 – 94	3	1.5
85 – 89	2	1
80 – 84	1	0.5
Less than 80	0	0

### Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.



## Unit I

**CO-BP701-1: To understand the basic principle, instrumentation & application of UV**

**Visible spectroscopy & Fluorimetry.**

Item	Approx Hrs
Lecture & Tutorial	10+3=13
Practical(P)	20
SW	1
SL	1
Total:	35

Session Outcomes (SOs)	Laboratory Instruction(LI)	Class room Instruction(CI)	Self Learning (SL)
Theory SO1.1:UV Visible spectroscopy. SO1.2: Fluorimetry Practical SO-P- 1.1:Determination of absorption maxima and effect of solvents on absorption maxima of organic compounds. SO-P- 1.2: Simultaneous estimation of ibuprofen and paracetamol by UV spectroscopy. SO-P- 1.3: Assay of paracetamol by UV-Spectro-photometry. SO-P-1.4: Estimation of quinine sulfate by fluorimetry. SO-P-1.5: Study of quenching of fluorescence.	1.1 To determine the absorption maxima and effect of solvents on absorption maxima of organic compounds. 1.2: To estimate the ibuprofen and paracetamol by UV spectroscopy. 1.3: To perform the assay of paracetamol by UV-Spectrophotometer. 1.4: To estimate the quinine sulfate by fluorimetry. 1.5: To study the quenching of fluorescence.	1.1: Electronic transitions, chromophores, auxochromes in UV Visible spectroscopy. 1.2: spectral shifts, solvent effect on absorption spectra in UV Visible spectroscopy. 1.4: Beer and Lambert's law, Derivation and deviations. 1T.1 Tutorial Class Instrumentation & detectors of UV Visible spectroscopy. Applications of UV Visible spectroscopy. Single component and multi component analysis in UV Visible spectroscopy. 1T.2 Tutorial Class Theory, Concepts of singlet, doublet and triplet electronic states of Fluorimetry. Internal and external conversions, factors affecting fluorescence of Fluorimetry. Instrumentation of Fluorimetry. Applications of Fluorimetry. 1T.3 Tutorial Class	Electronic transitions, chromophores, auxochromes in UV Visible spectroscopy.  Theory, Concepts of singlet, doublet and triplet electronic states of Fluorimetry.

**Suggested Assignments:** 1 Electronic transition 2. Beer and Lambert's law. 3. Photomultiplier tube.  
4. Concepts of singlet, doublet and triplet electronic states. 5. factors affecting fluorescence.



## Unit II

**CO-BP701-2: To acquired the knowledge of principle, instrumentation & application of IR spectroscopy, Flame Photometry, Atomic absorption spectroscopy & Nepheloturbidometry.**

Item	Approx Hrs
Lecture & Tutorial	10+3=13
Practical(P)	16
SW	1
SL	1
Total:	31

Session Outcomes(SOs)	Laboratory Instruction (LI)	Class room Instruction(CI)	Self Learning (SL)
<b>Theory</b> <b>SO2.1:</b> IR spectroscopy <b>SO2.2:</b> Flame Photometry <b>SO2.3:</b> Atomic absorption spectroscopy <b>SO2.4:</b> Nepheloturbidometry  <b>Practical SO-P-2.1:</b> Determination of sodium by flamephotometry. <b>SO-P-2.2:</b> Determination of potassium by flame photometry. <b>SO-P- 2.3:</b> Determinationof chlorides by nephelo turbidometry. <b>SO-P- 2.4:</b> Determinationof sulphates by nephelo turbidometry.	<b>2.1:</b> To determine the sodium by flame photometry. <b>2.2:</b> To determine the potassium by flame photometry. <b>2.3:</b> To determine the chlorides by nephelo turbidometry. <b>2.4:</b> To determine the sulphates by nephelo turbidometry.	2.1 Fundamental modes of vibrations in poly atomicmolecules, sample handling, factors affecting vibrations in IR spectroscopy. 2.2 Instrumentation & detectors of 2.3IR spectroscopy. applications of IR spectroscopy. <b>2T.1</b> Tutorial Class Principle, & interferences of Flame Photometry. <b>2.4</b> instrumentation and applications of Flame Photometry. <b>2.5</b> Principle, & interferences of AAS. <b>2T.2</b> Tutorial Class Instrumentation of AAS. applications of AAS. <b>2.6</b> Principle of Nepheloturbidometry. instrumentation, <b>2.7</b> Applications of Nepheloturbidometry. <b>2T.3</b> Tutorial Class	2.1: Applications of IR spectroscopy & Flame Photometry.  2. 2: applications of AAS & Nepheloturbido metry.

**Suggested Assignments:** 1. Factors affecting vibrations. 2. Sources of radiation. 3. applications of Flame Photometry . 4. applications of AAS. 5. applications of Nepheloturbidometry.



### Unit III

**CO-BP701-3: To understanding the various types of chromatography like-Adsorption and partition column chromatography, Thin layer chromatography, Paper chromatography & Electrophoresis.**

Item	Approx Hrs
Lecture & Tutorial	10+3=13
Practical(P)	12
SW	1
SL	1
Total:	27

Session Outcomes(SOs)	Laboratory Instruction(LI)	Class room Instruction(CI)	Self Learning (SL)
<b>Theory</b> <b>SO3.1:</b> Adsorption and partition column chromatography. <b>SO3.2:</b> Thin layer chromatography. <b>SO3.3:</b> Paper chromatography. <b>SO3.4:</b> Electrophoresis. <b>Practical</b> <b>SO-P-3.1:</b> Separation of amino acids by paper chromatography <b>SO-P-3.2:</b> Separation of sugars by thin layer chromatography <b>SO-P-3.3:</b> Separation of plant pigments by column chromatography	<b>3.1:</b> To carry out the Separation of amino acids by paper chromatography. <b>3.2:</b> To carry out the separation of sugars by thin layer chromatography. <b>3.3:</b> To carry out the separation of plant pigments by column chromatography.	3.1 Introduction & Methodology of Adsorption and partition column chromatography. 3.2: Advantages, Disadvantages & application of Adsorption and partition column chromatography. 3.3 Introduction, Principle of TLC. <b>3T.1</b> Tutorial Class 3.4: Methodology, R <sub>f</sub> values of TLC. 3.5: advantages, disadvantages and applications of TLC. 3.6: Introduction, methodology, development techniques of Paper chromatography. <b>3T.2</b> Tutorial Class 3.6: advantages, disadvantages and applications of Paper chromatography. 3.7 Introduction, factors affecting electrophoretic mobility of Electrophoresis. 3.8: Techniques of paper, gel Electrophoresis. 3.9: capillary electrophoresis & applications of Electrophoresis. <b>3T.3</b> Tutorial Class	<b>3.1</b> : Introduction to chromatography <b>3.2:</b> TLC

**Suggested Assignments:** 1. Capillary electrophoresis. 2. Gel electrophoresis. 3. TLC 4. Paper chromatography. 5. Adsorption and partition column chromatography



#### Unit IV

**CO-BP701-4: To familiarize with basic concept of Gas chromatography & High Performance liquid chromatography (HPLC).**

Item	Approx Hrs
Lecture & Tutorial	08+3=11
Practical(P)	08
SW	1
SL	1
Total:	21

Session Outcomes(SOs)	Laboratory Instruction(LI)	on Instruction(CI)	Self Learning (SL)
<b>Theory</b> <b>SO4.1:</b> Gas chromatography <b>SO4.2:</b> High performance liquid chromatography (HPLC) <b>Practical</b> <b>SO-P-4.1:</b> Demonstration experiment on HPLC. <b>SO-P-4.2:</b> Demonstration experiment on Gas Chromatography.	<b>4.1:</b> To demonstrate the experiment on HPLC. <b>4.2:</b> To demonstrate the experiment on Gas Chromatography.	4.1: Introduction, theory of GC. 4.2: instrumentation, derivatization, temperature programming of GC. <b>4T.1</b> Tutorial Class 4.3 advantages, disadvantages of GC. 4.4: applications of GC. 4.5: Introduction to HPLC. 4.6: Theory of HPLC. <b>4T.2</b> Tutorial Class 4.7: instrumentation of HPLC. 4.8 advantages and applications of HPLC. <b>4T.3</b> Tutorial Class	<b>4.1:</b> Introduction to GC. <b>4.2:</b> Introduction to HPLC.

**Suggested Assignments:** 1. GC 2. HPLC



## Unit V

**CO-BP701-5: To comprehend the basic concepts of Ion exchange chromatography, Gel chromatography & Affinity chromatography**

Item	Approx Hrs
Lecture & Tutorial	07+03=10
Practical(P)	0
SW	1
SL	1
Total:	28

Session Outcomes(SOs)	Laboratory Instruction (LI)	Class room Instruction(CI)	Self Learning (SL)
<b>Theory</b> <b>SO5.1:</b> Ion <b>SO5.2:</b> Gel chromatography <b>SO5.3:</b> Affinity chromatography	NA	5.1 Introduction, classification, ion 5.2 exchange resins of Ion exchange chromatography. 5.3: mechanism of ion exchange process, factors affecting ion exchange of Ion exchange chromatography. 5.4 Methodology and applications of Ion exchange chromatography. <b>5T.1</b> Tutorial Class 5.5: Introduction, theory of Gel chromatography. 5.6 Instrumentation and applications of Gel chromatography. <b>5T.2</b> Tutorial Class 5.7: Introduction, theory of Affinity chromatography. 5.8 : instrumentation and applications of Affinity chromatography. <b>5T.3</b> Tutorial Class	<b>5.1:</b> mechanism of ion exchange process. <b>5. 2:</b> factors affecting ion exchange.

**Suggested Assignments:** 1. Ion exchange chromatography, 2. Gel chromatography, Affinity chromatography



### Brief of Hours suggested for the Course Outcome

Course Out comes	Class Lecture (Cl)	(LI)	Session a l Work (SW)	Self Learning (Sl)	Total Hour (Cl+SW+ Sl+LI)
<b>CO-BP701-1:</b> To understand the basic principle, instrumentation & application of UV Visible spectroscopy & Fluorimetry.	13	20	1	1	35
<b>CO-BP701-2:</b> To acquired the knowledge of principle, instrumentation & application of IR spectroscopy, Flame Photometry, Atomic Absorption spectroscopy & Nepheloturbidometry.	13	16	1	1	31
<b>CO-BP701-3:</b> To understanding the various types of chromatography like-Adsorption And partition column chromatography, Thin layer chromatography, Paper chromatography & Electrophoresis.	13	12	1	1	27
<b>CO-BP701-4:</b> To familiarize with basic concept of Gas chromatography & High performance liquid chromatography (HPLC).	11	08	1	1	21
<b>CO-BP701-5:</b> To comprehend the basic concepts of Ion exchange chromatography, Gel chromatography & Affinity chromatography.	10	0	1	1	12
<b>Total Hours</b>	60	56	5	5	126



**Suggestion for End Semester Assessment**  
Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		A	C	E	
CO-1	To understand the basic principle, instrumentation & application of UV Visible spectroscopy & Fluorimetry.	08	06	01	15
CO-2	To acquired the knowledge of principle, instrumentation & application of IR spectroscopy, Flame Photometry, Atomic absorption spectroscopy & Nepheloturbidometry.	08	07	01	16
CO-3	To understanding the various types of chromatography like- Adsorption and partition column chromatography, Thin layer chromatography, Paper Chromatography & Electrophoresis.	08	07	01	16
CO-4	To familiarize with basic concept of Gas Chromatography & High performance liquid chromatography (HPLC).	07	06	01	14
CO-5	To comprehend the basic concepts of Ionexchange chromatography, Gel Chromatography & Affinity chromatography.	08	07	01	16
Total		39	33	05	77

**Legend: A : Analyze, C: Create, E: Evaluate**

The end of semester assessment for Instrumental Methods of Analysis will be held with written examination of 75 marks

**Note.** Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks.

Teachers can also design different tasks as per requirement, for end semester assessment.

**Suggested Instructional/Implementation Strategies:**

1. Improved Lecture
2. Tutorial
3. Case Method
4. Group Discussion
5. Role Play
6. Demonstration
7. ICT Based Teaching Learning (Video Demonstration/Tutorials CBT, Blog, Face book, Twitter, Whats app, Mobile, Online sources)
8. Brainstorming



### Suggested Learning Resources:

S. No.	Title	Author	Publisher	Edition & Year
1	Instrumental Methods of Chemical Analysis	B.K Sharma	Krishna Prakashan Media	1, 1981
2	Organic spectroscopy	Y.R Sharma	S. Chand	January, 2013
3	Text book of Pharmaceutical Analysis	Kenneth A. Connors	Wiley	3 <sup>rd</sup> , 2007
4	Vogel's Text book of Quantitative Chemical Analysis	A.I. Vogel	Vogel	5 <sup>th</sup> , 1989
5	Practical Pharmaceutical Chemistry	A.H. Beckett and J.B. Stenlake	The Anthlone Press	4 <sup>th</sup> , 2023
6	Organic Chemistry	I. L. Finar	PEARSON	6 <sup>th</sup> , 2002
7	Organic spectroscopy	William Kemp	Macmillan, 1975	3 <sup>rd</sup> , 2019
8	Quantitative Analysis of Drugs	D. C. Garrett	CBS PUBLICATION	3 <sup>rd</sup> , 2008
9	Quantitative Analysis of Drugs in Pharmaceutical Formulations	P. D. Sethi	CBS Publishers and Distributors	3 <sup>rd</sup> , 2007
10	Spectrophotometric identification of Organic Compounds	Silverstein	John Wiley & Sons	5 <sup>th</sup> , 1991

#### Curriculum Development Team:

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**Course Outcome, Program Specific Outcome& Program Outcome Mapping**

Course Code: BP701T & BP705P

Course Name: **Instrumental Methods of Analysis**

Course Outcome	Program Outcome											Program Specific outcome			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
	Pharmacy knowledge	Planning Abilities	Problem analysis	Modern tool usage	Leadership skills	Professional Identity	Pharmaceutical Ethics	Communication	The pharmacist and society	Environment and sustainability	Life-long learning	Knowledge of drug discovery	Quality Analysis of API's	MOA of Drug	Biological evaluation of drug
<b>CO-1:</b> UV Visible & Fluorimetry.	3	2	3	1	3	2	1	2	3	2	3	1	3	1	2
<b>CO-2:</b> IR spectroscopy, Flame Photometry, Atomic, Absorption Spectroscopy	2	3	1	3	1	2	2	1	2	3	3	3	2	1	3
<b>CO-3:</b> chromatography	3	2	3	2	2	1	2	1	2	2	3	3	2	1	3
<b>CO-4:</b> Familiarize with basic concept of Gas chromatography& HPLC	2	3	2	3	1	3	2	2	3	3	3	3	2	1	3
<b>CO-5:</b> Gel chromatography & Affinity chromatography	3	3	1	1	1	3	1	3	1	2	3	2	2	2	2

**Legend: 1- Low, 2-Medium, 3-High**



**Course Curriculum Mapping**

<b>Pos&amp; PSOs No</b>	<b>Cos No</b>	<b>Co Title</b>	<b>SOs No</b>	<b>Class Room Instructions</b>	<b>Laboratory Instructions</b>	<b>Self learning</b>
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	<b>CO-BP701-1:</b>	To understand the basic principle, instrumentation & application of UV Visible spectroscopy & Fluorimetry.	SO1.1 SO1.2	1.1,1.2,1.3,1.4,1.5,1.6,1.7,1.8,1.9,1.10	LI-1.1 LI-1.2 LI-1.3 LI-1.4	SI-1.1 SI-1.2
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	<b>CO-BP701-2:</b>	To acquired the knowledge of principle, instrumentation & application of IR spectroscopy, Flame Photometry, Atomic Absorption Spectroscopy & Nepheloturbidometry.	<b>SO-2.1</b> <b>SO-2.2</b>	2.1,2.2,2.3,2.4,2.5,2.6,2.7,2.8,2.9,2.10	LI-2.1 LI-2.2	SI-2.1
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	<b>CO-BP701-3:</b>	To understanding the various types of chromatography like- Adsorption and partition column chromatography, Thin layer chromatography, Paper chromatography & Electrophoresis.	<b>SO-3.1</b> <b>SO-3.2</b> <b>SO-3.3</b>	3.1,3.2,3.3,3.4,3.5,3.6,3.7,3.8,3.9,3.10	LI-4.1 LI-4.2	SI3.1
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	<b>CO-BP701-4:</b>	To familiarize with basic concept of Gas chromatography & High performance liquid chromatography (HPLC).	<b>SO-4.1</b> <b>SO-4.2</b>	4.1,4.2,4.3,4.4,4.5,4.6,4.7,4.8.	LI-4.1 LI-4.2 LI-4.3 LI-4.4	SI-4.1
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	<b>CO-BP701-5:</b>	To comprehend the basic concepts of Ion exchange chromatography, Gel chromatography & Affinity chromatography	SO-5.1 SO-5.2	5.1,5.2,5.3,5.4,5.5,5.6,5.7,5.8	-	<b>SI-5.1</b>





AKS University  
Faculty of Pharmaceutical Science & Technology  
Rajiv Gandhi Institute of Pharmacy  
Curriculum of B. Pharmacy (Industrial Pharmacy II) Program  
(Revised as on 01August2023)

**Semester-VII**

**Course Code:** BP702T

**Course Title:** Industrial Pharmacy II

**Pre-requisite:** Students should have knowledge about industrial pharmacy I.

**Rationale/Objectives:** Know the process of pilot plant and scale up of pharmaceutical dosage forms, Understand the process of technology transfer from lab scale to commercial batch, Know different Laws and Acts that regulate pharmaceutical industry, Understand the approval process and regulatory requirements for drug product.

**Course Out comes:**

**CO-BP702.1:** Understand Pilot plant scale up techniques, SUPAC guidelines, Introduction to platform technology.

**CO-BP702.2:** To Learn Technology development and transfer and TT agencies in India - APCTD, NRDC, TIFAC, BCIL, TBSE / SIDBI

**CO-BP702.3:** Understand Regulatory affairs and Regulatory requirements for drug approval.

**CO-BP702.4:** To Understanding Quality management systems in pharmaceutical.

**CO-BP702.5:** Learn about Central Drug Standard Control Organization (CDSCO) and State Licensing Authority



## Scheme of Studies

Course code	Title of the course	Program Name	TOTAL Number of contact hours/Week						Credit
			Classroom Instruction (A)		Practical (P)	SW	SL	Total Hours (H)	
			Lecture	Tutorial					
BP702T	Industrial Pharmacy II	B. Pharmacy	3	1	4	1	1	10	6

**Legend:CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others),

**LI: Laboratory Instruction** (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)

**SW: Sessional Work** (includes assignment, seminar, mini project etc.),

**SL: Self Learning, Credits.**

**Note:** SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

## Theory Assessment

Board of Study	Course Code	Course Title	Scheme of Assessment ( Marks )					EndSemester Assessment(C)	Total Marks(A+B+C)
			Progressive Assessment ( PRA)						
			Academic activity, Any three (Quiz/ Assignment, open book test, filed work and seminar)	Student teacher interaction	Class Attendance(AT)	(A)  Total Marks	Sessional Exam(B)		
Pharmacy	BP-702T	Industrial Pharmacy II	3	3	4	10	15	75	100



**Guidelines for the allotment of marks for attendance**

<b>Percentage of Attendance</b>	<b>Theory</b>	<b>Practical</b>
95 – 100	4	2
90 – 94	3	1.5
85 – 89	2	1
80 – 84	1	0.5
Less than 80	0	0



**Course-Curriculum Detailing:**

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

**Unit I****CO-BP702.1: Understand Pilot plant scale up techniques, SUPAC guidelines, Introduction to platform technology.**

Item	Approx Hrs
Lecture & Tutorial	10+3=13
Practical(P)	0
SW	1
SL	1
Total:	15

Session Outcomes(SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning(SL)
<b>Theory</b> <b>SO1.1</b> Understanding large scale production in pharmaceutical industry <b>SO1.2</b> Understand various requirements for R&D scale to scale up method. <b>SO1.3</b> Learn Pilot plant scale up considerations for solids, liquid orals, semi solids. <b>SO1.4</b> Understands about documentation and SUPAC guidelines <b>SO1.5</b> Understanding Introduction to platform technology.		<b>Unit-1. Pilot plant scale up techniques:</b> 1.1 General considerations. Significance of personnel. 1.2 Including space requirements. 1T.1 Tutorial class. 1.3 Raw materials. 1.4 Pilot plant scale up 1.5 considerations for solids 1.6 Liquid orals. 1T.2 Tutorial class. 1.7 Semi solids. Relevant documentation. SUPAC guidelines. 1T.3 Tutorial class. 1.8. Introduction to platform technology	1. Small scale technique  2. Learn conventional technique of formulation.

**Suggested Assignments:** 1. Raw materials. 2. Semi solids. 3. Liquid orals.



## Unit II

**CO-BP702.2: Learn Technology development and transfer and TT agencies in India - APCTD, NRDC, TIFAC, BCIL, TBSE / SIDBI**

Item	Approx Hrs
Lecture & Tutorial	10+3=13
Practical(P)	0
SW	1
SL	1
Total:	15

Session Outcomes(SOs)	Laboratory Instruction(LI)	Class room Instruction(CI)	Self Learning (SL)
<b>Theory</b> <b>SO2.1</b> To Understand WHO guidelines for Technology Transfer(TT) <b>SO2.2</b> Understand various preparations <b>SO2.3</b> To learn about Transfer from R & D to production. <b>SO2.4</b> To understand about Approved regulatory bodies and agencies. <b>SO2.5</b> To learn about Approved regulatory bodies and agencies		<b>UNIT 2 :Technology development and transfer:</b> WHO guidelines for Technology Transfer(TT): Terminology, Technology transfer protocol, Quality risk management. Transfer from R & D to production(Process, packaging and cleaning). Granularity of TT Process (API, excipients, finished products, packaging materials). 2T.1 Tutorial class. Documentation, Premises and equipments, qualification and validation, quality control, analytical method transfer. Approved regulatory bodies and agencies. Commercialization - practical aspects and problems (case studies). 2T.2 Tutorial class. TT agencies in India - APCTD, NRDC, TIFAC, BCIL, TBSE / SIDBI. TT related documentation. Confidentiality agreement Licensing. 2T.3 Tutorial class. MoUs, legal	1. Knowledge about . Various department in industry and their work in pharmaceutical industry.



**Suggested Assignments:** 1. Technology Transfer. 2. qualification and validation. 3. APCTD

### Unit III

**CO-BP702.3: Understand Regulatory affairs and Regulatory requirements for drug approval.**

Item	Approx Hrs
Lecture & Tutorial	10+3=13
Practical(P)	0
SW	1
SL	1
Total:	15

Session Outcomes(SOs)	Laboratory Instruction(LI)	Class room Instruction(CI)	Self Learning(SL)
<b>Theory</b> <b>SO3.1</b> Understand Introduction and History of Regulatory affairs.  <b>SO3.2</b> To understand about Professionals Drug Development Teams. <b>SO3.3</b> To learn about Investigational New Drug (IND), New Drug Application (NDA).  <b>SO3.4</b> To understand Data Presentation for FDA Submission s.  <b>SO3.5</b> To learn Management of Clinical Studies.		<b>Unit 3 Regulatory affairs and Regulatory requirements for drug approval:</b> 3.1 Introduction, Historical overview of Regulatory Affairs, Regulatory authorities, 3.2 Role of Regulatory affairs department, Responsibility of Regulatory Affairs 3.3 Professionals Drug Development Teams, Non-Clinical Drug Development, Pharmacology. 3T.1 Tutorial class 3.4 Drug Metabolism and Toxicology, General considerations of Investigational New Drug (IND) 3.5 Application, Investigator's Brochure (IB) and New Drug Application (NDA), 3.6 Clinical research / BE studies. 3T.2 Tutorial class 3.7 Clinical Research Protocols, 3.8 Biostatistics in Pharmaceutical Product Development, 3.9 Data Presentation for FDA Submissions. 3T.3 Tutorial class  Management of Clinical Studies.	<b>3.1 :</b> Basic requirement of drug development team.

**Suggested Assignments:** 1. NDA. 2. IND. 3. Non-Clinical Drug Development.



## Unit IV

### CO-BP702.4: Understanding Quality management systems in pharmaceutical.

Item	Approx Hrs
Lecture & Tutorial	10+3=13
Practical(P)	0
SW	1
SL	1
Total:	15

Session Outcomes(SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
<b>Theory</b> <b>SO4.1</b> Understanding Quality management & Certifications Concept of Quality.  <b>SO4.2</b> Evaluation Six Sigma concept, Out of Specifications.  <b>SO4.3</b> Understand Introduction to ISO 9000 series of quality systems standards.  <b>SO4.4</b> Understand ISO14000, NABL and GLP		<b>Unit-4 Quality management systems:</b>  Quality management & Certifications: Concept of Quality.  Total Quality Management.  Quality by Design (QbD). 4T.1 Tutorial class  Six Sigma concept, Out of Specifications (OOS).  Change control, Introduction to ISO 9000 series of quality systems standards,  4.6 ISO 14000 4T.2 Tutorial class  NABL  GLP.  4T.3 Tutorial class	<b>4.1:</b> Brief introduction of GLP



## Unit V

**CO-BP702.5: Learn about Central Drug Standard Control Organization (CDSCO) and State Licensing Authority.**

Item	Approx Hrs
Lecture & Tutorial	10+03=13
Practical(P)	0
SW	1
SL	1
Total:	15

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
<b>SO5.1</b> Understand about Central Drug Standard Control Organization  <b>SO5.2</b> Learn about State Licensing Authority: Organization  <b>SO5.3</b> Understands Certificate of Pharmaceutical Product.  <b>SO5.4</b> Understand Regulatory requirements. <b>SO5.5</b> Evaluation of Approval procedures for New Drug solid dosage forms		<b>Unit 5: Indian Regulatory Requirements:</b> 5.1 Central Drug Standard Control Organization (CDSCO). 5.2 State Licensing Authority: Organization. 5.3 of Responsibilities of CDSCO and state authority. 5T.1 Tutorial class. 5.4 Certificate of Pharmaceutical Product (COPP). 5.5 Regulatory requirements and 5.6 Approval procedures for New Drug solid dosage forms. 5T.2 Tutorial class.  5.7 Continue approval procedure.  5 T.3 Tutorial class.	1. Different authority in world.

**Suggested Assignments:** 1. CDSCO, 2. COPP.



### Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (CL)	Sessional Work (SW)	Self Learning (SL)	Total hour (CL+SW+SL)
<b>CO-BP702.1:</b> Understand Pilot plant scale up techniques, SUPAC guidelines, Introduction to platform technology.	13	1	1	15
<b>CO-BP702.2:</b> To Learn Technology development and transfer and TT agencies in India - APCTD, NRDC, TIFAC, BCIL, TBSE / SIDBI	13	1	1	15
<b>CO-BP702.3:</b> Understand Regulatory affairs and Regulatory requirements for drug approval.	13	1	1	15
<b>CO-BP702.4:</b> To Understanding Quality management systems in pharmaceutical.	11	1	1	13
<b>CO-BP702.5:</b> Learn about Central Drug Standard Control Organization (CDSCO) and State Licensing Authority.	10	1	1	12
Total Hours	60	5	5	70



### Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

Course Out comes	Unit Titles	Marks Distribution			Total Marks
		A	C	E	
<b>CO-BP702-1</b>	Pilot plant scale up techniques	07	05	03	15
<b>CO-BP702-2</b>	Technology development and transfer	10	03	02	15
<b>CO-BP702-3</b>	Regulatory affairs and Regulatory requirements for drug approval.	10	03	02	15
<b>CO-BP702-4</b>	Quality management systems	08	05	02	15
<b>CO-BP702-5</b>	Indian Regulatory Requirements	07	05	03	15
Total		42	21	12	75

**Legend:**     **A : Analyze,**            **C: Create,**            **E: Evaluate**

The end of semester assessment for Industrial Pharmacy II will be held with written examination of 75 marks

**Note.** Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks.

Teachers can also design different tasks as per requirement, for end semester assessment.

**Suggested Instructional/Implementation Strategies:**

1. Improved Lecture
2. Tutorial
3. Case Method
4. Group Discussion
5. Role Play
6. Demonstration
7. ICT Based Teaching Learning (Video Demonstration/Tutorials CBT, Blog, Face book, Twitter, Whats app, Mobile, Online sources)
8. Brainstorming



**Suggested Learning Resources:**

S. No.	Title	Author	Publisher	Edition & Year
1	Text book of FDA Regulatory Affairs A Guide for Prescription Drugs, Medical Devices, and Biologics'	Douglas J Pisano and David S. Mantus.	CRC Press	2nd edition (11 August 2008)
2	Industrial Pharmacy	Veena Kalyani S.Dr. Mohammed Younus Ali	Nirali prakashan	1 January 2020

**Curriculum Development Team:**

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3. **Ms Neha Goel**, Associate Professor, RGIP, AKS University



**Course Outcome, Program Specific Outcome& Program Outcome Mapping**

**Course Code: BP702T**

**Course Name: Industrial Pharmacy II**

Course Outcome	Program Outcome											Program Specific outcome			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
	Pharmacy knowledge	Planning Abilities	Problem analysis	Modern tool usage	Leadership skills	Professional Identity	Pharmaceutical Ethics	Communication	The pharmacist and society	Environment and sustainability	Life-long learning	Knowledge of drug discovery	Quality Analysis of API's	MOA of Drug	Biological evaluation of drug
<b>CO-1:</b> Pilot plant scale up techniques	3	2	3	1	3	2	1	2	3	2	3	1	3	1	2
<b>CO-2:</b> Technology development and transfer and TT agencies in India	2	3	1	3	1	2	1	1	2	3	3	3	2	1	3
<b>CO-3:</b> Understand Regulatory affairs and Regulatory requirements	3	2	3	2	2	1	2	1	2	2	3	3	2	1	3
<b>CO-4:</b> To Understanding Quality management systems in pharmaceutical	2	3	2	3	1	3	2	2	3	3	3	3	2	1	3
<b>CO-5:</b> Central Drug Standard Control Organization (CDSCO) and State Licensing Authority	3	3	1	1	1	3	2	3	1	2	3	2	2	2	2

**Legend: 1- Low, 2-Medium, 3-High**



## Course Curriculum Mapping

Pos& PSOs No	Cos No&	Title	SOs No	Class Room Instructions	Laboratory Instructions	Self learning
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	<b>CO-BP702-1</b>	Understand Pilot plant scale up techniques, SUPAC guidelines, Introduction to platform technology.	SO1.1 SO1.2 SO1.3	1.1,1.2,1.3,1.4,1.5,1.6,1.7,1.8,1.9,1.10	LI-1.1	SI-1.1
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	<b>CO-BP702-2</b>	To Learn Technology development and transfer and TT agencies in India - APCTD, NRDC, TIFAC, BCIL, TBSE / SIDBI	SO-2.1 SO-2.2 SO-2.3	2.1,2.2,2.3,2.4,2.5,2.6,2.7,2.8,2.9,2.10	LI-2.1 LI-2.2 LI-2.3	SI-2.1
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	<b>CO-BP702-3</b>	Understand Regulatory affairs andRegulatory requirements for drug approval.	SO-3.1 SO-3.2	3.1,3.2,3.3,3.4,3.5,3.6,3.7,3.8	LI-3.1 LI-3.2 LI-3.3	SI3.1
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	<b>CO-BP702-4</b>	To Understanding Quality management systems in pharmaceutical.	SO-4.1 SO-4.2	4.1,4.2,4.3,4.4,4.5,4.6,4.7,4.8.	LI-4.1 LI-4.2 LI-4.3	SI-4.1
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	<b>CO-BP702-5</b>	Learn about Central Drug Standard Control Organization(CDSCO) and State Licensing Authority.	SO-5.1	5.1,5.2,5.3,5.4,5.5,5.6	LI-5.1 LI-5.2 LI-5.3	SI-5.1





AKS University  
Faculty of Pharmaceutical Science & Technology  
Rajiv Gandhi Institute of Pharmacy  
Curriculum of B. Pharmacy (Pharmacy Practice) Program  
(Revised as on 01August2023)  
**Semester-VII**

**Course Code:** BP703T

**Course Title:** Pharmacy Practice

**Pre-requisite:** The Student should have basic knowledge of Drugs, Adverse drug reactions, patient counseling & Basics of community pharmacy.

**Rationale/Objectives:**

The primary mission of the pharmacy Practice is to have a positive impact on the provision of public health service by ensuring the safe and effective use of medications.

**Course Outcome**

**CO-BP-703.1:** To Understand the Organization Structure of a Hospital and. Know the basics of ADR with regulatory accepts.

**CO-BP-703.2:** To know various drug distribution methods in a hospital. Monitor drug therapy of patient through medication chart review and clinical review

**CO-BP-703.3:** To know pharmaceutical care services & patient counseling in community pharmacy.

**CO-BP-703.4:** To know the appreciate rational uses of drug & budget preparation and implementation.

**CO-BP-703.5:** To understand the inventory management system & Interpretation of Clinical Laboratory Tests

Board of Study	Course Code	Course Title	Scheme of studies (Hours/Week)					Total Credits (C)
			CI	LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	
Pharmacy	BP703T	Pharmacy Practice	4	0	1	1	6	4

**Legend: CI:**

Class room Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others),

**LI:** Laboratory Instruction (Includes Practical performances in laboratory



Workshop, field or other locations using different instructional strategies)

**SW:** Sessional Work (includes assignment, seminar, mini project etc.),

**SL:** Self Learning,

**C:** Credits

**Note:** SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning

### Scheme of Assessment:

#### Theory

Board Of Study	Course Code	Course Title	Scheme of Assessment(Marks)						
			Progressive Assessment(PRA)						
			Academic activity, Any three (Quiz/ Assignment, open book test, filed work and seminar)	Student teacher interaction	Class Attendance (AT)	Total Mark	(A) Sessional Exam (B)	End Semester	Total Marks(A+B+C)
Pharmacy	BP 703T	Pharmacy Practice– Theory	3	3	4	10	15	75	100

### Guidelines for the allotment of marks for attendance

#### Percentage Attendance Theory/Practical

Sr. No	Percentage of Attendance	Theory	Practical's
1.	95–100	4	2
2	90–94	3	1.5
3.	85–89	2	1
4	80–84	1	0.5
5.	Lessthan80	0	0

### Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the over all achievement of Course Outcomes (COs) upon the course's conclusion.



## **Unit I**

**CO-BP-703-01:** To Understand the Organization Structure of a Hospital, and Medical staffs involved in the hospital and Hospital pharmacy with its organization. Know the basics of ADR with regulatory aspects.

Item	Approx Hrs
Lecture & Tutorial	10+3=13
Practical(P)	0
SW	1
SL	1
Total	15

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction(CI)	Self Learning (SL)
a) Hospital and it's organization b) Hospital pharmacy and its organization c) Adverse drug reaction d) Community Pharmacy		<b>1.1</b> Definition, Classification of hospital-Primary, Secondary and Tertiary hospitals, Classification based on Clinical and non-clinical basis, <b>1.2</b> Organization structure of a hospital and medical staffs involved in the hospital and their functions. <b>1.3</b> Organization structure, Location, Layout and staff requirements, and Responsibilities and Functions of hospital pharmacists. <b>1.4</b> Adverse drug reaction: Classifications Excessive pharmacological effects, secondary pharmacological effects, <b>1.5:</b> idiosyncrasy, allergic drug reactions, genetically determined toxicity, toxicity following sudden withdrawal of drugs, <b>1.6:</b> Drug interaction- beneficial interactions, adverse interactions and pharmacokinetic drug interactions, Methods for detecting, spontaneous case reports and record linkage studies and Adverse drug reaction reporting and management. <b>1.7 :</b> Community Pharmacy Organization and structure of retail and whole sale drug store, types and design, Legal requirements for establishment and maintenance of a drug store, <b>1.8</b> Dispensing of proprietary products, maintenance of records of retail and wholesale drug store. <b>1T1.</b> Classification of hospital <b>1.9</b> hospital- Primary, Secondary and Tertiary hospitals, Classification based on clinic and non-clinical basis, <b>1T2</b> Organization <b>1.10</b> structure, Location, Layout and staff requirements, and Responsibilities and functions of hospital <b>1T3.</b> Drug interaction beneficial interactions, adverse interactions	1.1 Clinical trial & Post Marketing Surveillance reporting.

### **Suggested Sessional work**

Drug interaction, adverse drug reaction Classifications, Organization structure, Location, Layout and staff requirements, and Responsibilities and functions of hospital



## Unit II

**Co-BP- 703.2: To know various drug distribution methods in a hospital. Monitor drug therapy of patient through medication chart review and clinical review**

Item	Approx Hrs
Lecture & Tutorial	13
Practical(P)	0
SW	1
SL	1
Total	15

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
2.1 Drug distribution system in a hospital 2.2 Hospital formulary 2.3 Therapeutic drug monitoring 2.3 Medication adherence 2.4 Patient medication history interview 2.5 Community pharmacy management		<b>2.1</b> Dispensing of drugs to inpatients, types of drug distribution systems, charging policy and labeling <b>2.2</b> Dispensing of drugs to ambulatory patients, and Dispensing of controlled drugs. <b>2.3</b> Hospital formulary Definition, contents of hospital formulary, Differentiation of hospital formulary <b>2.4</b> Drug list, preparation And revision, and addition And deletion of drug from Hospital formulary <b>2.5</b> Therapeutic drug monitoring, Need for Therapeutic Drug Monitoring <b>2.6</b> Factors to be Considered during the Therapeutic Drug Monitoring, and Indian Scenario for Therapeutic Drug Monitoring. <b>2.7</b> Medication adherence, Causes of medication non-adherence. <b>2.8</b> pharmacist role in the Medication adherence and Monitoring of patient Medication adherence <b>2.9</b> Patient medication History interview Need for The patient medication History interview, Medication interview forms. <b>2.10</b> Community pharmacy Management Financial, materials, staff, and Infrastructure requirements  <b>2T1.</b> Hospital formulary <b>2T2.</b> Therapeutic drug monitoring <b>3T3.</b> Medication Adherence Causes of Medication non-adherence, Pharmacist role in the Medication adherence , and monitoring of patient medication adherence	1. Study the bioavailability of drug 2. Advanced methods of Drug distribution system



### Suggested Sessional work

- A) Hospital formulary, Therapeutic drug monitoring ,Drug distribution system In a hospital, Patient medication history interview

### CO-BP-703.3: To know pharmaceutical care services & patient counseling in community pharmacy

Item	Approx Hrs
Lecture & Tutorial	10+3=13
Practical (P)	0
SW	1
SL	1
Total	15

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
<p>A) Pharmacy and therapeutic committee</p> <p>B) Drug information services</p> <p>C) Patient counseling</p> <p>D) Education and training program in the hospital</p> <p>C) Prescribed medication order and communication skills</p>		<p><b>3.1</b> Pharmacy and therapeutic committee Organization, functions</p> <p><b>3.2.</b> Policies of the pharmacy and therapeutic committee in including drugs into formulary, i</p> <p><b>3.3</b> Inpatient and outpatient prescription, automatic stop order, and emergency drug list preparation.</p> <p><b>3.4</b> Drug information services-Drug and Poison information centre,</p> <p><b>3.5</b>, Sources of drug information, Computerized services, and storage and retrieval of information.</p> <p><b>3.6</b> Patient counseling Definition of patient counseling; steps on evolved inpatient counseling, and Special cases that require the pharmacist</p> <p><b>3.7</b> Education and training program in the hospital Role of pharmacist in the Education and training program</p> <p><b>3.8</b> Internal and external Training program, Services to the nursing homes/clinics</p> <p><b>3.9</b> Code of ethics for community pharmacy, and Role of pharmacist in the interdepartmental Communication and community health Education.</p> <p><b>3.10</b> Prescribed medication order and communication Skills Prescribed Medication order- Interpretation and legal requirements, and Communication skills- Communication with prescribers and patients</p> <p><b>3T1.</b> Pharmacy and the therapeutic committee</p> <p><b>3T2.</b> Counseling Definition of patient counseling; steps</p>	<p>1. Sources of drug information on services</p> <p>2. Code of ethics for community pharmacy</p>



		<b>3T3.</b> Code of ethics for community pharmacy and Role of pharmacist in the interdepartmental communication and community health education.	
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**CO-BP-703.4: To know the appreciate Rational uses of drug. Budget preparation and implementation**

Item	Approx Hrs
Lecture & Tutorial	8+3=11
Practical(P)	0
SW	1
SL	1
Total	13

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
A) Budget preparation and implementation B) Clinical Pharmacy C) Over the counter (OTC) sales		<b>4.1</b> Budget preparation, Types of budget, importance and implementation <b>4.2.</b> Clinical Pharmacy Introduction to Clinical Pharmacy, Concept of clinical pharmacy, <b>4.3:</b> functions and responsibilities of clinical pharmacist, Drug therapy monitoring - medication chart review, clinical review, pharmacist intervention <b>4.4:</b> Ward round participation, Medication history and Pharmaceutical care, Dosing pattern and drug therapy based on Pharmacokinetic disease pattern <b>4.5:</b> Over the counter u(OTC) sales Introduction and sale of over the counter <b>4.7:</b> Rational use of common over the counter medications. <b>4.8:</b> Medication history and Pharmaceutical care. <b>4T1.1</b> Budget preparation, Types of budget, importance and implementation <b>4T2.</b> functions and responsibilities of clinical pharmacist, Drug therapy monitoring <b>4T3.</b> Medication history And Pharmaceutical care.	1. Drug & cosmetic act 2. Schedules of drug & cosmetics act



**CO-BP-703.5:To understand the inventory management system & Interpretation of Clinical Laboratory Tests**

Item	Approx Hrs
Lecture & Tutorial	10
Practical(P)	0
SW	1
SL	1
Total	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction(CI)	Self Learning (SL)
5.1) Drug store management and inventory control 5.2) Investigational use of drugs 5.3) Interpretation of Clinical Laboratory Tests		<b>5.1</b> Drugstore management, Organization of drug store, types of materials stocked and storage conditions <b>5.2.</b> Purchase and inventory control: principles, purchase procedure, purchase order, <b>5.3</b> Procurement and stocking, Economic order quantity, Reorder quantity level, <b>5.4</b> Methods used for the analysis of the drug expenditure <b>5.5.</b> Investigational use of drugs, Description, Principle involved, classification <b>5.6</b> control, identification, Role of hospital pharmacist, Advisory committee <b>5.7</b> Interpretation of Clinical Laboratory Tests Blood chemistry, hematology, and urinalysis  <b>5T1.</b> Purchase and inventory control: principles, purchase procedure, purchase order, procurement and stocking, Economic order quantity <b>5T2</b> role of hospital pharmacist in Investigational use of drugs <b>5T3</b> Interpretation of Clinical Laboratory Tests	1.1 Understand the Various reference biochemical values.



### Brief of Hours suggested for the Course Outcome

Course Out comes	Class Lecture (Cl)	(LI)	Sessional Work (SW)	Self Learning (Sl)	Total Hour (Cl+SW+ Sl+LI)
<b>CO-BP-703.1:</b> To Understand the Organization Structure of a Hospital, and Medical staffs involved in the hospital and Hospital pharmacy with its organization. Know the basics of ADR with regulatory aspects.	13	0	1	1	15
<b>Co_-BP- 703.2:</b> To know various drug distribution methods in a hospital. Monitor drug therapy of patient through medication chart review and clinical review	13	0	1	1	15
<b>CO-BP-703:</b> To know pharmaceutical care services & patient counseling in community pharmacy	13	0	1	1	15
<b>CO-BP-703.4:</b> To know the appropriate Rational uses of drug. Budget preparation and implementation.	10	0	1	1	12
<b>CO-BP-703.5:</b> To understand the inventory management system & Interpretation of Clinical Laboratory Tests	10	0	1	1	12
<b>Total Hours</b>	59	0	5	5	69



## Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

Course Outcome	Unit Titles	Marks Distribution			Total Marks
		A	C	E	
<b>CO-BP-703.1</b>	To Understand the Organization Structure of a Hospital, and Medical staffs involved in the hospital and Hospital pharmacy with its organization. Know the basics of ADR with regulatory Aspects.	08	06	01	15
<b>Co-BP-703.2:</b>	To know various drug distribution methods in a hospital. Monitor drug therapy of patient through medication chart review and clinical review	12	07	01	20
<b>Co_-BP-703.3:</b>	To know pharmaceutical care services & patient counseling in community pharmacy	02	06	02	10
<b>Co_-BP-703.4:</b>	To know the appreciate Rational uses of drug. Bud get preparation and implementation	10	02	03	15
<b>Co-BP-703.5:</b>	To understand the inventory management system & Interpretation of Clinical Laboratory Tests	05	07	03	15
<b>Total</b>		<b>37</b>	<b>28</b>	<b>10</b>	<b>75</b>

**Legend: A: Analyze, C: Create, E: Evaluate**

The end of semester assessment for Pharmacy Practice will be held with written examination of 75marks

**Note.** Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks.

Teachers can also design different tasks as per requirement, for end semester assessment.

### **Suggested Instructional/Implementation Strategies:**

1. Improved Lecture
2. Tutorial
3. Case Method
4. Group Discussion
5. Role Play
6. Demonstration
7. ICT Based Teaching Learning (Video Demonstration/Tutorials CBT, Blog, Face book, Twitter, Whats app, Mobile, Online sources)
8. Brainstorming



### Suggested Learning Resources:

S. No.	Title	Author	Publisher	Edition & Year
1	A textbook of hospital pharmacy,	Merchant S.H. and Dr. J.S.Quadry.	Ahmadabad: B.S. Shah Prakakshan;	4th ed., 2001
2	A textbook of Clinical Pharmacy Practice- essential concepts and skills,	Parthasarathi G, Karin Nyfort-Hansen, Milap C Nahata.	Orient Longman Private Limited;.	1st ed., 2004
3	Hospital pharmacy	William E. Hassan.	Lea & Febiger, Philadelphia	5th ed., 1986.
4	Hospital Pharmacy	Tipnis Bajaj.	Career Publications, Maharashtra:	1st ed., 2008
5	Basic skills in interpreting laboratory data	P. Gundu Rao	Wiley publication	2021
6	Health Education and Community Pharmacy	Parmar N.S.	CBS Publishers & Distributers	18th ed, CBS Publishers & Distributers; 2008.

#### Curriculum Development Team:

1. **Prof. SP Gupta**, Director, RGIP, AKS University
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**Course Outcome, Program Specific Outcome& Program Outcome Mapping**

**Course Code: BP703T**

**Course Name: Pharmacy Practice**

Course Outcome	Program Outcome											Program Specific outcome			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
	Pharmacy knowledge	Planning Abilities	Problem analysis	Modern tool usage	Leadership skills	Professional Identity	Pharmaceutical Ethics	Communication	The pharmacist and society	Environment and sustainability	Life-long learning	Knowledge of drug discovery	Quality Analysis of API's	MOA of Drug	Biological evaluation of drug
<b>CO-1:</b> Organization of a Hospital, Medical staffs involved in the hospital and Hospital pharmacy	3	2	3	1	3	2	1	2	3	2	3	1	3	1	2
<b>CO-2:</b> Drug distribution methods in a hospital.	2	3	1	3	1	2	0	1	2	3	3	3	2	1	3
<b>CO-3:</b> Pharmaceutical care services & patient counseling in community pharmacy	3	2	3	2	1	1	2	1	2	2	3	3	2	1	3
<b>CO-4:</b> Appreciate Rational uses of drug	2	3	2	3	1	3	2	2	3	3	3	3	2	1	3
<b>CO-5:</b> Inventory management system & Interpretation of Clinical Laboratory Tests	3	3	1	1	1	3	0	3	1	2	3	2	2	2	2

**Legend: 1Low, 2-Medium, 3-High**



## Course Curriculum Mapping

Pos& PSOs No	Cos No&	Title	SOs No	Class Room Instructions	Laboratory Instructions	Self learning
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	CO-1	To Understand the Organization Structure of a Hospital, and Medical staffs involved in the hospital and Hospital pharmacy with its organization. Know the basics of ADR with regulatory Aspects.	SO1.1 SO1.2 <b>SO1.3</b> <b>SO1.4</b> <b>SO1.5</b>	1.1,1.2,1.3,1.4,1.5,1.6,1.7,1.8,1.9,1.10 T1,T2,T3	LI-1.1 LI-1.2 LI-1.3	SI-1.1 SI-1.2
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	CO-2	To know various drug distribution methods in a hospital. Monitor drug therapy of patient through medication chart review and clinical review	<b>SO-2.1</b> <b>SO-2.2</b> <b>SO-2.3</b> <b>SO-2.4</b> <b>SO-2.5</b>	2.1,2.2,2.3,2.4,2.5,2.6,2.7,2.8,2.9,2.10 T1,T2,T3	LI-2.1 LI-2.2	SI-2.1 SI-2.2
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	CO-3	To know pharmaceutical care services & patient counseling in community pharmacy	<b>SO-3.1</b> <b>SO-3.2</b> <b>SO-3.3</b> <b>SO-3.4</b> <b>SO-3.5</b>	3.1,3.2,3.3,3.4,3.5,3.6,3.7,3.8,3.9,3.10 T1,T2,T3	LI-3.1 LI-3.2 LI-3.3 LI-3.4 LI-3.5 LI-3.6 LI-3.7 LI-3.8	SI-3.1 SI-3.2
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	CO-4	To know the appreciate Rational uses of drug. Budget preparation and implementation	<b>SO-4.1</b> <b>SO-4.2</b> <b>SO-4.3</b> <b>SO-4.4</b> <b>SO-4.5</b>	4.1,4.2,4.3,4.4,4.5,4.6,4.7,4.8. T1,T2,T3	-	SI-4.1 SI-4.2 SI-4.3
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	CO-5	To understand the inventory management system & Interpretation of Clinical Laboratory Tests	SO-5.1 SO-5.2	5.1,5.2,5.3,5.4,5.5,5.6,5.7,	<b>LI-5.1</b> <b>LI-5.2</b>	<b>SI-5.1</b>





AKS University  
Faculty of Pharmaceutical Science & Technology  
Rajiv Gandhi Institute of Pharmacy  
Curriculum of B. Pharmacy (Novel Drug Delivery Systems) Program  
(Revised as on 01 August 2023)  
**Semester-VII**

**Course Code:** BP704T

**Course Title:** Novel Drug Delivery Systems

**Pre-requisite:** This subject is designed to impart basic knowledge on the area of novel drug delivery systems.

**Rationale/Objective s:** Up on completion of the course student shall be able to

1. To understand various approaches for development of novel drug delivery systems.
2. To understand the criteria for selection of drugs and polymers for the development of Novel drug delivery systems, their formulation and evaluation.

**Course Out comes:**

**CO- BP704 -1:** To understand the various approaches for development of novel drug delivery systems.

**CO- BP704 -2:** To acquired the knowledge of Mucosal Drug Delivery system and Implantable Drug Delivery Systems

**CO- BP704 -3:** To understanding the various types of drug delivery systems.

**CO- BP704 -4:** To familiarize with basic concept in Targeted drug Delivery.

**CO- BP704 -5:** To acquired the knowledge of Ocular Drug Delivery Systems and Intrauterine Drug Delivery Systems.



## Scheme of Studies

Course code	Title of the course	Program Name	TOTAL Number of contact hours/Week						Credit
			Classroom Instruction (A)		Practical(P)	SW	SL	Total Hours (H)	
			Lecture	Tutorial					
BP704T	Novel Drug Delivery Systems Theory	B. Pharmacy	3	1	0	1	1	6	4

**Legend: CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others),

**LI:** Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)

**SW:** Sessional Work (includes assignment, seminar, mini project etc.),

**SL:** Self Learning, Credits.

**Note:** SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

## Theory Assessment

Board of Study	Course Code	Course Title	Scheme of Assessment ( Marks )						
			Progressive Assessment ( PRA)						
			Academic activity,Any three (Quiz/ Assignment, open book test, filed work and seminar)	Student teacher interaction	Class Attendance (A)	(A) Total Marks	Sessional Exam		
Pharmacy	BP704T	Novel Drug Delivery Systems	3	3	4	10	15	75	100

## Guidelines for the allotment of marks for attendance

Percentage of Attendance	Theory	Practical
95 – 100	4	2
90 – 94	3	1.5
85 – 89	2	1
80 – 84	1	0.5
Less than 80	0	0



**Course-Curriculum Detailing:**

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

**Unit I**

**CO- BP704 -1: To understand the various approaches for development of novel drug delivery systems.**

Item	Approx Hrs
Lecture & Tutorial	10+3=13
SW	1
SL	1
Total:	15

Session Outcomes(SOs)	Laboratory Instruction (LI)	Class room Instruction(CI)	Self Learning(SL)
<b>Theory</b> <b>SO1.1:</b> dissolution and ion exchange principles. <b>SO1.2:</b> application of polymers in formulation. <b>SO1.3:</b> controlled release drug delivery systems.		1.1: Introduction, terminology/definitions and rationale, advantages, disadvantages, selection of drug candidates 1.2 Approaches to design controlled release formulations based on diffusion, dissolution and ion exchange principles. 1.3 Introduction, classification, properties, advantages. 1.4 Application of polymers in formulation of controlled release drug delivery systems. <b>1T.1</b> Tutorial Class 1.5: Physicochemical properties of drugs relevant to controlled release formulations <b>1T.2</b> Tutorial Class 1.6: Biological properties of drugs relevant to controlled release formulations <b>1T.3</b> Tutorial Class	1.1: Approaches to design controlled release formulations based on diffusion

**Suggested Assignments**

1. Approaches to design controlled release formulations based on diffusion, dissolution and ion exchange principles.



## Unit II

**CO- BP704 -2: To acquired the knowledge of Mucosal Drug Delivery system and Implantable Drug Delivery Systems.**

Item	Approx Hrs
Lecture &Tutorial	10+3=13
SW	1
SL	1
Total:	15

Session Outcomes(SOs)	Laboratory Instruction (LI)	Class room Instruction(CI)	Learning(SL)
<b>Theory</b> <b>SO2.1:</b> Definition, advantages and disadvantages, microspheres. <b>SO2.2:</b> Introduction, Principles of mucoadhesion <b>SO2.3:</b> :Introduction, advantages and disadvantages, osmotic pump.		Definition, advantages and disadvantages, microspheres /microcapsules, microparticles, methods of microencapsulation, applications <b>2T.1</b> Tutorial Class Introduction, Principles of bio adhesion. Trans mucosal permeability . <b>2T.2</b> Tutorial Class formulation considerations of buccal delivery systems. <b>2T.3</b> Tutorial Class Introduction, advantages and disadvantages, concept of implant sand osmotic pump.	2.1: microparticles  2. 2: Principles of bioadhesion. 2. 3: Advantages osmotic pump.

**Suggested Assignments:**

1. Formulation of buccal delivery systems
2. Trans mucosal permeability
3. Concept of implant sand osmotic pump



### Unit III

CO- BP704 -3: To understanding the various types of drug delivery systems.

Item	Approx Hrs
Lecture & Tutorial	10+3=13
SW	1
SL	1
Total:	15

Session Outcomes(SOs)	Laboratory Instruction(LI)	Class room Instruction(CI)	Self Learning(SL)
<b>Theory</b> <b>SO3.1:</b> Introduction Transdermal Drug Delivery Systems. <b>SO3.2:</b> Introduction Gastroretentive drug delivery systems. <b>SO3.3:</b> Introduction Naso pulmonary drug delivery system.		Introduction, Permeation through skin. Introduction, advantages, disadvantages, approaches for GRDDS. Introduction to Nasal and Pulmonary routes of drug delivery. <b>3T.1</b> Tutorial Class factors affecting permeation. permeation enhancers. <b>3T.2</b> Tutorial Class Floating, high density systems. inflatable and gastro adhesive systems <b>3T.3</b> Tutorial Class Formulation of Inhalers (dry powder and metered dose).	3.1 Basic components of TDDS. 3.2 Gastroretentive drug delivery systems. 3.3 nasal sprays, nebulizers.

**Suggested Assignments:** 1. Formulation approaches  
2. Inflatable and gastro adhesive systems and their applications.  
3. Nasal sprays, nebulizers.



**Unit IV****CO- BP704 -4: To familiarize with basic concept in Targeted drug Delivery.**

Item	Approx Hrs
Lecture &Tutorial	08+3=11
SW	1
SL	1
Total:	13

Session Outcomes(SOs)	Laboratory Instruction(LI)	Class room Instruction(CI)	Self Learning(SL)
<b>Theory</b> <b>SO4.1:</b> Basic concepts Targeted drug Delivery. <b>SO4.2:</b> Introduction to liposomes. .	NA	4.1 Concepts of Targeted drug Delivery. 4.2 Approaches of Targeted drug Delivery. 4.3 Advantages and disadvantage 4.4 Targeted drug Delivery. <b>4T.1</b> Tutorial Class 4.5 Introduction to liposomes. <b>4T.2</b> Tutorial Class 4.6 Introduction to niosomes, 4.7 nanoparticles. <b>4T.3</b> Tutorial Class 4.8 monoclonal antibodies and their applications	4.1. Concepts and approaches advantages and disadvantages of Targeted drug Delivery. 4.2. introduction to liposomes, niosomes.

**Suggested Assignments:** 1. Nanoparticles 2. monoclonal antibodies and their applications



**Unit V CO- BP704 -5: To acquired the knowledge of Ocular Drug Delivery Systems and Intrauterine Drug Delivery Systems.**

Item	Approx Hrs
Lecture & Tutorial	07+03=10
SW	1
SL	1
Total	15

Session Outcomes(SOs)	Laboratory Instruction (LI)	Class room Instruction(CI)	Self Learning (SL)
<b>Theory</b> <b>SO5.1:</b> Preliminary study, ocular formulations and ocuserts. <b>SO5.2:</b> Introduction intrauterine Drug Delivery Systems.		5.1 Intra ocular barriers. 5.2 Development of intra uterine devices (IUDs) and applications. <b>5T.1</b> Tutorial Class 5.3 Introduction Ocular Drug Delivery Systems. <b>5T.2</b> Tutorial Class 5.4 ocular formulations and ocuserts. <b>5T.3</b> Tutorial Class 5.5 Development of intra uterine devices (IUDs) and applications.	<b>5.1:</b> Basic concepts in Ocular Drug Delivery Systems.  <b>5. 2:</b> intra uterine devices (IUDs)

**Suggested Assignments:** 1. Principles and applications of Ocular Drug Delivery Systems  
 2. Types of intra uterine devices



### Brief of Hours suggested for the Course Outcome

Course Out comes	Class Lecture (Cl)	(LI)	Sessional Work (SW)	Self Learning (Sl)	Total Hour (Cl+SW+Sl+LI)
<b>CO- BP704 -1:</b> To understand the various approaches for development of novel drug delivery systems.	13	12	1	1	27
<b>CO- BP704 -2:</b> To acquired the knowledge of Mucosal Drug Delivery system and Implantable Drug Delivery Systems.	13	12	1	1	27
<b>CO- BP704 -3:</b> To understanding the various types of drug delivery systems.	13	12	1	1	27
<b>CO- BP704 -4:</b> To familiarize with basic concept in Targeted drug Delivery.	11	0	1	1	13
<b>CO- BP704- 5:</b> To acquired the knowledge of Ocular Drug Delivery Systems and Intrauterine Drug Delivery Systems.	10	16	1	1	28
<b>Total Hours</b>	60	52	5	5	122



**Suggestion for End Semester Assessment**  
Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		A	C	E	
CO-BP704.1	Controlled drug delivery systems & Polymers:	08	06	01	15
CO-BP704.2	Microencapsulation, mucosal Drug Delivery system & Implantable Drug Delivery Systems	08	07	01	16
CO-BP704.3	Transdermal Drug Delivery System, Gastroretentive drug delivery systems & Nasopulmonary drug delivery system.	08	07	01	16
CO-BP704.4	Targeted drug Delivery.	07	06	01	14
CO-BP704.5	Ocular Drug Delivery System & Intrauterine Drug Delivery Systems.	08	07	01	16
Total		39	33	05	77

**Legend: A: Analyze, C: Create, E: Evaluate**

The end of semester assessment for Novel Drug Delivery Systems will be held with written examination of 75 marks.

**Note.** Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks. Teachers can also design different tasks as per requirement, for end semester assessment.

**Suggested Instructional/Implementation Strategies:**

- Improved Lecture
- Tutorial
- Case Method
- Group Discussion
- Role Play
- Demonstration
- ICT Based Teaching Learning (Video Demonstration/Tutorials CBT, Blog, Face book, Twitter, Whats app, Mobile, Online sources)
- Brainstorming



## Suggested Learning Resources:

S. No.	Title	Author	Publisher	Edition &Year
1	Novel Drug Delivery Systems .	Y W. Chien	Marcel Dekker, Inc., New York,	2 nd edition, revised and expanded, 1992.
2	Controlled Drug Delivery Systems.	Robinson, J. R., Lee V. H. L	Marcel Dekker, Inc., New York,	6 <sup>th</sup> edition 1992.
3	Encyclopedia of Controlled Delivery.	Edith Mathiowitz	Published by Wiley Interscience Publication, John Wiley and Sons, Inc, New York. Chichester/Weinheim	2 nd edition, revised,2006.
4	Controlled and Novel Drug Delivery.	N.K. Jain,	CBS Publishers & Distributors, New Delhi	First edition 1997 (reprint in 2001).
5	Controlled Drug Delivery concepts and advances.	S.P. Vyas and R.K. Khar	Vallabh Prakashan, New Delhi	First edition 2002

### Curriculum Development Team:

1. **Prof. SP Gupta**, Director, RGIP, AKS University
2. **Mr. Satyendra Garg**, Assistant professor, RGIP, AKS University
3. **Mrs. Neelam Sigh**, Assistant professor, RGIP, AKS University



**Course Outcome, Program Specific Outcome& Program Outcome Mapping**

**Course Code: BP704T**

**Course Name: Novel Drug Delivery Systems**

Course Outcome	Program Outcome											Program Specific outcome			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
	Pharmacy knowledge	Planning Abilities	Problem analysis	Modern tool usage	Leadership skills	Professional Identity	Pharmaceutical Ethics	Communication	The pharmacist and society	Environment and sustainability	Life-long learning	Knowledge of drug discovery	Quality Analysis of API's	MOA of Drug	Biological evaluation of drug
<b>CO-1:</b> Various approaches for development of novel drug delivery	3	2	3	1	3	2	1	2	3	2	3	1	3	1	2
<b>CO-2:</b> Mucosal Drug Delivery system and Implantable Drug Delivery Systems	2	3	1	3	2	2	1	1	2	3	3	3	2	1	3
<b>CO-3:</b> To understanding the various types of drug delivery systems.	3	2	3	2	1	1	2	1	2	2	3	3	2	1	3
<b>CO-4:</b> To familiarize with basic concept in Targeted drug Delivery	2	3	2	3	1	3	2	2	3	3	3	3	2	1	3
<b>CO-5:</b> To acquired the knowledge of Ocular Drug Delivery Systems and Intrauterine Drug Delivery Systems	3	3	1	1	1	3	1	3	1	2	3	2	2	2	2

**Legend: 1- Low, 2-Medium, 3-High**



**Course Curriculum Mapping**

<b>Pos&amp; PSOs No</b>	<b>Cos No</b>	<b>Co Title</b>	<b>SOs No</b>	<b>Class Room Instructions</b>	<b>Laboratory Instructions</b>	<b>Self learning</b>
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	<b>CO-BP704-1:</b>	To understand the various approaches for development of novel drug delivery systems.	SO1.1 SO1.2	1.1,1.2,1.3,1.4,1.5,1.6,1.7,1.8,1.9,1.10	LI-1.1 LI-1.2 LI-1.3 LI-1.4	SI-1.1 SI-1.2
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	<b>CO-BP704-2:</b>	To acquired the knowledge of Mucosal Drug Delivery system and Implantable Drug Delivery Systems.	<b>SO-2.1</b> <b>SO-2.2</b>	2.1,2.2,2.3,2.4,2.5,2.6,2.7,2.8,2.9,2.10	LI-2.1 LI-2.2	SI-2.1
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	<b>CO-BP704-3:</b>	To understanding the various types of drug delivery systems.	<b>SO-3.1</b> <b>SO-3.2</b> <b>SO-3.3</b>	3.1,3.2,3.3,3.4,3.5,3.6,3.7,3.8,3.9,3.10	LI-4.1 LI-4.2	SI3.1
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	<b>CO-BP704-4:</b>	To familiarize with basic concept in Targeted drug Delivery	<b>SO-4.1</b> <b>SO-4.2</b>	4.1,4.2,4.3,4.4,4.5,4.6,4.7,4.8.	LI-4.1 LI-4.2 LI-4.3 LI-4.4	SI-4.1
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	<b>CO-BP704-5:</b>	To acquired the knowledge of Ocular Drug Delivery Systems and Intrauterine Drug Delivery Systems.	SO-5.1 SO-5.2	5.1,5.2,5.3,5.4,5.5,5.6,5.7,5.8	-	<b>SI-5.1</b>





AKS University  
Faculty of Pharmaceutical Science & Technology  
Rajiv Gandhi Institute of Pharmacy  
Curriculum of B. Pharmacy (Biostatistics and research methodology) Program  
(Revised as on 01August2023)

**Course Code:** BP801T

**Course Title :** Biostatistics and research methodology

**Pre- requisite:** Students should have knowledge about MS word and excel.

**Rationale:** Upon completion of the course the student shall be able to Know the operation of M.S. Excel, SPSS, R and MINITAB, DOE (Design of Experiment). Know the various statistical techniques to solve statistical problems Appreciate statistical techniques in solving the problems.

**Course Outcomes:**

**CO-BP801.1:** To understand the applications of Biostatics in Pharmacy.

**CO-BP801.2:** This subject deals with descriptive statistics, Graphics, Correlation, Regression, logistic regression Probability theory, Sampling technique, parametric tests, Non Parametric tests, ANOVA.

**CO-BP801.3:** Understand introduction to Design of Experiments and Phases of Clinical trials.

**CO-BP801.4:** To Understanding observational and experimental studies, SPSS, R and MINITAB Statistical software's, analyzing the statistical data using Excel

**CO-BP801.5:** Learn about Design and Analysis of experiments, Factorial Design and Response, Surface methodology



**Scheme of Studies:**

Board of Study	Course Code	Course Title	Scheme of studies(Hours/Week)						Total Credits (C)
			CI		LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	
			L	T					
Pharmacy	BP-802 T	Biostatistics and Research Methodology (Theory)	3	1	0	1	1	6	4

**Legend: CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others),

**LI:** Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)

**SW:** Sessional Work (includes assignment, seminar, mini project etc.),

**SL:** Self Learning,

**C:** Credits.

**Note:** SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

**Scheme of Assessment:** Theory

Board of Study	Course Code	Course Title	Scheme of Assessment ( Marks )						
			Progressive Assessment ( PRA )					End Semester Assessment  (ESA)	Total Marks  (PRA+ ESA)
			Academic activity, Any three (Quiz/ Assignment, open book test, filed work and seminar)	Student teacher interaction	Class Attendance	Sessional exam	Total Marks		
Pharmacy	BP801T	Biostatistics and research methodology	3	3	4	15	25	75	100



### **Guidelines for the allotment of marks for attendance**

<b>Percentage of Attendance</b>	<b>Theory</b>	<b>Practical</b>
95 – 100	4	2
90 – 94	3	1.5
85 – 89	2	1
80 – 84	1	0.5
Less than 80	0	0

### **Course-Curriculum Detailing:**

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.



**CO-BP801.1: Understand Pilot plant scale up techniques, SUPAC guidelines, Introduction to platform technology.**

Approximate Hours	
Item	Appx. Hrs
CI	10+3
LI	0
SW	1
SL	1
Total	15

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
<b>SO1.1</b> To Understand introduction of Statistics and biostatistics . <b>SO1.2</b> Understand Measures of central tendency Mean, Median, Mode. <b>SO1.3</b> To evaluate pharmaceutical examples Measures of dispersion: Dispersion, Range, standard deviation <b>SO1.4</b> Understands about Definition, Karl Pearson's coefficient of correlation.		<b>Unit-1.</b> 1.1 Introduction: Statistics 1.2 Biostatistics 1.3 Frequency distribution 1.4 Measures of central tendency: Mean, Median, Mode 1T.1 Tutorial class. 1.5 Pharmaceutical examples Measures of dispersion: Dispersion. 1.6 Range, standard deviation. 1.7 Pharmaceutical problems Correlation 1T.2 Tutorial class. 1.8 Definition, Karl Pearson's coefficient of correlation. 1.9 Multiple correlation 1.10 Pharmaceuticals examples. 1T.3 Tutorial class.	1.1 Lear about importance of Biostatistics with their application in Pharmacy

**Suggested Assignments:** Frequency distribution , Range, standard deviation, Multiple correlation

**CO-BP801.2: Learn Technology development and transfer and TT agencies in India APCTD, NRDC, TIFAC, BCIL, TBSE / SIDBI**

Approximate Hours	
Item	Appx Hrs
CI	10+3
LI	0
SW	1
SL	1
Total	15



Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
<b>SO2.1</b> To Understand Probability: Definition of probability, Binomial distribution, Normal distribution, Poisson's distribution. <b>SO2.2</b> Understand properties problems Sample, Population, large sample, small sample <b>SO2.3</b> To learn Null hypothesis, alternative hypothesis, sampling, essence of sampling, types of sampling, Error-I type, Error-II type, Standard error of mean (SEM) <b>SO2.4</b> To understand about Pharmaceutical examples Parametric test: t-test(Sample, Pooled or Unpaired and Paired) . <b>SO2.5</b> To learn about ANOVA, (One way and Two way), Least Significance difference		<b>UNIT 2</b> 1 Regression: Curve fitting by the method of least squares, 2 fitting the lines $y = a + bx$ and $x = a + by$ , 3 Multiple regression. 2T.1 Tutorial class. 4 standard error of regression– Pharmaceutical Examples. 5 Probability: Definition of probability. 6 Binomial distribution, Normal distribution, Poisson's distribution. 2T.2 Tutorial class. 7 properties - problems Sample, Population, large sample, small sample, 8 Null hypothesis, alternative hypothesis, sampling, essence of sampling, types of sampling, Error-I type, Error-II type, Standard error of mean (SEM). 2T.2 Tutorial class. 9 Pharmaceutical examples Parametric test: t-test(Sample, Pooled or Unpaired and Paired) , 2.10 ANOVA, (One way and Two way), Least Significance 2.11 nce. 2T.2 Tutorial class.	1. Various Statical methods with their applications

**Suggested Assignments:** ANOVA, Null hypothesis, alternative hypothesis, sampling, essence of sampling, Binomial distribution

**CO-BP801.3: Understand Regulatory affairs and Regulatory requirements for drug approval.**

**Approximate Hours**

Item	Appx. Hrs
CI	10+3
LI	0
SW	1
SL	1
Total	15



Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
<p><b>SO3.1</b> To understand Non Parametric tests: Wilcoxon Rank Sum Test, Mann-Whitney U test and Mann-Whitney U test.</p> <p><b>SO3.2</b> To understand about Introduction to Research: Need for research, Need for design of Experiments.</p> <p><b>SO3.3</b> To learn Graphs: Histogram, Pie Chart, Cubic Graph, response surface plot, Counter Plot graph</p> <p><b>SO3.4</b> To understand Designing the methodology: Sample size determination and Power of a study</p> <p><b>SO3.5</b> To learn Report writing and presentation of data, Protocol, Cohorts studies.</p> <p><b>SO3.6</b> To understand Observational studies, Experimental studies and Designing clinical trial, various phases.</p>		<p>UNIT 3</p> <p>3.1 Non Parametric tests: Wilcoxon Rank Sum Test,</p> <p>3.2 Mann-Whitney U test.</p> <p>3.3 Kruskal-Wallis test and Friedman Test 156.</p> <p>3T.1 Tutorial class.</p> <p>3.4 Introduction to Research: Need for research, Need for</p> <p>3.5 design of Experiments.</p> <p>3.6 Experiential Design Technique, plagiarism.</p> <p>3.7 Graphs: Histogram, Pie Chart, Cubic Graph, response surface plot, Counter Plot graph.</p> <p>3T.2 Tutorial class.</p> <p>3.8 Designing the methodology: Sample size determination and Power of a study.</p> <p>3.9 Report writing and presentation of data, Protocol, Cohorts studies.</p> <p>3.10 Observational studies, Experimental studies.</p> <p>3T.3 Tutorial class.</p> <p>3.11 Designing clinical trial, various phases.</p>	<p>i. Basic knowledge of MS word.</p> <p>ii. Phase of clinical trials</p>

**Suggested Assignments:** Friedman Test 156, Cohorts studies, Graphs: Histogram, Pie Chart, Cubic Graph, response surface plot, Counter Plot graph



**CO-BP801.4: Understanding Quality management systems in pharmaceutical.****Approximate Hours**

Item	Appx Hrs
CI	10+3
LI	0
SW	1
SL	1
Total	15

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
<b>SO4.1</b> Understanding Blocking and confounding system for Two-level factorials <b>SO4.2</b> To Understand Regression modeling: Hypothesis testing in Simple and Multiple regression models <b>SO4.3</b> Understand Introduction to Practical components of Industrial and Clinical Trials Problems: <b>SO4.4</b> Understand Statistical Analysis Using Excel, SPSS, MINITAB <b>SO4.5</b> To learn about DESIGN OF EXPERIMENTS, R - Online Statistical Software's to Industrial and Clinical trial approach		<b>UNIT 4</b> 4.1Blocking and confounding system for Two-level factorials 4.2Regression modeling: Hypothesis testing in Simple. 4.3 Multiple regression models. 4T.1 Tutorial class. 4.4Introduction to Practical components of Industrial. 4.5Clinical Trials Problems: 4.6Statistical Analysis Using Excel. 4T.2 Tutorial class. 4.7SPSS, MINITAB 4.8DESIGN OF EXPERIMENTS, R - Online Statistical Software's to Industrial and Clinical trial approach. 4T.3 Tutorial class.	1. Study how to Work on excel

**Suggested Assignments:** Regression modeling: Hypothesis testing in Simple, Multiple regression models, Clinical Trials Problems, Blocking and confounding system for Two-level factorials



**CO-BP801.5: Learn about Central Drug Standard Control Organization (CDSCO) and State Licensing Authority.**

Item	Appx Hrs
CI	10+3
LI	0
SW	1
SL	1
Total	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
<b>SO5.1</b> Understand about Design and Analysis of experiments <b>SO5.2</b> Learn about Factorial Design: Definition: 22, 23design <b>SO5.3</b> Understands Advantage of factorial design Response Surface methodology. <b>SO5.4</b> Understand Central composite design Historical design <b>SO5.5</b> To Evaluation of Optimization Techniques		<b>UNIT 5</b> 5.1 Design and Analysis of experiments 5.2 Factorial Design: Definition 5T.1 Tutorial class 5.3 22, 23design. 5.4 Advantage of factorial design Response Surface methodology 5T.2 Tutorial class 5.5 Central composite design, 5.6 Historical design. 5T.3 Tutorial class 5.7 Optimization Techniques	1. Types of Analysis of experiments

**Brief of Hours suggested for the Course Outcome**

Course Outcomes	Class Lecture (CI)	Sessional Work (SW)	Self Learning (SI)	Total hour (CI+SW+SI)
<b>CO-BP801.1:</b> To understand the applications of Biostatistics in Pharmacy.	13	1	1	15
<b>CO-BP801.2:</b> This subject deals with descriptive statistics, Graphics, Correlation, Regression, logistic regression Probability theory, Sampling technique, parametric tests, Non Parametric tests, ANOVA.	13	1	1	15
<b>CO-BP801.3</b> Understand introduction to Design of Experiments and Phases of Clinical trials.	13	1	1	15
CO-BP801.4: : To Understanding observational and experimental studies, SPSS, R and MINITAB statistical software's, analyzing the statistical data using Excel	11	1	1	13
<b>CO-BP801.5:</b> Learn about Design and Analysis of experiments, Factorial Design and Response Surface methodology	10	1	1	12
<b>Total Hours</b>	<b>60</b>	<b>5</b>	<b>5</b>	<b>70</b>



## Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

Course Out comes	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
<b>CO-BP801-1</b>	Introduction Measures of central tendency, Correlation and Measures of dispersion	07	05	03	15
<b>CO-BP801-2</b>	Regression, Probability and Parametric test	10	03	02	15
<b>CO-BP801-3</b>	Non Parametric tests, introduction to Research, Graphs and graph Designing the methodology	10	03	02	15
<b>CO-BP801-4</b>	Introduction to Practical components of Industrial and Clinical Trials Problems	08	05	02	15
<b>CO-BP801-5</b>	Design and Analysis of experiments:	07	05	03	15
Total		42	21	12	75

**Legend: R: Remember, U: Understand, A: Apply**

The end of semester assessment for biostatistics and research methodology will be held with written examination of 75 marks

**Note.** Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks.

Teachers can also design different tasks as per requirement, for end semester assessment.

### **Suggested Instructional/Implementation Strategies:**

1. Improved Lecture
2. Tutorial
3. Case Method
4. Group Discussion
5. Role Play
6. Demonstration
7. ICT Based Teaching Learning (Video, Demonstration/Tutorials CBT, Blog, Face book, Twitter, Whatsapp, Mobile, Online sources)
8. Brainstorming



**Suggested Learning Resources:**

<b>S. No.</b>	<b>Title</b>	<b>Author</b>	<b>Publisher</b>	<b>Edition &amp; Year</b>
1	Pharmaceutical statistics- Practical and clinical applications	,Sanford Bolton	Marcel Dekker Inc. NewYork	3rd edition (28 February August 1997)
2	Design and Analysis of Experiments	R. Pannerselvam	II Learning Private Limited	January 2012
3	Fundamental of Statistics	S.C. Guptha	Himalaya Publishing House	Seventh Edition (1 May 2018)
4	Design and Analysis of Experiments	Douglas and C. Montgomery	Wiley Students	10 <sup>th</sup> Edition

**Curriculum Development Team:**

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- 2. Mr. Satyendra Garg**, Assistant professor, RGIP, AKS University
- 3. Dr Deepak Mishra**, Department of Biotechnology , AKs University



**Course Outcome, Program Specific Outcome& Program Outcome Mapping**

**Course Code: BP801T**

**Course Name: Biostatistics and research methodology**

Course Outcome	Program Outcome											Program Specific outcome			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
	Pharmacy knowledge	Planning Abilities	Problem analysis	Modern tool usage	Leadership skills	Professional Identity	Pharmaceutical Ethics	Communication	The pharmacist and society	Environment and sustainability	Life-long learning	Knowledge of drug discovery	Quality Analysis of API's	MOA of Drug	Biological evaluation of drug
<b>CO-1:</b> To understand the applications of Biostatics in Pharmacy.	3	2	3	1	3	2	1	2	3	2	3	1	3	1	2
<b>CO-2:</b> Sampling technique, parametric tests, Non Parametric tests, ANOVA	2	3	1	3	1	2	2	1	2	3	3	3	2	1	3
<b>CO-3:</b> Introduction to Design of Experiments and Phases of Clinical trials.	3	2	3	2	1	1	2	1	2	2	3	3	2	1	3
<b>CO-4:</b> MINITAB statistical software's, analyzing the statistical	2	3	2	3	1	3	2	2	3	3	3	3	2	1	3
<b>CO-5:</b> Factorial Design and Response Surface methodology	3	3	1	1	1	3	1	3	1	2	3	2	2	2	2



### Course Curriculum Mapping

Pos& PSOs No	Cos No&	Title	SOs No	Class Room Instructions	Laboratory Instructions	Self learning
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	CO-BP801 T.1	To understand the applications of Biostatistics in Pharmacy.	SO1.1 SO1.2 SO1.3	1.1,1.2,1.3,1.4,1.5,1.6,1.7,1.8,1.9,1.10	-	SI-1.1 SI-1.2
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	CO-BP801 T.2	This subject deals with descriptive statistics, Graphics, Correlation, Regression, logistic regression, Probability theory, Sampling technique, parametric tests, Non Parametric tests, ANOVA.	SO-2.1 SO-2.2 SO-2.3	2.1,2.2,2.3,2.4,2.5,2.6,2.7,2.8,2.9,2.10	-	SI-2.1 SI-2.2
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	CO-BP801 T.3	Introduction to Design of Experiments and Phases of Clinical trials.	SO-3.1 SO-3.2	3.1,3.2,3.3,3.4,3.5,3.6,3.7,3.8,3.9,3.10	-	SI-3.1
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	CO-BP801 T.4	To Understanding observational and experimental studies, SPSS, R and MINITAB statistical software's, analyzing the statistical data using Excel	SO-4.1 SO-4.2 SO-4.3	4.1,4.2,4.3,4.4,4.5,4.6,4.7,4.8	-	SI-4.1 SI-4.2
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	CO-BP801 T.5	Learn about Design and Analysis of experiments, Factorial Design and Response Surface methodology	SO-5.1 SO-5.2 SO-5.3	5.1,5.2,5.3,5.4,5.5,5.6,5.7	-	SI-5.1 SI-5.2





AKS University  
Faculty of Pharmaceutical Science & Technology  
Rajiv Gandhi Institute of Pharmacy  
Curriculum of B. Pharmacy (Social and Preventive Pharmacy) Program  
(Revised as on 01August2023)

**Semester-VIII**

<b>Course Code:</b>	<b>BP802T</b>
<b>Course Title:</b>	<b>Social and Preventive Pharmacy</b>
<b>Pre-requisite:</b>	The Student should have basic knowledge on various number of national health programs along with that patient's health issues and their challenges
<b>Rationale/ Objectives:</b>	<p>After the successful completion of this course, the student shall be able to:</p> <ul style="list-style-type: none"><li>• Acquire high consciousness/realization of current issues related to health and</li><li>• Pharmaceutical problems within the country and worldwide.</li><li>• Have a critical way of thinking based on current healthcare development.</li><li>• Evaluate alternative ways of solving problems related to health and pharmaceutical issues</li></ul>

**Course Out comes:**

**CO- BP802T -1:** To understand Concept of health and diseases, Role of hygiene in health system.

**CO- BP802T -2:** To know the various treatment approach for microbial infections like Ebola virus, influenza, etc.

**CO- BP802T -3:** To know the various National health programs run by Govt. of India., its objectives, functioning and outcome

**CO- BP802T -4:** To know the role of WHO in national health intervention programs for mother child, elder *Etc* .

**CO- BP802T -5:** To understand the Community services in rural, urban and school health.



## Scheme of Studies

:Course code	Title of the course	Program Name	TOTAL Number of contact hours/Week						Credit
			Classroom Instruction (A)		Practica l(P)	SW	SL	Total Hours (H)	
			Lecture	Tutorial					
BP802T	Social and preventive pharmacy	B. Pharmacy	3	1	4	1	1	10	6

**Legend:** **CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others),

**LI:** Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)

**SW:** Sessional Work (includes assignment, seminar, mini project etc.),

**SL:** Self Learning, Credits.

**Note:** SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

## Theory Assessment

Board of Study	Course Code	Course Title	Scheme of Assessment ( Marks )					EndSemester Assessment(C)	Total Marks(A+B+C)
			Progressive Assessment ( PRA)						
			Academic activity, Any three (Quiz/ Assignment, open book test, filed work and seminar)	Student teacher interaction	Class Attendan ce(AT)	(A)  Total Marks	Sessional Exam.(B)		
Pharmacy	BP802 T	Social and preventiv e pharmacy	3	3	4	10	15	75	100



**Guidelines for the allotment of marks for attendance**

<b>Percentage of Attendance</b>	<b>Theory</b>	<b>Practical</b>
95 – 100	4	2
90 – 94	3	1.5
85 – 89	2	1
80 – 84	1	0.5
Less than 80	0	0



**Course-Curriculum Detailing:**

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

**Unit I**

**CO- BP802T -1: To understand Concept of health and diseases, Role of hygiene in health system.**

Item	Approx Hrs
Lecture & Tutorial	10+3=13
Practical(P)	0
SW	1
SL	1
Total:	15

Session Outcomes(SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
<b>Theory</b> <b>SO1.1:</b> Concept of health and disease:  <b>SO1.2:</b> Social and health education  <b>SO 1.3:</b> Sociology and health <b>SO1.4:</b> Hygiene and health:		<b>1.1:</b> Definition, concepts and evaluation of public health <b>1.2</b> Understanding the concept of prevention and control of disease. <b>1.3</b> social causes of diseases <b>1.4:</b> social problems of the sick. <b>1T1: Tutorial Class</b> <b>1.5</b> Food in relation to nutrition and health, <b>1.6</b> Balanced diet, Nutritional deficiencies, Vitamin	<b>1.1:</b> Role & Society for health awareness.



		deficiencies <b>1.7</b> Malnutrition and its prevention. <b>1.8:</b> Socio cultural factors related to health and disease, <b>1T2: Tutorial Class</b> <b>1.9:</b> Impact of urbanization on health and disease, Poverty and health <b>1.10: Hygiene and health:</b> personal hygiene and health care; avoidable habits <b>1T3: Tutorial Class</b>	
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**Suggested Assignments:** Impact of urbanization on health and disease, Hygiene and health

## Unit II

**CO- BP802T -2: To know the various treatment approach for microbial infections like Ebola virus, influenza, etc**

Item	Approx Hrs
Lecture & Tutorial	10+3=13
Practical(P)	0
SW	1
SL	1
Total:	15



Session Outcomes(SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
<b>Theory</b> <b>SO1.1: Preventive medicine</b> .		<b>2.1:</b> General principles of prevention and control of diseases cholera, <b>2.2:</b> SARS, Ebola virus <b>2.3</b> influenza, acute respiratory infections, malaria, <b>2.4:</b> chicken guinea, dengue,,  <b>2T.1: Tutorial Class</b> <b>2.5:</b> lymphatic filariasis, pneumonia, <b>2.6:</b> hypertension,, <b>2.7:</b> diabetes mellitus, <b>2.8:</b> cancer,  <b>2T.2: Tutorial class</b> <b>2.9:</b> drug addiction <b>2.10:</b> drug substance abuse <b>2T.3: Tutorial class</b>	<b>2.1:</b> Study the General approaches& treatment approaches & pathogenesis of Infections .

**Suggested Assignments::** pneumonia, hypertension, diabetes mellitus, cancer, drug addiction-drug substance abuse



### Unit III

**CO- BP802T-3: To know the various National health programs run by Govt. of India., its objectives, functioning and outcome**

Item	Approx Hrs
Lecture & Tutorial	10+3
Practical(P)	0
SW	1
SL	1
Total:	15

Session Outcomes(SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
<b>Theory</b> <b>SO 3.1: National health programs, its objectives, functioning.</b> .		<b>Chemotherapy</b> <b>3.1:</b> National health programs HIV, <b>3.2:</b> HIV AND AIDS control programme, <b>3.3</b> TB, Integrated disease surveillance program (IDSP), <b>3.4:</b> National leprosy control programme <b>3T.1: Tutorial Class</b> <b>3.5:</b> National mental health program, <b>3.6:</b> National mental health program <b>3.7:</b> National 158 programme for prevention and control of deafness, <b>3.8:</b> Universal Immunization programme, <b>3T.2: Tutorial class</b> <b>3.9:</b> National programme for control of blindness, <b>3.10:</b> Pulse polio programme <b>3T.3: Tutorial class</b>	<b>3.1:</b> Study the General approaches & treatment approaches & pathogenesis of Infections .



**Suggested Assignments:** TB, Integrated disease surveillance program (IDSP), National leprosy control programme, National mental health program, National programme for prevention and control of deafness, Universal immunization programme.

#### Unit IV

**CO- BP802T -4: To know the role of WHO in national health intervention programs for mother child, elder *Etc.***

Item	Approx Hrs
Lecture & Tutorial	8+3=11
Practical(P)	0
SW	1
SL	1
Total:	13

Session Outcomes(SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
<b>Theory</b> <b>SO4.1</b> National health intervention programme for mother and child  <b>SO4.2:</b> National programme for the health <b>SO4.3:</b> Role of WHO in Indian national program		<b>4.1:</b> National health intervention programme for mother and child, <b>4.2</b> National family welfare programme, <b>4.3:</b> National tobacco control programme <b>4.4:</b> National Malaria Prevention Program <b>4T1: Tutorial Class</b> <b>4.5</b> National programme for the health care for the elderly, <b>4.6:</b> Social health programme <b>4..7:</b> Role of WHO in Indian national program	<b>4.1:</b> Study the General approaches for Various National health intervention programme.



		<b>4.8 National family welfare programme, 4T.2: Tutorial class 4T1: Tutorial Class</b>	
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**Suggested Assignments:** National health intervention programme for mother and child, National family welfare programme, National tobacco control programme, National Malaria Prevention Program, National programme for the health care for the elderly, Social health programme; role of WHO in Indian national program

### Unit V

**CO- BP802T -5: To understand the Community services in rural, urban and school health.**

Item	Approx Hrs
Lecture & Tutorial	7+3=10
Practical(P)	0
SW	1
SL	1
Total:	12

Session Outcomes(SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
<b>Theory</b> <b>SO5.1:</b> Community services in rural, urban and school health:		<b>5.1:</b> Community services <b>5.2:</b> Improvement in rural sanitation <b>5.3:</b> National urban health mission <b>5.4:</b> Health promotion and education in school <b>5T1: Tutorial class</b> <b>5.5:</b> Functions of PHC <b>5.6:</b> Role of PHC in	<b>5.1:</b> Understand the importance of Community services .



		rural health care sanitation <b>5..7:</b> Importance of urban health mission <b>5T.2: Tutorial class</b> <b>5T.3: Tutorial class</b>	
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**Suggested Assignments:** National health intervention programme for mother and child, National family welfare programme, National tobacco control programme, National Malaria Prevention Program, National programme for the health care for the elderly, Social health programme; role of WHO in Indian national program



### Brief of Hours suggested for the Course Outcome

Course Out comes	Class Lecture (Cl)	(LI)	Session a 1 Work (SW)	Self Learning (Sl)	Total Hour (Cl+SW+ Sl+LI)
<b>Course Out comes:</b>					
<b>CO- BP802T -1:</b> To understand Concept of health and diseases, Role of hygiene in helath system.	13	16	1	1	31
<b>CO- BP802T -2:</b> To know the various treatment approach for microbial infections like Ebola virus, influenza, etc	13	8	1	1	23
<b>CO- BP802T -3:</b> To know the various National health programs run by Govt. of India., its objectives, functioning and outcome	13	12	1	1	27
<b>CO- BP802T -4:</b> To know the role of WHO in national health intervention programs for mother child, elder <i>etc</i> .	10	8	1	1	20
<b>CO- BP802T -5:</b> To understand the Community services in rural, urban and school health.	10	0	1	1	12
<b>Total Hours</b>	<b>59</b>	<b>44</b>	<b>5</b>	<b>5</b>	<b>113</b>



### Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

Course Outcome	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
<b>CO-BP802T -1:</b>	To understand Concept of health and diseases, Role of hygiene in health system.	08	06	01	15
<b>CO-BP802T -2:</b>	To know the various treatment approach for microbial infections like Ebola virus, influenza, etc	12	07	01	20
<b>CO-BP802T -3:</b>	To know the various National health programs run by Govt. of India., its objectives, functioning and outcome	02	06	02	10
<b>CO-BP802T -4:</b>	To know the role of WHO in national health intervention programs for mother child, elder <i>Etc</i> .	10	02	03	15
<b>CO-BP802T -5:</b>	To understand the Community services in rural, urban and school health.	05	07	03	15
<b>Total</b>		<b>37</b>	<b>28</b>	<b>10</b>	<b>75</b>

**Legend: R: Remember, U: Understand, A: Apply**

The end of semester assessment for Social and Preventive Pharmacy will be held with written examination of 75 marks

**Note.** Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks.

Teachers can also design different tasks as per requirement, for end semester assessment.

#### **Suggested Instructional/Implementation Strategies:**

1. Improved Lecture
2. Tutorial
3. Case Method
4. Group Discussion
5. Role Play
6. Demonstration
7. ICT Based Teaching Learning (Video Demonstration/Tutorials CBT, Blog, Face book, Twitter, Whats app, Mobile, Online sources)
8. Brainstorming



### **Suggested Learning Resources:**

<b>S. No.</b>	<b>Title</b>	<b>Author</b>	<b>Publisher</b>	<b>Edition &amp; Year</b>
1	Short Textbook of Preventive and Social Medicine,	Prabhakara GN,	JAYPEE Publications	2 <sup>nd</sup> Edition 2018
2	Textbook of Preventive and Social Medicine	Katzung B. G., Masters S. B., Trevor A. J.,	Tata Mc Graw-Hill	Fifth edition 2022
3	Review of Preventive and Social Medicine	Jain Vivek	JAYPEE Publications	6 <sup>th</sup> Edition, 2014
4	Essentials of Community Medicine.	Hiremath Lalita D, Hiremath Dhananjaya A.	JAYPEE Publications	2 <sup>nd</sup> Edition, 2012

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**Course Outcome, Program Specific Outcome& Program Outcome Mapping**

**Course Code: BP802T**

**Course Name: Social and Preventive Pharmacy**

Course Outcome	Program Outcome											Program Specific outcome			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
	Pharmacy knowledge	Planning Abilities	Problem analysis	Modern tool usage	Leadership skills	Professional Identity	Pharmaceutical Ethics	Communication	The pharmacist and society	Environment and sustainability	Life-long learning	Knowledge of drug discovery	Quality Analysis of API's	MOA of Drug	Biological evaluation of drug
<b>CO-1:</b> Concept of health and diseases, Role of hygiene in health system	3	2	3	1	3	2	1	2	3	2	3	1	3	1	2
<b>CO-2:</b> various treatment approach for microbial infections	2	3	1	3	1	2	1	1	2	3	3	3	2	1	3
<b>CO-3:</b> National health programs run by Govt. of India	3	2	3	2	2	1	2	1	2	2	3	3	2	1	3
<b>CO-4:</b> Role of WHO in national health intervention programs for mother child, elder	2	3	2	3	1	3	2	2	3	3	3	3	2	1	3
<b>CO-5:</b> Community services in rural, urban and school health.	3	3	1	1	1	3	3	3	1	2	3	2	2	2	2

**Legend: 1- Low, 2-Medium, 3-High**



### Course Curriculum Mapping

Pos& PSOs No	Cos No&	Title	SOs No	Class Room Instructions	Laboratory Instructions	Self learning
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	CO- BP 802.1E T	To understand Concept of health and diseases, Role of hygiene in helath system.	SO1.1 SO1.2 SO1.3	1.1,1.2,1.3,1.4,1.5,1.6,1.7,1.8,1.9,1.10	-	SI-1.1 SI-1.2
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	CO- BP 802.2E T	To know the various treatment approach for microbial infections like Ebola virus, influenza, etc	SO-2.1 SO-2.2 SO-2.3	2.1,2.2,2.3,2.4,2.5,2.6,2.7,2.8,2.9,2.10	-	SI-2.1 SI-2.2
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	CO- BP 802.3E T	To know the various National health programs run by Govt. of India., its objectives, functioning and outcome	SO-3.1 SO-3.2	3.1,3.2,3.3,3.4,3.5,3.6,3.7,3.8,3.9,3.10	-	SI-3.1
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	CO- BP 802.4E T	To know the role of WHO in national health intervention programs for mother child, elder <i>Etc</i> .	SO-4.1 SO-4.2 SO-4.3	4.1,4.2,4.3,4.4,4.5,4.6,4.7,4.8	-	SI-4.1 SI-4.2
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	CO- BP 802.5E T	To understand the Community services in rural, urban and school health.	SO-5.1 SO-5.2 SO-5.3	5.1,5.2,5.3,5.4,5.5,5.6,5.7	-	SI-5.1 SI-5.2





AKS University  
Faculty of Pharmaceutical Science & Technology  
Rajiv Gandhi Institute of Pharmacy  
Curriculum of B. Pharmacy (Pharma Marketing Management) Program  
(Revised as on 01August2023)

**Semester-VIII**

<b>Course Code:</b>	BP803ET
<b>Course Title:</b>	Pharma Marketing Management
<b>Pre-requisite:</b>	Student should have basic knowledge of General Marketing, Pharma Marketing, Marketing management, Consumer behaviour.
<b>Rationale/Objective s:</b>	<p>Up on completion of the course student shall be able to</p> <ul style="list-style-type: none"><li>• To understand the marketing concepts and techniques and their applications in the pharmaceutical industry.</li><li>• To describe, classify, structure and combine concepts, theories, methods and models taught.</li><li>• To identify and develop relevant issues within pharmaceutical marketing.</li><li>• To analyze and synthesize specific issues within pharmaceutical marketing by using the concepts, theories, methods and models taught.</li><li>• To assess and communicate problem-solving on a reflective, scientific basis.</li></ul>

**Course Out comes:**

- CO-BP803-1:** To understand the marketing & pharmaceutical market.
- CO-BP803-2:** To acquired the knowledge of product decision & product management in pharmaceutical industry
- CO-BP803-3:** To understanding the promotion & online promotional techniques for OTC Products.
- CO-BP803-4:** To familiarize with basic concept of pharmaceutical marketing channels & professional sales, representative (PSR)
- CO-BP803-5:** To comprehend the basic concepts of pricing & emerging concepts in marketing.



## Scheme of Studies

Course code	Title of the course	Program Name	TOTAL Number of contact hours/Week						Credit
			Classroom Instruction (A)		Practical(P)	SW	SL	Total Hours (H)	
			Lecture	Tutorial					
BP803ET	Pharma Marketing Management	B. Pharmacy	3	1	4	1	1	10	6

**Legend:CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T)and others),

**LI: Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)**

**SW: Sessional Work** (includes assignment, seminar, mini project etc.),

**SL:** Self Learning, Credits.

**Note:** SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

## Theory Assessment

Board of Study	Course Code	Course Title	Scheme of Assessment ( Marks )					Sessional Examination Marks (C)	Total Marks (A+B+C)
			Progressive Assessment ( PRA)						
			Academic activity, Any three (Quiz/ Assignment, open book test, filed			Sessional Marks			
						Total			
Pharmacy	BP-803 ET	Pharmaceutical Marketing Management	3	3	4	10	15	75	100



**Guidelines for the allotment of marks for attendance**

<b>Percentage of Attendance</b>	<b>Theory</b>	<b>Practical</b>
95 – 100	4	2
90–94	3	1.5
85–89	2	1
80–84	1	0.5
Less than 80	0	0



**Course-Curriculum Detailing:**

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

**Unit I****CO-BP803-1: To understand the marketing & pharmaceutical market.**

Item	Approx Hrs
Lecture & Tutorial	10+3=13
Practical(P)	0
SW	1
SL	1
Total:	15

Session Outcomes(SOs)	Laboratory Instruction(LI)	Class room Instruction (CI)	Self Learning (SL)
<b>Theory</b> SO1.1: Marketing SO1.2: Pharmaceutical Marketing	NA	.1 Definition, general concepts and scope of marketing 1.2 Distinction between marketing & selling; Marketing environment 1.3 Industry and competitive analysis <b>1T.1</b> Tutorial Class 1.4 Analyzing consumer buying behavior & industrial buying behavior. 1.5 Quantitative and qualitative aspects & size and composition of the market. 1.6 Demographic descriptions and socio-psychological characteristics of the consumer.  <b>1T.2</b> Tutorial Class 1.7 Market segmentation & targeting & Consumer profile. 1.8 Motivation and prescribing habits of the Physician. 1.9 Patients' choice of physician and retail pharmacist. 1.10 Analyzing the Market; Role of market research. <b>1T.3</b> Tutorial Class	1.1: Motivation and prescribing habits of the physician;  1.2: patients' choice of physician and retail pharmacist

**Suggested Assignments:**

1. General concepts and scope of marketing
2. Analyzing consumer buying behavior.
3. Socio-psychological characteristics of the consumer.
4. Size and composition of the market.
5. Patient's choice of physician and retail pharmacist



## Unit II

**CO-BP803-2: To acquired the knowledge of product decision & product management in pharmaceutical industry.**

Item	Approx Hrs
Lecture & Tutorial	08+3=11
Practical (P)	0
SW	1
SL	1
Total:	13

Session Outcomes(SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
<b>Theory</b> <b>SO2.1:</b> Product decision <b>SO2.2:</b> Product life cycle <b>SO2.3:</b> New product decisions <b>SO2.4:</b> Product management in pharmaceutical industry.	NA	2.1 Product decision & Classification. 2.2 Product line and product mix decisions. 2.3 Product life Cycle. <b>2T.1</b> Tutorial Class 2.4 Product portfolio analysis & product positioning. 2.5 New product decisions. 2.6 Product branding. <b>2T.2</b> Tutorial Class 2.7Product packaging and labeling decisions. 2.8 Product management in pharmaceutical industry. <b>2T.3</b> Tutorial Class	2.1: Product life cycle  2.2: Product packaging and labeling decisions.

**Suggested Assignments:** 1. Product line 2. Product mix decisions 3. Product life cycle 4. New product decisions 5. Product packaging and labeling decisions

## Unit III

**CO-BP803-3: To understanding the promotion & 504 promotional techniques for OTC Products.**



Item	Approx Hrs
Lecture & Tutorial	07+3=10
Practical(P)	0
SW	1
SL	1
Total:	12

Session Outcomes(SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
<b>Theory SO3.1:</b> Promotion & methods <b>SO3.2:</b> Promotional budget <b>SO3.3:</b> Online promotional techniques for OTC Products.	NA	3.1 Promotion & Methods 3.2 Determinants of promotional mix <b>3T.1</b> Tutorial Class 3.3 Promotional budget 3.4An overview of personal selling 3.5 Advertising, direct mail, journals, sampling <b>3T.2</b> Tutorial Class 3.6 Retailing, medical Exhibition & public relations 3.7 Online promotional techniques for OTC Products. <b>3T.3</b> Tutorial Class	3.1: Advertising & direct mail 3.2: Journals & sampling

**Suggested Assignments:** 1. Personal selling 2. Advertising 3. Direct mail & journals 4. Sampling 5. Retailing



# Unit IV

**CO-BP803-4: To familiarize with basic concept of pharmaceutical marketing channels & professional sales representative (PSR).**

Item	Approx Hrs
Lecture & Tutorial	10+3=13
Practical(P)	0
SW	1
SL	1
Total:	15

Session Outcomes(SO s)	Laboratory Instruction (LI)	Class room Instruction(CI)	Self Learning (SL)
<b>Theory</b> <b>SO4.1:</b> Pharmaceutical marketing channels <b>SO4.2:</b> Professional sales representative (PSR)	NA	4.1 Designing channel & channel members 4.2 Selecting the appropriate channel 4.3 Conflict in channels <b>4T.1</b> Tutorial Class 4.4 Physical distribution management: Strategic importance 4.5 Tasks in physical distribution management. 4.6 Duties of PSR & purpose of detailing <b>4T.2</b> Tutorial Class 4.7 Selection and training & supervising 4.8 Norms for customer calls 4.9 Motivating, evaluating & compensation 4.10 future prospects of the PSR. <b>4T.3</b> Tutorial Class	4.1: Physical distribution management 4.2: Duties of PSR

**Suggested Assignments:** 1. channel members 2. tasks in physical distribution management. 3. Duties of PSR 4. selection and training 5. norms for customer calls



**Unit V**

**CO-BP803-5: To comprehend the basic concepts of pricing & emerging concepts in marketing.**

Item	Approx Hrs
Lecture & Tutorial	10+03=13
Practical(P)	0
SW	1
SL	1
Total:	15

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
<b>Theory</b> <b>SO5.1:</b> Pricing <b>SO5.2:</b> Emerging concepts in marketing		5.1 Meaning, importance & objectives of Pricing 5.2 Determinants of price 5.3 Pricing methods and strategies & issues in price management in pharmaceutical industry. <b>5T.1</b> Tutorial Class 5.4 DPCO (Drug Price Control Order) 5.5 NPPA (National Pharmaceutical Pricing Authority). 5.6 Vertical & Horizontal Marketing <b>5T.2</b> Tutorial Class 5.7 Rural Marketing 5.8 Consumerism 5.9 Industrial Marketing 5.10 Global Marketing <b>5T.3</b> Tutorial Class	<b>5.1:</b> Determinants of price <b>5.2:</b> Consumerism

**Suggested Assignments:** 1. Determinants of price 2. DPCO 3. NPPA 4. Vertical & Horizontal Marketing 5. Global Marketing



**rief of Hours suggested for the Course Outcome**

<b>Course Out comes</b>	<b>Class Lecture (Cl)</b>	<b>(LI)</b>	<b>Session a l Work (SW)</b>	<b>Self Learning (SI)</b>	<b>Total Hour (Cl+SW+ SI+LI)</b>
<b>CO-BP803-1:</b> To understand the marketing & pharmaceutical market.	13	0	1	1	15
<b>CO-BP803-2:</b> To acquired the knowledge of product decision & product management in pharmaceutical industry.	11	0	1	1	13
<b>CO-BP803-3:</b> To understanding the promotion & online promotional techniques for OTC Products.	10	0	1	1	12
<b>CO-BP803-4:</b> To familiarize with basic concept of pharmaceutical marketing channels & professional sales representative (PSR).	13	0	1	1	15
<b>CO-BP803-5:</b> To comprehend the basic concepts of pricing & emerging concepts in marketing.	13	0	1	1	15
<b>Total Hours</b>	<b>60</b>	<b>0</b>	<b>5</b>	<b>5</b>	<b>70</b>



## Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	Understand the marketing & To pharmaceutical market.	08	06	01	15
CO-2	To acquired the knowledge product management in pharmaceutical industry.	08	07	01	16
CO-3	To understanding the promotion & online promotional techniques for OTC Products.	08	07	01	16
CO-4	To familiarize with basic concept of pharmaceutical marketing channels & professional sales representative (PSR).	07	06	01	14
CO-5	To comprehend the basic concepts of pricing & emerging concepts in marketing.	08	07	01	16
Total		39	33	05	77

**Legend: R: Remember, U: Understand, A: Apply**

The end of semester assessment for Pharmaceutical Marketing Management will be held with written examination of 75 marks

**Note.** Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks.

Teachers can also design different tasks as per requirement, for end semester assessment.

### Suggested Instructional/Implementation Strategies:

1. Improved Lecture
2. Tutorial
3. Case Method
4. Group Discussion
5. Role Play
6. Demonstration
7. ICT Based Teaching Learning (Video Demonstration/Tutorials CBT, Blog, Face book, Twitter, Whats app, Mobile, Online sources)
8. Brainstorming



### Suggested Learning Resources:

S. No.	Title	Author	Publisher	Edition Year
1	Marketing Management	Philip Kotler, Kevin Lane Keller	Prentice Hall of India, New Delhi	2012
2	Marketing Strategy- Planning and Implementation	Walker, Boyd and Larreche	Tata MC GrawHill, New Delhi	2016
3	Marketing	Dhruv Grewal and Michael Levy	Tata MC Graw Hill	2006
4	Marketing Management	Arun Kumar and N Menakshi	Vikas Publishing, India	2021
5	Marketing Management	Rajan Saxena	Tata MC Graw-Hill	(India Edition)
6	Marketing Managemnt:Global Perspective, IndianContext	Ramaswamy, U.S & Nanakamari, S:	Macmilan India, New Delhi.	2018
7	Service Marketing	Shanker, Ravi:	Excell Books, New Delhi	2014
8	Pharmaceutical Marketing in India (GIFT – Excel series)	Subba Rao Changanti,	Excel Publications.	--

### Curriculum Development Team:

1. **Prof. SP Gupta**, Director, RGIP, AKS University
2. **Mr. Satyendra Garg**, Assistant professor, RGIP, AKS University
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**Course Outcome, Program Specific Outcome & Program Outcome Mapping**

**Course Code:** BP803ET

**Course Name:** Pharma Marketing Management

Course Outcome	Program Outcome											Program Specific outcome			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	SO2	PSO3	PSO4
	Pharmacy knowledge	Planning abilities	Problem analysis	Modern tool usage	Leadership skills	Professional Identity	Pharmaceutical Ethics	Communication	The pharmacist and society	Environment and sustainability	Life-long learning	Knowledge of drug discovery	Quality Analysis of API's	MOA of Drug	Biological valuation of drug
<b>CO-1:</b> Marketing & pharmaceutical market	3	2	3	1	3	2	1	2	3	2	3	1	3	1	2
<b>CO-2:</b> product decision & product management	2	3	1	3	1	2	1	1	2	3	3	3	2	1	3
<b>CO-3:</b> online promotional techniques for OTC	3	2	3	2	2	1	2	1	2	2	3	3	2	1	3
<b>CO-4:</b> Pharmaceutical marketing channels & professional sales representative (PSR).	2	3	2	3	1	3	2	2	3	3	3	3	2	1	3
<b>CO-5:</b> Basic concepts of pricing & emerging concepts in marketing	3	3	1	1	1	3	2	3	1	2	3	2	2	2	2

**Legend: 1- Low, 2-Medium, 3-High**



### Course Curriculum Mapping

Pos& PSOs No	Cos No&	Title	SOs No	Class Room Instructions	Laboratory Instructions	Self learning
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	CO-BP 803.1ET	To understand the marketing & pharmaceutical market.	SO1.1 SO1.2 SO1.3	1.1,1.2,1.3,1.4,1.5,1.6,1.7,1.8,1.9,1.10		SI-1.1 SI-1.2
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	CO- BP 803.2ET	To acquired the knowledge of product decision & product management in pharmaceutical industry.	SO-2.1 SO-2.2 SO-2.3	2.1,2.2,2.3,2.4,2.5,2.6,2.7,2.8,2.9,2.10		SI-2.1 SI-2.2
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	CO- BP 803.3ET	To acquired the knowledge of online promotional techniques for OTC	SO-3.1 SO-3.2	3.1,3.2,3.3,3.4,3.5,3.6,3.7,3.8,3.9,3.10		SI-3.1
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	CO- BP 803.4ET	To familiarize with basic concept of pharmaceutical marketing channels & professional sales representative (PSR).	SO-4.1 SO-4.2	4.1,4.2,4.3,4.4,4.5,4.6,4.7,4.8		SI-4.1 SI-4.2
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	CO- BP 803.5ET	To comprehend the basic concepts of pricing & emerging concepts in marketing	SO-5.1 SO-5.2 SO-5.3	5.1,5.2,5.3,5.4,5.5,5.6,5.7		SI-5.1 SI-5.2





AKS University  
Faculty of Pharmaceutical Science & Technology  
Rajiv Gandhi Institute of Pharmacy  
Curriculum of B. Pharmacy (Pharmaceutical Regulatory Science) Program  
(Revised as on 01August2023)

**Semester-VIII**

<b>Course Code:</b>	<b>BP804ET</b>
<b>Course Title:</b>	<b>Pharmaceutical Regulatory Science</b>
<b>Pre-requisite:</b>	The Student should have basic knowledge of drug discovery and development.
<b>Rationale/Objective s:</b>	<p>Up on completion of the course student shall be able to</p> <ul style="list-style-type: none"><li>• Know about the process of drug discovery and development</li><li>• Know the regulatory authorities and agencies governing the manufacture and sale of pharmaceuticals</li><li>• Know the regulatory approval process and their registration in Indian and international markets</li></ul>

**Course Out comes:**

**CO-BP804ET-1:** To understand about the drug discovery and development of generic drug.

**CO-BP804ET-2:** To know about the processes and rules during new drug development.

**CO-BP804ET-3:** To understand about the procedure of registration of Indian drug product in overseas market.

**CO-BP804ET-4:** To gain the knowledge about clinical trials protocols & ethics committee.

**CO-BP804ET-5:** Understand about the technical terms, guidelines, law and acts and code of federal regulatory.



## Scheme of Studies

Course code	Title of the course	Program Name	TOTAL Number of contact hours/Week						Credit
			Classroom Instruction (A)		Practical(P)	SW	SL	Total Hours (H)	
			Lecture	Tutorial					
BP804ET	Pharmaceutical Regulatory Science	B. Pharmacy	3	1	4	1	1	10	6

**Legend:** **CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others),

**LI:** Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)

**SW:** Sessional Work (includes assignment, seminar, mini project etc.),

**SL:** Self Learning, Credits.

**Note:** SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

### Theory Assessment

Board of Study	Course Code	Course Title	Scheme of Assessment ( Marks )						
			Progressive Assessment ( PRA)						
			Academic activity, Any three (Quiz/ Assignment, open book test, filed work and seminar)	Studentteacherinteraction	ClassAttendance(AT)	(A)  Total Marks	SessionalExam(B)	EndSemesterAssesment((C)	TotalMarks(A+B+C)
Pharmacy	BP804ET	Pharm Aceuti Cal Regul Atory Scienc E	3	3	4	10	15	75	100



## Practical Assessment

Board of Study	Course Code	Course Title	Scheme of Assessment ( Marks )						
			Internal Assessment (A)			End Semester Examination(B)			Total Marks (A+B)
			Attendance	Record	Sessional Exam.	Synopsi s	Experiment	Viva	
	BP-104P	Pharmaceutical Regulatory Science	2	3	10	5	25	5	50

## Guidelines for the allotment of marks for attendance

Percentage of Attendance	Theory	Practical
95 – 100	4	2
90–94	3	1.5
85–89	2	1
80–84	1	0.5
Less than 80	0	0



**Course-Curriculum Detailing:**

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

**CO-BP804ET-1: To understand about the drug discovery and development of generic drug**

Item	Approx Hrs
Lecture & Tutorial	10+3=13
Practical (P)	0
SW	1
SL	1
Total	15

Session Outcomes(SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
Theory SO1.1: Understand New drug delivery concept SO1.2: Understand drug development process. SO1.3: Generic drug product development.		1.1: New drug delivery concept. 1.2: development concept. 1.3: Stages of drug discovery. 1.4: Drug development process 1T.1: Tutorial 1.5: pre-clinical studies 1.6: non-clinical activities, 1.7: clinical studies 1T.2: Tutorial class 1.8: clinical studies 1.9: Concept of generics 1.10: Generic drug product development. 1T.3: Tutorial class	1.1: To study about the drug development process of two different categories drugs.

**Suggested Assignments:** Stages of drug discovery, Drug development process, pre-clinical studies



## Unit II

**CO-BP104-2: To know about the processes and rules during new drug development.**

Item	Approx Hrs
Lecture & Tutorial	10+3=13
Practical(P)	0
SW	1
SL	1
Total	15

Session Outcomes(SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO2.1: Understand the Approval processes. SO2.2: New Drug Application (NDA). SO2.3: Organization structure and types of applications.		2.1: Approval processes 2.2: timelines involved in Investigational New Drug (IND) 2.3: New Drug Application (NDA) 2.4: Abbreviated New Drug Application (ANDA). 2T.1: Tutorial 2.5: Changes to an approved NDA /ANDA 2.6: Overview of regulatory authorities of India. 2T.2: Tutorial 2.7: United States 2.8: European Union 2.9: Australia, Japan 2.10: Canada (Organization structure and types of appli	2.1: Study about the detailed process of new drug application and their modern perspective.

**Suggested Assignments:** New Drug Application (NDA), Abbreviated New Drug Application (ANDA), Changes to an approved NDA / ANDA.



### Unit III

**CO-BP804ET-3: To understand about the procedure of registration of Indian drug product in overseas market**

Item	Approx Hrs
Lecture & Tutorial	10+3=13
Practical(P)	0
SW	1
SL	1
Total:	15

Session Outcomes(SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
Theory SO3.1: Registration of Indian drug product SO3.2: Procedure for export of pharmaceutical products SO3.3: Common Technical Document (CTD) SO3.4: Common Technical Document (ACTD) research		3.1: Registration of Indian drug product 3.2: overseas market 3.3: Procedure for export of pharmaceutical products 3.4: Procedure for export of pharmaceutical products 3T.1: Tutorial Class 3.5 : Technical documentation 3.6: Drug Master Files (DMF) 3.7: Common Technical Document (CTD) 3.8: electronic Common Technical Document (Ectd) 3T.2: Tutorial class 3.9: ASEAN 3.10: Common Technical Document (ACTD) research 3T3: Tutorial class	3.1: Study the various drugs registration process

**Suggested Assignments:** Procedure for export of pharmaceutical products, Technical documentation, Drug Master Files (DMF)



#### Unit IV

**CO-BP804ET-4: To gain the knowledge about clinical trials protocols & ethics committee.**

Item	Approx Hrs
Lecture & Tutorial	8+3=11
Practical(P)	0
SW	1
SL	1
Total:	13

Session Outcomes(SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
Theory <b>SO4.1:</b> Understand Developing clinical trial protocols <b>SO4.2:</b> Informed consent process and procedures, GCP obligations of Investigators <b>SO4.3:</b> Pharmacovigilance - safety monitoring in clinical trials		4.1: Developing clinical Trial protocols. 4.2: Institutional Review 4.3: Board / Independent Ethics committee 4.4: formation and working procedures <b>4T1: Tutorial</b> 4.5: Informed consent process and procedures, GCP obligations of Investigators 4.6: sponsors & Monitor <b>4T2: Tutorial</b> 4.7: Managing and Monitoring clinical trials 4.8: Pharmacovigilance - safety monitoring in clinical trials <b>4T3: Tutorial</b>	4.1: Study about the different committee working in the Pharmaceutical field.



## Unit V

**CO-BP104-5: Understand about the technical terms, guidelines, law and acts and code of federal regulatory**

Item	Approx Hrs
Lecture & Tutorial	7+3=10
Practical(P)	0
SW	1
SL	1
Total:	12

Session Outcomes(SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
Theory SO5.1: Understand Basic terminology SO5.2: Federal Register, Code of Federal Regulatory		5.1: Basic terminology 5.2: , guidance, guidelines 5.3: regulations: Half life, 5T1: Tutorial 5.4: Laws and Acts 5.5: Orange book 5T2: Tutorial 5.6: Federal Register, Code of Federal Regulatory 5.7: Purple book 5T.3: Tutorial	5.1: Write the difference between orange book and purple book with importance.

**Suggested Assignments:** Orange book, Federal Register, Code of Federal Regulatory, Purple book



### Brief of Hours suggested for the Course Outcome

Course Out comes	Class Lecture (C)	(LI)	Sessional Work (SW)	Self Learning (SI)	Total Hour (C+S+SI+LI)
<b>CO-BP804ET-1:</b> To understand about the drug discovery and development of Generic drug.	13	10	1	1	15
<b>CO-BP804ET-2:</b> To know about the processes and rules during new drug development	13	0	1	1	15
<b>CO-BP804ET-3:</b> To understand about the procedure of registration of Indian drug product in overseas market	13	0	1	1	15
<b>CO-BP804ET-4:</b> To gain the knowledge about clinical trials protocols & ethics committee.	11	0	1	1	13
<b>CO-BP804ET-5:</b> Understand about the technical terms, guidelines, law and acts and code of federal regulatory.	10	0	1	1	12
<b>Total Hours</b>	60	0	5	5	70



**Suggestion for End Semester Assessment**  
Suggested Specification Table (For ESA)

Course Outcome	Unit Titles	Marks Distribution			Total Marks	
		R	U	A		
<b>CO-BP804ET-1:</b>	To understand about the drug discovery and development of generic drug	8		6	1	15
<b>CO-BP804ET-2:</b>	To know about the processes and rules during new drug development	12		7	1	20
<b>CO-BP804ET-3:</b>	To understand about the procedure of registration of Indian drug product in overseas market	2		6	2	10
<b>CO-BP804ET-4:</b>	To gain the knowledge about clinical trials protocols & ethics committee	10		2	3	15
<b>CO-BP804ET-5:</b>	Understand about the technical terms, guidelines, law and acts and code of federal regulatory	5		7	3	15
<b>Total</b>		37		38	10	75

The end of semester assessment for **Pharmaceutical Regulatory Science** will be held with written examination of 75 marks

**Note.** Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks.

Teachers can also design different tasks as per requirement, for end semester assessment.

**Suggested Instructional/Implementation Strategies:**

1. Improved Lecture
2. Tutorial
3. Case Method
4. Group Discussion
5. Role Play
6. Demonstration
7. ICT Based Teaching Learning (Video Demonstration/Tutorials CBT, Blog, Face book, Twitter, Whats app, Mobile, Online sources)
8. Brainstorming



### Suggested Learning Resources:

S. No.	Title	Author	Publisher	Edition & Year
1	Drug Regulatory Affairs	Sachin Itkar, Dr. N.S. Vyawahare	Nirali Prakashan	Latest edition
2	The Pharmaceutical Regulatory Process	Ira R. Berry and	Informa Healthcare Publishers	-
3	Generic Drug Product Development,	Robert P. Martin Leon Shargel and Isader	Marcel Dekker series	Vol.143
4	Solid Oral Dosage forms Principles and Practices of Clinical Research	Kaufer John I. Gallin and Frederick P.Ognibene		Second Edition,2006
5	Drugs: From Discovery to Approval	Rick Ng		Second Edition,2010
6	Guidebook for drug regulatory submissions	John Wiley & Sons. Inc		Latest Edition

### Curriculum Development Team:

1. **Prof. SP Gupta**, Director, RGIP, AKS University
2. **Mr. Satyendra Garg**, Assistant professor, RGIP,AKS University



**Course Outcome, Program Specific Outcome& Program Outcome Mapping****Course Code: BP804ET****Course Name: Pharmaceutical Regulatory Science**

Course Outcome	Program Outcome											Program Specific outcome			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	SO2	PSO3	PSO4
	Pharmacy knowledge	Planning Abilities	Problem analysis	Modern tool usage	Leadership skills	Professional Identity	pharmaceutical Ethics	communication	the pharmacist and society	Environment and sustainability	Life-long learning	Knowledge of drug discovery	Quality Analysis of API's	MOA of Drug	Biological valuation of drug
<b>CO-1:</b> Drug discovery and development of generic drug	3	2	3	1	3	2	1	2	3	2	3	1	3	1	2
<b>CO-2:</b> Processes and rules during new drug development	2	3	1	3	1	2	1	1	2	3	3	3	2	1	3
<b>CO-3:</b> procedure of registration of Indian drug product in overseas market	3	2	3	2	2	1	2	1	2	2	3	3	2	1	3
<b>CO-4:</b> To gain the knowledge about clinical trials protocols & ethics committee	2	3	2	3	1	3	2	2	3	3	3	3	2	1	3
<b>CO-5:</b> the technical terms, guidelines, law and acts and code of federal regulatory	3	3	1	1	1	3	1	3	1	2	3	2	2	2	2

**Legend: 1- Low, 2-Medium, 3-High**



## Course Curriculum Mapping

Pos& PSOs No	Cos No&	Title	SOs No	Class Room Instructions	Laboratory Instructions	Self learning
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	CO-BP8041 T-1:	To understand about the drug discovery and development of generic drug	SO1.1 SO1.2 SO1.3	1.1,1.2,1.3,1.4,1.5,1.6,1.7,1.8,1.9,1.10		SI-1.1 SI-1.2
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	CO-BP8041 T-2:	To know about the processes and rules during new drug development	SO-2.1 SO-2.2 SO-2.3	2.1,2.2,2.3,2.4,2.5,2.6,2.7,2.8,2.9,2.10		SI-2.1 SI-2.2
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	CO-BP8041 T-3:	To understand about the procedure of registration of Indian drug product in overseas market	SO-3.1 SO-3.2	3.1,3.2,3.3,3.4,3.5,3.6,3.7,3.8,3.9,3.10		SI-3.1
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	CO-BP8041 T-4:	To gain the knowledge about clinical trials protocols & ethics committee	SO-4.1 SO-4.2 SO-4.3	4.1,4.2,4.3,4.4,4.5,4.6,4.7,4.8		SI-4.1 SI-4.2
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	CO-BP8041 T-5:	Understand about the technical terms, guidelines, law and acts and code of federal regulatory	SO-5.1 SO-5.2 SO-5.3	5.1,5.2,5.3,5.4,5.5,5.6,5.7		SI-5.1 SI-5.2





AKS University  
Faculty of Pharmaceutical Science & Technology  
Rajiv Gandhi Institute of Pharmacy  
Curriculum of B. Pharmacy (Pharmacovigilance) Program  
(Revised as on 01August2023))

**Semester-VIII**

**Course** BP805T

**Code:**

**Course** **Pharmacovigilance**

**Title:**

**Pre-**

**requisite:**

The student to learn about development of pharmacovigilance as a science, basic terminologies used in pharmacovigilance, global scenario of Pharmacovigilance, train students on establishing pharmacovigilance program in an organization, various methods that can be used to generate safety data and signal detection. This paper also develops the skills of classifying drugs, diseases and adverse drug reactions

**Rationale/**

**Objectives:**

After the successful completion of this course, the student shall be able to:

- Important for drug safety monitoring
- National and international scenario of pharmacovigilance
- Dictionaries, coding and terminologies used in pharmacovigilance
- Methods to generate safety data during pre clinical, clinical and post approval phases of drugs' life cycle

**Course Out comes:**

**CO- BP805T -1:** To understand the need & development of Pharmacovigilance System.

**CO- BP805T -2:** To know the various basic terminology, establishment & regulatory drugs dictionary used in Pharmacovigilance

**CO- BP805T -3:** To know the various active surveillance methods for vaccine safety & drug safety in Pharmacovigilance study.

**CO- BP805T -4:** To know the ICH Guidelines for Pharmacovigilance

**CO- BP805T -5:** To understand the role of CIOMS, CDSCO & Pharmacogenomics of adverse drug reactions.



## Scheme of Studies

:Course code	Title of the course	Program Name	TOTAL Number of contact hours/Week						Credit
			Classroom Instruction (A)		Practical( P)	SW	SL	Total Hours (H)	
			Lecture	Tutorial					
BP805T	Pharmacovigilance	B. Pharmacy	3	1	4	1	1	10	6

**Legend:** **CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others),

**LI:** Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)

**SW:** Sessional Work (includes assignment, seminar, mini project etc.),

**SL:** Self Learning, Credits.

**Note:** SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

## Theory Assessment

Board of Study	Course Code	Course Title	Scheme of Assessment ( Marks )						
			Progressive Assessment ( PRA)						
			Academic activity, Any three (Quiz/ Assignment, open book test, filed work and seminar)	Student teacher interaction	Class Attendance(AT)	(A)  Total Marks	Sessional Exam (B)		
Pharmacy	BP805T	Pharmacovigilance	3	3	4	10	15	75	100

## Guidelines for the allotment of marks for attendance

Percentage of Attendance	Theory	Practical
95 – 100	4	2
90 – 94	3	1.5
85 – 89	2	1
80 – 84	1	0.5
Less than 80	0	0



**Course-Curriculum Detailing:**

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

**Unit I**

**CO- BP805T -1: To understand the need & development of Pharmacovigilance System.**

Item	Approx Hrs
Lecture & Tutorial	10+3=13
Practical(P)	0
SW	1
SL	1
Total:	15

Session Outcomes(SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
<b>Theory</b> <b>SO1.1:</b> Introduction to Pharmacovigilance <b>SO1.2:</b> Introduction to adverse drug reactions <b>SO 1.3:</b> Basic terminologies used in pharmacovigilance		<b>1.1:</b> History and development of Pharmacovigilance <b>1.2</b> Importance of safety monitoring of Medicine. <b>1.3</b> WHO international drug monitoring programme <b>1.4:</b> social problems of the sick. <b>1T1: Tutorial Class</b> <b>1.5</b> Pharmacovigilance Program of India(PvPI) <b>1.6:</b> Methods in Causality assessment <b>1.7</b> Severity and seriousness assessment <b>1.8:</b> Predictability and preventability assessment <b>1T2: Tutorial Class</b> <b>1.9:</b> Management of adverse drug reactions <b>1.10:</b> Basic terminologies used in Pharmacovigilance(regulatory & ADR) <b>1T3: Tutorial Class</b>	<b>1.1:</b> Importance of ADR, Types of ADR

**Suggested Assignments:** History and development of Pharmacovigilance, Pharmacovigilance Program of India(PvPI), Introduction to adverse drug reactions



## Unit II

**CO- BP805T -2: To know the various basic terminology, establishment & regulatory drugs dictionary used in Pharmacovigilance**

Item	Approx Hrs
Lecture & Tutorial	10+3=13
Practical(P)	0
SW	1
SL	1
Total:	15

Session Outcomes(SO)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
<b>Theory</b> <b>SO1.1:</b> <b>Preventive medicine</b>		<b>2.1:</b> Anatomical, therapeutic and chemical classification of drugs <b>2.2:</b> International classification of diseases <b>2.3</b> Daily defined doses, International Non proprietary Names for drugs <b>2.4:</b> chicken guinea, dengue,,  <b>2T.1: Tutorial Class</b> <b>2.5:</b> WHO adverse reaction terminologies <b>2.6:</b> MedDRA and Standardised MedDRA queries <b>2.7:</b> Eudravigilance medicinal product dictionary <b>2.8:</b> Specialised resources for ADRs <b>2T.2: Tutorial class</b> <b>2.9</b> Establishing in a hospital, Establishment & operation of drug safety department in industry <b>2.10:</b> Contract Research Organisations (CROs) <b>2T.3: Tutorial class</b>	<b>2.1:</b> Understand the importance of event severity by WHO/Med DRA coding.

**Suggested Assignments:** Drug dictionaries and coding in pharmacovigilance, Information resources in pharmacovigilance



**CO- BP805T -2: To know the various basic terminology, establishment & regulatory drugs dictionary used in Pharmacovigilance**

Item	Approx Hrs
Lecture & Tutorial	10+3
Practical(P)	0
SW	1
SL	1
Total:	15

Session Outcomes(SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
<b>Theory</b> <b>SO 3.1:</b> Vaccine safety surveillance  <b>SO3.2:</b> Pharmacovigilance methods.  <b>SO3.3:</b> Communication in pharmacovigilance		<b>Chemotherapy</b> <b>3.1:</b> Vaccine Pharmacovigilance <b>3.2:</b> Vaccination failure <b>3.3</b> Adverse events following immunization <b>3.4:</b> Passive surveillance – Spontaneous reports and case series <b>3T.1: Tutorial Class</b>  <b>3.5:</b> Stimulated reporting <b>3.6:</b> Active surveillance – Sentinel sites, drug event monitoring and registries <b>3.7</b> Comparative observational studies – Cross sectional study, case control study and cohort study <b>3.8:</b> Targeted clinical investigations, <b>3T.2: Tutorial class</b> <b>3.9:</b> Effective communication in Pharmacovigilance ,Communication in Drug Safety Crisis management <b>3.10:</b> Communicating with Regulatory Agencies, Business Partners, Healthcare facilities & Media <b>3T.3: Tutorial class</b>	<b>3.1</b> Understand the importance of event severity by WHO/Med DRA coding.

**Suggested Assignments:** Pharmacovigilance methods, Vaccine safety surveillance



## Unit IV

### **CO- BP805T -4: To know the ICH Guidelines for Pharmacovigilance**

Item	Approx Hrs
Lecture & Tutorial	8+3=11
Practical(P)	0
SW	1
SL	1
Total:	13

Session Outcomes(SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
<b>Theory</b> <b>SO4.</b> Safety data generation  <b>SO4.2 ICH</b> Guidelines for Pharmacovigilance		<b>4.1</b> Pre clinical phase <b>4.</b> Clinical phase <b>4.3</b> Post approval phase (PMS) <b>4.4</b> Organization and objectives of ICH <b>4T1: Tutorial Class</b> <b>4.5</b> Expedited reporting <b>4.6:</b> Individual case safety reports <b>4..7</b> Periodic safety update reports <b>4.8</b> Post approval expedited reporting <b>4T.2: Tutorial class</b> <b>4.9</b> Pharmacovigilance planning <b>4.10</b> Good clinical practice in pharmacovigilance studies <b>4T3: Tutorial Class</b>	<b>4.1:</b> Various regulatory bodies for PV

**Suggested Assignments:** ICH Guidelines for Pharmacovigilance, Periodic safety update reports, Post approval expedited reporting, Good clinical practice in pharmacovigilance studies



## Unit V

**CO- BP805T -5: To understand the role of CIOMS, CDSCO & Pharmacogenomics of adverse drug reactions.**

Item	Approx Hrs
Lecture & Tutorial	7+3=10
Practical(P)	0
SW	1
SL	1
Total:	12

Session Outcomes(SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
<b>Theory</b> <b>SO5.1:</b> Pharmacogenomics of adverse drug reactions.  <b>SO5.2:</b> Drug safety evaluation in special population  <b>SO5.3:</b> CIOMS  <b>SO5.4:</b> CDSCO (India) and Pharmacovigilance		<b>5.1</b> Genetics related ADR with example focusing PK parameters. <b>5.2</b> Paediatrics <b>5.3:</b> Pregnancy and lactation <b>5.4</b> Geriatrics <b>5T1: Tutorial class</b> <b>5.5:</b> CIOMS Working Groups <b>5.6</b> CIOMS Form <b>5..7</b> D&C Act and Schedule Y <b>5..8</b> Differences in Indian and global pharmacovigilance requirements <b>5T.2: Tutorial class</b>	<b>5.1:</b> Reporting form of UK, Japan, USA

**Suggested Assignments:** Drug safety evaluation in special population, Genetics related ADR with example focusing PK parameters. D&C Act and Schedule Y.



### Brief of Hours suggested for the Course Outcome

Course Out comes	Class Lecture (Cl)	(L)	Sessional Work (SW)	Self Learning (Sl)	Total Hour (Cl+SW+Sl+LI)
<b>Course Out comes:</b> <b>CO-BP805T-1:</b> To understand the need & development of Pharmacovigilance System.	13	16	1	1	31
<b>CO- BP805T -2:</b> To know the various basic terminology, establishment & regulatory drugs dictionary used in Pharmacovigilance	13	8	1	1	23
<b>CO- BP805T -3:</b> To know the various active surveillance methods for vaccine safety& drug safety in Pharmacovigilance study.	13	12	1	1	27
<b>CO- BP805T -4:</b> To know the ICH Guidelines for Pharmacovigilance	10	8	1	1	20
<b>CO- BP805T -5:</b> To understand the role of CIOMS, CDSCO & Pharmacogenomics of adverse drug reactions.	10	0	1	1	12
<b>Total Hours</b>	<b>59</b>	<b>44</b>	<b>5</b>	<b>5</b>	<b>113</b>

### Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

Course Outcome	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
<b>CO-BP805T -1:</b>	To understand the need & development of Pharmacovigilance System.	08	06	01	15
<b>CO-BP805T -2:</b>	To know the various basic terminology, establishment & regulatory drugs dictionary used in Pharmacovigilance	12	07	01	20
<b>CO-BP805T -3:</b>	To know the various active surveillance methods for vaccine safety& drug safety in Pharmacovigilance study.	02	06	02	10
<b>CO-BP805T -4:</b>	To know the ICH Guidelines for Pharmacovigilance	10	02	03	15
<b>CO-BP805T -5:</b>	To understand the role of CIOMS, CDSCO & Pharmacogenomics of adverse drug reactions.	05	07	03	15
<b>Total</b>		<b>37</b>	<b>28</b>	<b>10</b>	<b>75</b>

**Legend: R: Remember, U: Understand, A:Apply**



The end of semester assessment for Pharmacovigilance will be held with written examination of 75 marks

**Note.** Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks.

Teachers can also design different tasks as per requirement, for end semester assessment.

**Suggested Instructional/Implementation Strategies:**

1. Improved Lecture
2. Tutorial
3. Case Method
4. Group Discussion
5. Role Play
6. Demonstration
7. ICT Based Teaching Learning (Video Demonstration/Tutorials CBT, Blog, Face book, Twitter, Whats app, Mobile, Online sources)
8. Brainstorming

**Suggested Learning Resources:**

S. No	Title	Author	Publisher	Edition & Year
1	Textbook of pharmacovigilance	S K Gupta,	JAYPEE Publications	2 <sup>nd</sup> Edition 2018
2	Practical Drug Safety from A to Z	Barton cobert., Pierre Biron,	Jones and Bartlett Publishers.	Fifth edition 2022
3	Mann's Pharmacovigilance	Elizabeth B. Andrews, nicholas, Wiley Publishers.	Wiley Publishers.	6 <sup>th</sup> Edition, 2014
4	A Textbook of Clinical Pharmacy Practice	Essential Concepts and Skills:G, Parthasarathi, Karin	Brian L. Strom, Stephen E, Kimmel, Sean Hennessy	2 <sup>nd</sup> Edition, 2012
5	Textbook of Pharmacoepidemiology		Wiley Publishers.	2 <sup>nd</sup> Edition 2018
6	Cobert's Manual of Drug Safety and Pharmacovigilance	Barton Cobert, Jones & Bartlett Publishers	Bartlett Publishers	Fifth edition 2022
7	Text Book of Medicine	Yash pal Munjal	JP Medical Ltd,	6 <sup>th</sup> Edition, 2015



**Curriculum Development Team:**

1. **Prof. SP Gupta**, Director, RGIP, AKS University
2. **Mr. Satyendra Garg**, Assistant professor, RGIP, AKS University



### Course Outcome, Program Specific Outcome & Program Outcome Mapping

**Course Code: BP805T**

Course Name: Pharmacovigilance

Course Outcome	Program Outcome											Program Specific outcome			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
	Pharmacy knowledge	Planning Abilities	Problem analysis	Modern tool usage	Leadership skills	Professional Identity	Pharmaceutical Ethics	Communication	The pharmacist and society	Environment and sustainability	Life-long learning	Knowledge of drug discovery	Quality Analysis of API's	MOA of Drug	Biological evaluation of drug
<b>CO-1:</b> Need & development of Pharmacovigilance System	3	2	3	1	3	2	1	2	3	2	3	1	3	1	2
<b>CO-2:</b> Dictionary used in Pharmacovigilance	2	3	1	3	1	2	1	1	2	3	3	3	2	1	3
<b>CO-3:</b> vaccine safety & drug safety in Pharmacovigilance	3	2	3	2	1	1	2	1	2	2	3	3	2	1	3
<b>CO-4:</b> ICH Guidelines for Pharmacovigilance	2	3	2	3	1	3	2	2	3	3	3	3	2	1	3
<b>CO-5:</b> Role of CIOMS, CDSCO & Pharmacogenomics of adverse drug reactions.	3	3	1	1	1	3	3	3	1	2	3	2	2	2	2

**Legend: 1- Low, 2-Medium, 3-High**



### Course Curriculum Mapping

Pos& PSOs No	Cos No&	Title	SOs No	Class Room Instructions	Laboratory Instructions	Self learning
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	CO-BP 805.1 ET	To understand the need & development of Pharmacovigilance System.	SO1.1 SO1.2 SO1.3	1.1,1.2,1.3,1.4,1.5,1.6,1.7,1.8,1.9,1.10	-	SI-1.1 SI-1.2
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	CO-BP 805.2 ET	To know the various basic terminology, establishment & regulatory drugs dictionary used in Pharmacovigilance	SO-2.1 SO-2.2 SO-2.3	2.1,2.2,2.3,2.4,2.5,2.6,2.7,2.8,2.9,2.10	-	SI-2.1 SI-2.2
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	CO-BP 805.3 ET	To know the various active surveillance methods for vaccine safety & drug safety in Pharmacovigilance study.	SO-3.1 SO-3.2	3.1,3.2,3.3,3.4,3.5,3.6,3.7,3.8,3.9,3.10	-	SI-3.1
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	CO-BP 805.4 ET	To know the ICH Guidelines for Pharmacovigilance	SO-4.1 SO-4.2 SO-4.3	4.1,4.2,4.3,4.4,4.5,4.6,4.7,4.8	-	SI-4.1 SI-4.2
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	CO-BP 805.5 ET	To understand the role of CIOMS, CDSCO & Pharmacogenomics of adverse drug reactions.	SO-5.1 SO-5.2 SO-5.3	5.1,5.2,5.3,5.4,5.5,5.6,5.7	-	SI-5.1 SI-5.2





AKS University  
Faculty of Pharmaceutical Science & Technology  
Rajiv Gandhi Institute of Pharmacy  
Curriculum of B. Pharmacy (Quality control and standardization of herbals) Program  
(Revised as on 01August2023)  
**Semester-VIII**

**Course Code:** BP806ET

**Course Title:** Quality control and standardization of herbals

**Pre-requisite:** The Student should have basic knowledge of Quality control and standardization of herbals includes various methods and guidelines for evaluation and standardization of herbs and herbal drugs.

**Rationale/Objective s:** Upon completion of the subject student shall be able to;

1. know WHO guidelines for quality control of herbal drugs
2. know Quality assurance in herbal drug industry
3. know the regulatory approval process and their registration in Indian and international markets
4. appreciate EU and ICH guidelines for quality control of herbal drugs

**Course Out comes:**

**CO-BP806.1ET:** To understand the WHO guidelines for quality control of herbal drugs.

**CO-BP806.2ET:** To understand about the Quality assurance in herbal drug industry

**CO-BP806.3ET:** To appreciate EU and ICH guidelines for quality control of herbal drugs

**CO-BP806.4ET:** To understand about the regulatory approval process and their registration in Indian and international markets

**CO-BP806.5ET:** To understand about Regulatory requirements for herbal medicines.



## Scheme of Studies

Course code	Title of the course	Program Name	Total Number of contact hours/Week						Credit
			Classroom Instruction (A)		Practical (P)	SW	SL	Total Hours (H)	
			Lecture	Tutorial					
BP806ET	Quality control and standardization of herbals	B. Pharmacy	3	1	0	1	1	6	4

**Legend:** **CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and **LI:** Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)

**SW:** Sessional Work (includes assignment, seminar, mini project etc.),

**SL:** Self Learning, Credits.

**Note:** SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

## Theory Assessment

Board of Study	Course Code	Course Title	Scheme of Assessment ( Marks )						
			Progressive Assessment ( PRA)						
			Academic activity,Any three (Quiz/ Assignment, open book test, filed work and seminar)	Student teacher interaction	Class Attendan ce	Total Marks	Sessional Exam (B)		
Pharmacy	BP-806ET	Quality control and standardizati on of herbals	3	3	4	10	15	75	100



## Guidelines for the allotment of marks for attendance

Percentage of Attendance	Theory	Practical
95 – 100	4	2
90 – 94	3	1.5
85 – 89	2	1
80 – 84	1	0.5
Less than 80	0	0

### Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

**CO-BP806.1:** To understand the WHO guidelines for quality control of herbal drugs.

Item	Approx Hrs
Lecture & Tutorial	10+3=13
Practical(P)	0
SW	1
SL	2
Total:	16

Session Outcomes(SOs)	Laboratory Instruction(LI)	Class room Instruction(CI)	Self Learning (SL)
<b>Theory</b> <b>SO1.1:</b> Basic tests for drugs <b>SO1.2:</b> WHO guidelines for quality control of herbal drugs <b>SO1.3:</b> Evaluation of commercial crude drugs	NA	<b>1.1</b> Introduction of pharmaceutical drugs <b>1.2</b> Basic tests for drugs <b>1.3</b> Pharmaceutical substances <b>1T.1:</b> Tutorial class <b>1.4</b> Discuss the Medicinal plants materials <b>1.5</b> Defined and types of Dosage forms <b>1.6</b> General introduction of WHO guidelines <b>1T.2:</b> Tutorial class <b>1.7</b> Basic concept of herbal drugs <b>1.8</b> WHO guidelines for quality control of herbal drugs. <b>1.9</b> quality control test of herbal drugs <b>1.10</b> Evaluation of commercial crude drugs intended for use <b>1T.3:</b> Tutorial class	<b>1.1</b> WHO guidelines for quality control of herbal drugs <b>1.2</b> Basic concept of herbal drugs



**Suggested Assignments:**

1. Basic knowledge of herbal drugs and given various dosage form.
2. WHO guidelines for quality control of herbal drugs

**Unit II**

**CO-BP806.2: To understand about the Quality assurance in herbal drug industry.**

Item	Approx Hrs
Lecture & Tutorial	10+3=13
Practical(P)	0
SW	1
SL	2
Total	16

Session Outcomes(SOs)	Laboratory Instruction(LI)	Class room Instruction(CI)	Self Learning (SL)
<b>Theory</b> <b>SO2.1:</b> Quality assurance in herbal drug industry of cGMP, GAP, GMP and GLP in traditional system of medicine. <b>SO2.2:</b> WHO Guidelines on current good manufacturing Practices (cGMP) for Herbal Medicines <b>SO2.3:</b> WHO Guidelines on GACP for Medicinal Plants.	NA	2.1 Introduction of Quality assurance 2.2 Discuss about the Q.A. in herbal drug industry 2.3 Quality assurance in herbal drug industry of cGMP and GAP in traditional system of medicine <b>2T.1:</b> Tutorial class 2.4 Quality assurance in herbal drug industry of GMP in traditional system of medicine 2.5 QA in herbal drug industry of GLP in traditional system of medicine 2.6 Discuss about the WHO guideline for Herbal Medicines <b>2T.2:</b> Tutorial class 2.7 WHO Guidelines on current good manufacturing Practices (cGMP) for Herbal Medicine 2.8 General introduction of medicinal plants. 2.9 General discussion of GACP(good agricultural and collection practices) 2.10 WHO Guidelines on GACP for Medicinal Plants. <b>2T.3:</b> Tutorial class	2.1: What about the WHO Guidelines on current good manufacturing Practices (cGMP) for Herbal Medicines. 2.2: What about the WHO Guidelines on GACP for Medicinal Plants



**Suggested Assignments:**

1. To know about WHO Guidelines on GACP (good agricultural and collection practices) for Medicinal Plants.
2. Write about the Quality assurance in herbal drug industry of cGMP and GAP in traditional system of medicine

**Unit III**

**CO- BP806.3** To appreciate EU and ICH guidelines for quality control of herbal drugs

Item	Approx Hrs
Lecture & Tutorial	10+3=13
Practical(P)	0
SW	1
SL	1
Total:	15

Session Outcomes(SOs)	Laboratory Instruction(LI)	Class room Instruction(CI)	Self Learning (SL)
<b>Theory</b> <b>SO3.1</b> EU and ICH guidelines for quality control of herbal drugs.  <b>SO3.2</b> Research Guidelines for Evaluating the Safety and Efficacy of Herbal Medicines	NA	3.1 general introduction of EU (European union). 3.2 Explain about ICH guidelines 3.3 EU (European union) for quality control of herbal drugs <b>3T.1:</b> Tutorial class 3.4 ICH guidelines for quality control of herbal drugs 3.5 Research Guidelines of Herbal Medicines 3.6 Evaluating of Herbal Medicines <b>3T.2:</b> Tutorial class 3.7 Safety of Herbal Medicines 3.8 Efficacy of Herbal Medicines 3.9 General introduction of herbal medicines 3.10 explain about herbal product <b>3T.3:</b> Tutorial class	<b>3.1</b> Research Guidelines for Evaluating of the Herbal Medicines



**Suggested Assignments:**

1. EU and ICH guidelines for quality control of herbal drugs.
2. Evaluating the Safety and Efficacy of Herbal Medicines.

**Unit IV:**

CO- **BP806.4:** To understand about the regulatory approval process and their registration in Indian and international markets.

Item	Approx Hrs
Lecture & Tutorial	8+3=11
Practical(P)	0
SW	1
SL	2
Total:	14

Session Outcomes(SOs)	Laboratory Instruction (LI)	Class room Instruction(CI)	Self Learning(SL)
<b>Theory</b> <b>SO4.1:</b> Stability testing of herbal medicines <b>SO4.2:</b> chromatographic techniques in standardization of herbal products. <b>SO4.3:</b> GMP requirements and Drugs & Cosmetics Act provisions	NA	4.1 Brief in Stability testing of herbal medicines. 4.2 General introduction of chromatographic techniques 4.3 Application of various chromatographic techniques in herbal products. <b>4T.1:</b> Tutorial class 4.4 Preparation of documents for new drug application 4.5 Preparation of documents for export registration <b>4T.2:</b> Tutorial class 4.6 GMP requirements of herbal medicines 4.7 Drugs & Cosmetics Act provisions of herbal medicines 4.8 Application and standardization of herbal products. <b>4T.3:</b> Tutorial class	<b>4.1</b> Stability testing of herbal medicines <b>4.2</b> Application of various chromatographic techniques in herbal products.



**Suggested Assignments:**

1. What are Drugs & Cosmetics Act provisions of herbal medicines?
2. Describe chromatographic techniques.

**Unit V: CO- BP806.5:** To understand about Regulatory requirements for herbal medicines

Item	Approx Hrs
Lecture & Tutorial	7+3=10
Practical(P)	0
SW	1
SL	2
Total:	13

Session Outcomes(SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
<b>Theory</b> <b>SO5.1:</b> WHO guidelines on safety monitoring of herbal medicines <b>SO5.2:</b> Regulatory requirements for herbal medicines <b>SO5.3:</b> Role of chemical and biological markers in standardization of herbal products	NA	<b>5.1</b> Regulatory requirements for herbal medicines <b>5.2</b> WHO guidelines on safety monitoring of herbal medicines <b>5T.1:</b> Tutorial class  <b>5.3</b> herbal medicines in pharmacovigilance systems <b>5.4</b> Comparison of various Herbal Pharmacopoeias.  <b>5T.2:</b> Tutorial class <b>5.5</b> Role of chemical markers in herbal products <b>5.6</b> Role of biological markers in herbal products <b>5.7</b> standardization of herbal products <b>5T.3:</b> Tutorial class	<b>5.1</b> what about Regulatory requirements for herbal medicines <b>5.2</b> Role of biological markers in herbal products

**Suggested Sessional work****Assignments:**

1. Role of chemical and biological markers in standardization of herbal products.



<b>Course Out comes</b>	<b>Class Lecture (Cl)</b>	<b>(LI)</b>	<b>Sessional Work (SW)</b>	<b>Self Learning (SI)</b>	<b>Total Hour (Cl+SW+ SI+LI)</b>
<b>CO-BP806.1ET-</b> To understand the WHO guidelines for quality control of herbal drugs.	13	0	1	2	16
<b>CO-BP806.2ET-</b> To understand about the Quality assurance in herbal drug industry	13	0	1	2	16
<b>CO- BP806.3ET-</b> To appreciate EU and ICH guidelines for quality control of herbal drugs	13	0	1	1	15
<b>CO-BP806.4ET</b> -To understand about the regulatory approval process and their registration in Indian and international markets	11	0	1	2	14
<b>CO-BP806.5ET-</b> To understand about Regulatory requirements for herbal medicines	10	0	1	2	13
<b>Total Hours</b>	60	0	05	09	74



**Suggestion for End Semester Assessment**  
Suggested Specification Table (For ESA)

Course Outcome	Unit Titles	Marks Distribution			Total Marks
		A	C	E	
<b>CO- BP 806.1ET</b>	To understand the WHO guidelines for quality control of herbal drugs.	08	06	01	15
<b>CO- BP 806.2 ET</b>	To understand about the Quality assurance in herbal drug industry	12	07	01	20
<b>CO- BP 806.3 ET</b>	To appreciate EU and ICH guidelines for quality control of herbal drugs	02	06	02	10
<b>CO- BP 806.4ET</b>	To understand about the regulatory Approval process and their registration in Indian and international markets	10	02	03	15
<b>CO- BP 806.5 ET</b>	To understand about Regulatory requirements for herbal medicines	05	07	03	15
<b>Total</b>		<b>37</b>	<b>28</b>	<b>10</b>	<b>75</b>

**Legend: A: Analyse, C: Creat, E:Evaluate**

The end of semester assessment for quality control and standardization of herbals will be held with written examination of 75 marks.

**Note.** Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks. Teachers can also design different tasks as per requirement, for end semester assessment.

**Suggested Instructional/Implementation Strategies:**

1. Improved Lecture
2. Tutorial
3. Case Method
4. Group Discussion
5. Role Play
6. Demonstration
7. ICT Based Teaching Learning (Video Demonstration/Tutorials CBT, Blog, Face book, Twitter, Whats app, Mobile, Online sources)
8. Brainstorming



### Suggested Learning Resources:

S. No.	Title	Author	Publisher	Edition & Year
1	Pharmacognosy & tH	Trease and Evans		16 <sup>th</sup> edition 2009
2	Pharmacognosy	Kokate, Purohit and Gokhale	Nirali prakashan	58 -Edition 2023
3	Text book of Pharmacognosy and Phytochemistry	Rangari, V.D.	Carrier publication	Vol-I, 2017
4	Herbal Drug Technology	Aggrawal, S.S.	Universities Press	7 <sup>th</sup> edition 2021
5	Quality Control of Herbal Drugs: An Approach to Evaluation of Botanicals.	Mukherjee, P.K	Business Horizons Publishers,	New Delhi, India, 2019
6	Application of quality control principles to herbal drugs	Shinde M.V., Dhalwal K., Potdar K., Mahadik K.	International Journal of Phytomedicine	1 <sup>st</sup> edition (2009)
7	Quality Control Methods for Medicinal Plant Materials	Geneva	WHO publisher	1998
8	WHO. Quality Control Methods for Medicinal Plant Materials.	Geneva	WHO publisher	1999
9	WHO Global Atlas of Traditional, Complementary and Alternative Medicine	Geneva	WHO publisher	Vol. 1, 2005
10	WHO. Guidelines on Good Agricultural and Collection Practices (GACP) for Medicinal Plants	Geneva	WHO publisher	2004

#### Curriculum Development Team:

1. **Prof. SP Gupta**, Director, RGIP, AKS University
2. **Mr Satyendra Garg**, Assistant professor, RGIP, AKS University



**Course Outcome, Program Specific Outcome& Program Outcome Mapping**

**Course Code: BP806T**

**Course Name: Quality control and standardization of herbals**

Course Outcome	Program Outcome											Program Specific outcome			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
	Pharmacy knowledge	Planning Abilities	Problem analysis	Modern tool usage	Leadership skills	Professional Identity	Pharmaceutical Ethics	Communication	The pharmacist and society	Environment and sustainability	Life-long learning	Knowledge of drug discovery	Quality Analysis of API's	MOA of Drug	Biological evaluation of drug
<b>CO-1:</b> WHO guidelines for quality control of herbal drugs	3	2	3	1	3	2	1	2	3	2	3	1	3	1	2
<b>CO-2:</b> Quality assurance in herbal drug industry	2	3	1	3	1	2	1	1	2	3	3	3	2	1	3
<b>CO-3:</b> EU and ICH guidelines for quality control of herbal drugs	3	2	3	2	1	1	2	1	2	2	3	3	2	1	3
<b>CO-4:</b> Regulatory approval process and their registration in Indian and international markets	2	3	2	3	1	3	2	2	3	3	3	3	2	1	3
<b>CO-5:</b> Regulatory requirements for herbal medicines	3	3	1	1	1	3	3	3	1	2	3	2	2	2	2



### 1. Course Curriculum Mapping

Pos& PSOs No	Cos No&	Title	SOs No	Class Room Instructions	Laboratory Instructions	Self learning
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	CO-BP 806.1 ET	To understand the WHO guidelines for quality control of herbal drugs.	SO1.1 SO1.2 SO1.3	1.1,1.2,1.3,1.4,1.5,1.6,1.7,1.8,1.9,1.10	-	SI-1.1 SI-1.2
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	CO-BP 806.2 ET	To understand about the Quality assurance in herbal drug industry	SO-2.1 SO-2.2 SO-2.3	2.1,2.2,2.3,2.4,2.5,2.6,2.7,2.8,2.9,2.10	-	SI-2.1 SI-2.2
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	CO-BP 806.3 ET	To appreciate EU and ICH guidelines for quality control of herbal drugs	SO-3.1 SO-3.2	3.1,3.2,3.3,3.4,3.5,3.6,3.7,3.8,3.9,3.10	-	SI-3.1
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	CO-BP 806.4 ET	To understand about the regulatory approval process and their registration in Indian and international markets	SO-4.1 SO-4.2 SO-4.3	4.1,4.2,4.3,4.4,4.5,4.6,4.7,4.8	-	SI-4.1 SI-4.2
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	CO-BP 806.5 ET	To understand about Regulatory requirements for herbal medicines	SO-5.1 SO-5.2 SO-5.3	5.1,5.2,5.3,5.4,5.5,5.6,5.7	-	SI-5.1 SI-5.2





AKS University  
Faculty of Pharmaceutical Science & Technology  
Rajiv Gandhi Institute of Pharmacy  
Curriculum of B. Pharmacy (Computer Aided Drug Design) Program  
(Revised as on 01August2023)

**Semester-8**

**Course Code:** BP 807 ET

**Course Title:** Computer Aided Drug Design

**Pre-requisite:** This subject is designed to provide detailed knowledge of rational drug design process and various techniques used in rational drug design process.

**Rationale/Objectives:** Upon completion of the course, the student shall be able to understand

1. Design and discovery of lead molecules
2. The role of drug design in drug discovery process
3. The concept of QSAR and docking
4. Various strategies to develop new drug like molecules.
5. The design of new drug molecules using molecular modeling software

**Course Outcome:**

**CO-BP807 ET. 1:** To understand the Introduction to Drug Discovery and Development.

**CO-BP807 ET.2:** To understand the Study of Quantitative Structure Activity Relationship.

**CO-BP807 ET.3:** To understand the Molecular Modeling and virtual screening techniques.

**CO-BP807 ET.4:** To understand the Informatics & Methods in drug design.

**CO-BP807 ET.5:** To understand the Molecular Modeling.



## Scheme of Studies

Course code	Title of the course	Program name	TOTAL Number of contact hours/Week						Credit
			Classroom Instruction(A)		Practical (P)	SW	SL	Total Hour s(H)	
			Lecture	Tutorial					
BP 807 ET	Computer Aided Drug Design	B. Pharmacy	3	1	0	1	1	4	4

**Legend CI:** Class room Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and other  
**LI:** Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other location using different instructional strategies.

**SW: Sessional Work** (includes assignment, seminar, mini-project etc.),

**SL:** Self Learning, Credits.

**Note:** SW&SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

## Theory Assessment

Board of Study	Course Code	Course Title	Scheme of Assessment(Marks)						
			Progressive Assessment(PRA)						
			Academic activity ,Any three (Quiz/Assignment, open book test, filed work and seminar)	Studentteacher interaction	Class Attendance (AT)	(A) Total Marks	Sessional Exam(B)		
Pharmacy	BP 807 ET	Computer Aided Drug Design	3	3	4	10	15	75	100

## Guidelines for the allotment of marks for attendance

Percentage of Attendance	Theory	Practical
95–100	4	2
90–94	3	1.5
85–89	2	1
80–84	1	0.5
Less than 80	0	0



**Course-Curriculum Detailing:**

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) up on the course' conclusion.

**Unit I**

**CO-BP807 ET.1 : To understand the Introduction to Drug Discovery and Development.**

Item	Approx Hrs
Lecture & Tutorial	10
Practical(P)	0
SW	2
SL	1
Total:	13

Session Outcomes(SOs)	Laboratory Instructio(LI)	Classroom Instruction(CI)	Self Learning(SL)
<b>Theory</b> <b>SO1.1:</b> Introduction to Drug Discovery and Development. <b>SO1.2:</b> Lead discovery and Analog Based Drug Design. <b>SO1.3:</b> Analog Based Drug Design.		<b>1.1</b> Stages of drug discovery and development. <b>1.2</b> Rational approaches to lead discovery based on traditional medicine. <b>1.3</b> Random screening, Non-random screening. Serendipitous drug discovery. <b>1T.1 Tutorial class.</b> <b>1.4</b> Lead discovery based on drug metabolism. <b>1.5</b> lead discovery based on Clinical observation. <b>1.6</b> Analog Based Drug Design: Bio-isosterism. <b>1.7</b> Analog Based Drug Design: Classification. <b>1.8</b> Analog Based Drug Design: Bio-isosteric replacement. <b>1T.2 Tutorial class.</b> <b>1.9</b> Analog Based Drug Design: Any one case studies. <b>1.10</b> Analog Based Drug Design: Any two case studies. <b>1T.3 Tutorial class.</b>	<b>1.1:</b> Introduction to Drug Discovery and Development, Lead discovery and Analog Based Drug Design, Analog Based Drug Design.

**Suggested Assignments:**

1. Explain lead discovery based on clinical observation.
2. Stages of drug discovery and development.

**Mini-Project:-** Analog Based Drug Design: Bio-isosterism, Classification, Bio-esoteric replacement. Any three case studies.



**Unit II****CO-BP807 ET.2: To understand the Study of Quantitative Structure Activity Relationship.**

Item	Approx Hrs
Lecture & Tutorial	10
Practical(P)	0
SW	2
SL	1
Total:	13

Session Outcomes (SOs)	Laboratory Instruction(I)	Class room Instruction(CI)	Self Learning(SL)
<b>Theory</b> <b>SO2.1:</b> Quantitative Structure Activity Relationship (QSAR).		<b>2.1</b> SAR versus QSAR. <b>2.2</b> History of QSAR. <b>2.3</b> Development of QSAR. <b>2.4</b> Types of physicochemical parameters. <b>2T.1 Tutorial class</b> <b>2.5</b> Experimental and theoretical approaches for the determination of physicochemical parameters such as Partition coefficient. <b>2.6</b> Hammett's substituent. <b>2.7</b> Taft's steric constant. <b>2.8</b> Free Wilson analysis. <b>2T.2 Tutorial class</b> <b>2.9</b> 3D-QSAR approaches like COMFA. <b>2.10</b> 3D-QSAR approaches like COMSIA. <b>2T.3 Tutorial class</b>	<b>1.1</b> SAR versus QSAR, History and development of QSAR, Types of physicochemical parameters, experimental and theoretical approaches.

**Suggested Assignments:**

1. Types of physicochemical parameters,.
2. Explain D-QSAR approaches like COMFA and COMSIA.  
Mini Project :- Hammett's substituent constant and Taft's steric constant.



### Unit-III

**CO-BP807 ET.3: To understand the Molecular Modeling and virtual screening techniques.**

Item	Approx Hrs
Lecture & Tutorial	10
Practical(P)	0
SW	2
SL	1
Total:	13

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
<b>Theory</b> <b>SO3.1</b> Virtual Screening technique. <b>SO3.2</b> Molecular docking.		<b>3.1</b> Molecular Modeling and virtual screening techniques. <b>3.2</b> Virtual Screening techniques. <b>3.3</b> Drug likeness screening. <b>3.4</b> Concept of pharmacophore mapping. <b>3T.1 Tutorial class.</b> <b>3.5</b> Concept of pharmacophore based Screening. <b>3.6</b> Molecular docking. <b>3.7</b> Rigid docking. <b>3.8</b> flexible docking. <b>3T.1 Tutorial class.</b> <b>3.9</b> manual docking. <b>3.10</b> Docking based screening. De novo drug design.	1.1 Molecular Modeling and virtual screening techniques

**Suggested Assignments:**

1. Manual docking.
2. Docking based screening.

**Mini-Projects:** Project report on pharmacophore based Screening.



**UnitIV:**

CO-BP807 ET.4:To understand the Informatics &amp; Methods in drug design.

Item	Approx Hrs
Lecture &Tutorial	8
Practical (P)	0
SW	2
SL	1
Total:	11

Session Outcomes(SOs)	Laboratory Instruction(LI)	Class room Instruction(CI)	Self Learning(SL)
<b>Theory</b> <b>SO4.1:</b> Informatics & Methods in drug design.		Informatics & Methods in drug design. Introduction to Bioinformatics. chemoinformatics. Absorption, Distribution databases. <b>1 Tutorial class</b> metabolism, Excretion databases. chemical databases. <b>4T.2 Tutorial class.</b> biochemical databases. pharmaceutical databases. <b>4T.2 Tutorial class.</b>	1.1 Introduction to Bioinformatics, chemoinformatics. ADME databases, chemical, biochemical and pharmaceutical databases.

**Suggested Assignments:**

1. Explain ADME databases.
2. Introduction to Bioinformatics.

**Mini-Projects:** To create the biochemical and pharmaceutical databases.



**Unit-V****CO-BP807 ET.5:** To understand the Molecular Modeling.

Item	ApproxHrs
Lecture & Tutorial	7
Practical(P)	0
SW	2
SL	1
Total:	10

Session Outcomes (SOs)	Laboratory Instruction(LI)	Class room Instruction(CI)	Self Learning(SL)
<b>Theory</b> <b>SO5.1:</b> Molecular Modeling		<b>5.1</b> Molecular Modeling. <b>5.2</b> Introduction to molecular mechanics.  <b>5T.1 Tutorial class</b>  <b>5.3</b> Introduction to quantum mechanics. <b>5.4</b> Energy Minimization methods. <b>5.5</b> Quasi-newton Raphson method. <b>5.6</b> Conformational Analysis.  <b>5T.2 Tutorial class</b>  <b>5.7</b> determination of global conformational minima.  <b>5T.3 Tutorial class</b>	Introduction to molecular mechanics and quantum mechanics.Energy Minimization methods and Conformational Analysis, global conformational minima determination.

**Suggested Sessional work Assignments:**

1. Explain Conformational Analysis.
2. Energy Minimization methods.

**Mini Projects:-** global conformational minima determination.



### Brief of Hours suggested for the Course Outcome

<b>Course Outcomes</b>	<b>Class Lecture(CI)</b>	<b>(L)</b>	<b>Session al Work (SW)</b>	<b>Self- Learning (SI)</b>	<b>Total Hour (CI+SW+ SI+LI)</b>
<b>CO-BP807 ET.1:</b> To understand the Introduction to Drug Discovery and Development.	10	0	2	1	13
<b>CO-BP807 ET.2:</b> To understand the Study of Quantitative Structure Activity Relationship.	10	0	2	1	13
<b>CO-BP807 ET.3:</b> To understand the Molecular Modeling and virtual screening techniques.	10	0	2	1	13
<b>CO-BP807 ET.4:</b> To understand the Informatics & Methods in drug design.	8	0	2	1	11
<b>CO-BP807 ET.5:</b> To understand the Molecular Modeling.	7	0	2	1	10
<b>Total Hours</b>	<b>45</b>	<b>0</b>	<b>10</b>	<b>5</b>	<b>60</b>



**Suggestion for End Semester Assessment**  
Suggested Specification Table (For ESA)

Course Out Come	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
<b>CO-BP807 ET.1:</b>	To understand the Introduction to Drug Discovery and Development.	08	06	01	15
<b>CO-BP807 ET.2</b>	To understand the Study of Quantitative Structure Activity Relationship.	12	07	01	20
<b>CO-BP807 ET.3:</b>	To understand the Molecular Modeling and virtual screening techniques.	02	06	02	10
<b>CO-BP807 ET.4</b>	To understand the Informatics & Methods in drug design.	10	02	03	15
<b>CO-BP807 ET.5:</b>	To understand the Molecular Modeling.	05	07	03	15
<b>Total</b>		<b>37</b>	<b>28</b>	<b>10</b>	<b>75</b>

**Legend: R: Remember, U: Understand, A: Apply**

The end of semester assessment for Computer aided drug design will be held with written examination of 75 marks

**Note.** Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks

Teachers can also design different tasks as per requirement, for end semester assessment.

**Suggested Instructional/Implementation Strategies:**

1. Improved Lecture
2. Tutorial
3. Case Method
4. Group Discussion
5. Role Play
6. Demonstration
7. ICT Based Teaching Learning (Video Demonstration /Tutorials CBT, Blog, Facebook, Twitter, Whats app, Mobile, On line sources)
8. Brain storming



### Suggested Learning Resources:

S. No.	Title	Author	Publisher	Edition & Year
1	“Drug Action at the Molecular Level”	Robert GCK	University Prak Press Baltimore.	16th edition 2016-
2	“Quantitative Drug Design”	Martin YC	Dekker, New York	7th edition 2018
3	“Wilson & Gisvolds’s Text Book of Organic Medicinal & Pharmaceutical Chemistry”	Delgado JN, Remers WA	Lippincott, New York	4th edition 2012
4	“Principles of Medicinal chemistry”	Foye WO	Lea & Febiger	3 <sup>rd</sup> edition 2012-
5	“Essentials of Medicinal Chemistry”	Koro lkovas A, Burckhalter JH.	Wiley Interscience.	2018
6	“The Basis of Medicinal Chemistry, Burger’s Medicinal Chemistry”	Wolf ME, ed	John Wiley & Sons, New York.	4 <sup>th</sup> edition 2010
7	An Introduction to Medicinal Chemistry.	Patrick Graham, L	Oxford University Press.	5 <sup>th</sup> edition 2011
8	“Introduction to the principles of Drug Design”	Smith HJ, Williams H	Wright Boston.	
9	The organic Chemistry of Drug Design and Drug Action”	Silverman R.B	Academic Press New York.	

#### Curriculum Development Team:

1. **Prof. S P Gupta**, Director, RGIP, AKS University
2. **Mr Satyendra Garg**, Assistant professor, RGIP, AKS University



### Course Outcome, Program Specific Outcome& Program Outcome Mapping

Course Code: BP 807 ET

Course Name: Computer Aided Drug Design

Course Outcome	Program Outcome											Program Specific outcome			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
	Pharmacy knowledge	Planning Abilities	Problem analysis	Modern tool usage	Leadership skills	Professional Identity	Pharmaceutical Ethics	Communication	The pharmacist and society	Environment and sustainability	Life-long learning	Knowledge of drug discovery	Quality Analysis of API's	MOA of Drug	Biological evaluation of drug
<b>CO-1:</b> Drug Discovery and Development.	3	2	3	1	3	2	1	2	3	2	3	1	3	1	2
<b>CO-2:</b> Quantitative Structure Activity Relationship	2	3	1	3	1	2	1	1	2	3	3	3	2	1	3
<b>CO-3:</b> Molecular Modeling and virtual screening techniques.	3	2	3	2	1	1	2	1	2	2	3	3	2	1	3
<b>CO-4:</b> Informatics & Methods in drug design	2	3	2	3	1	3	2	2	3	3	3	3	2	1	3
<b>CO-5:</b> Molecular Modeling	3	3	1	1	1	3	1	3	1	2	3	2	2	2	2

**Legend: 1- Low, 2-Medium, 3-High**



### Course Curriculum Mapping

Pos& PSOs No	Cos No&	Title	SOs No	Class Room Instructions	Laboratory Instructions	Self learning
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	CO-BP 808.1E T	To understand the Drug Discovery and Development.	SO1.1 SO1.2 SO1.3	1.1,1.2,1.3,1.4,1.5,1.6,1.7,1.8,1.9,1.10	-	SI-1.1 SI-1.2
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	CO- BP 808.2E T	To understand the Study of Quantitative Structure Activity Relationship.	SO-2.1 SO-2.2 SO-2.3	2.1,2.2,2.3,2.4,2.5,2.6,2.7,2.8,2.9,2.10	-	SI-2.1 SI-2.2
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	CO- BP 808.3E T	To understand the Molecular Modeling and virtual screening techniques.	SO-3.1 SO-3.2	3.1,3.2,3.3,3.4,3.5,3.6,3.7,3.8,3.9,3.10	-	SI-3.1
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	CO- BP 808.4E T	To understand the Informatics & Methods in drug design.	SO-4.1 SO-4.2 SO-4.3	4.1,4.2,4.3,4.4,4.5,4.6,4.7,4.8	-	SI-4.1 SI-4.2
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	CO- BP 808.5E T	To understand the Molecular Modeling.	SO-5.1 SO-5.2 SO-5.3	5.1,5.2,5.3,5.4,5.5,5.6,5.7	-	SI-5.1 SI-5.2





AKS University  
Faculty of Pharmaceutical Science & Technology  
Rajiv Gandhi Institute of Pharmacy  
Curriculum of B. Pharmacy (Cell and Molecular Biology) Program  
(Revised as on 01 August 2023)  
**Semester-VIII**

**Course Code:** BP808ET

**Course Title:** Cell and Molecular Biology

**Pre-requisite:** Cell biology is a branch of biology that studies cells – their physiological properties, their structure, the organelles they contain, interactions with their Environment, their life cycle, division, death and cell function.

**Rationale/ Objectives:** : After the successful completion of this course, the student shall be able to:

- Summarize cell and molecular biology history.
- Summarize cellular functioning and composition.
- Describe the chemical foundations of cell biology.
- Summarize the DNA properties of cell biology.
- Describe protein structure and function.
- Describe cellular membrane structure and function.
- Describe basic molecular genetic mechanisms.
- Summarize the Cell Cycle

**Course Out comes:**

**CO- BP808T -1:** To Know & understand the Cell & Cell organelles with their importance.

**CO- BP885T -2:** To Know & understand the Nucleic acid with their contents. Importance of DNA & RNA

**CO- BP808T -3:** To know the various types of Proteins, Protein Pathways & significance of Protein Synthesis.

**CO- BP808T -4:** To know about cell cycle, gene, Mitosis and Meiosis & Cellular activities

**CO- BP808T -5:** To understand the role of Cell Signals: Receptors for Cell Signals.



## Scheme of Studies

:Course code	Title of the course	Program Name	TOTAL Number of contact hours/Week						Credit
			Classroom Instruction (A)		Practical (P)	S W	SL	Total Hours (H)	
			Lecture	Tutorial					
BP808ET	Cell and molecular Biology	B. Pharmacy	3	1	4	1	1	10	6

**Legend: CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others),

**LI: Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)**

**SW: Sessional Work** (includes assignment, seminar, mini project etc.),

**SL: Self Learning, Credits.**

**Note:** SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

## Theory Assessment

Board of Study	Course Code	Course Title	Scheme of Assessment ( Marks )					EndSemester Assessment(C)	Total Marks(A+B+C)
			Progressive Assessment ( PRA)						
			Academic activity, Any three (Quiz/ Assignment, open book test, filed work and seminar)	Student teacher interaction	Class Attendance (AT)	(A) Total Marks	Sessional Exam (B)		
Pharmacy	BP808ET	Cell and Molecular Biology	3	3	4	10	15	75	100

## Guidelines for the allotment of marks for attendance

Percentage of Attendance	Theory	Practical
95 – 100	4	2
90 – 94	3	1.5
85 – 89	2	1
80 – 84	1	0.5
Less than 80	0	0



**Course-Curriculum Detailing:**

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

**Unit I**

**CO- BP808T -1: To Know & understand the Cell & Cell organelles with their importance.**

Item	Approx Hrs
Lecture & Tutorial	10+3=13
Practical (P)	0
SW	1
SL	1
Total:	15

Session Outcomes(SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
<b>Theory</b> <b>SO1.1:</b> Cell and Molecular Biology <b>SO1.2:</b> Cell and Molecular Biology: History and Summation. <b>SO 1.3:</b> Properties of cells & Cell membrane <b>SO 1.4:</b> Cellular Reproduction		<b>1.1:</b> History and development of Cells <b>1.2</b> Types of Cells& theory and basics and Applications. <b>1.3</b> Properties of cells. <b>1.4:</b> Compositions of cell wall and cell membrane <b>1T1: Tutorial Class</b> <b>1.5</b> Prokaryotic versus Eukaryotic <b>1.6:</b> Cellular Reproduction <b>1.7</b> Chemical Foundations – an Introduction and Reactions <b>1.8:</b> Chemical Foundations – an Introduction and Reactions <b>1T2: Tutorial Class</b> <b>1.9:</b> Types of Cell division. <b>1.10 1T3: Tutorial Class</b>	<b>1.1:</b> Application of Different kind of cell

**Suggested Assignments:** Cell, cell division & importance of cell



## Unit II

**CO- BP808T -2: To Know & understand the Nucleic acid with their contents. Importance of DNA & RNA**

Item	Approx Hrs
Lecture & Tutorial	10+3=13
Practical(P)	0
SW	1
SL	1
Total:	15

Session Outcomes(SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
<b>Theory</b> <b>SO2.1:</b> DNA and the Flow of Molecular Information <b>SO2.2:</b> DNA& RNA Functioning <b>SO2.3:</b> Transcription and Translation		<b>2.1:</b> Nucleic acid & Their Compositions. <b>2.2:</b> Molecular Structure of DNA <b>2.3</b> Models of DNA Understanding <b>2.4:</b> Different function of DNA <b>2T.1: Tutorial Class</b> <b>2.5:</b> Molecular Structure of RNA <b>2.6:</b> Flow of Molecular information of RNA <b>2.7</b> Theories of RNA <b>2.8:</b> Transcription <b>2T.2: Tutorial class</b> <b>2.9</b> Translation <b>2.10: Types of RNA</b> <b>2T.3: Tutorial class</b>	<b>2.1:</b> Detection & Isolation tech. of DNA& RNA.

**Suggested Assignments:** DNA and the Flow of Molecular Information, DNA Functioning, DNA and RNA, Types of RNA, Transcription and Translation.



**CO- BP808T -3: To know the various types of Proteins, Protein Pathways & significance of Protein Synthesis.**

Item	Approx Hrs
Lecture & Tutorial	10+3
Practical(P)	0
SW	1
SL	1
Total:	15

Session Outcomes(SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
<b>Theory</b> <b>SO 3.1:</b> Proteins <b>SO3.2:</b> Regularities in Protein Pathways <b>SO3.3:</b> Cellular Processes <b>SO3.4:</b> Positive Control and significance of Protein Synthesis		<b>3.1:</b> Historical Development of Protein <b>3.2:</b> Definition & Basics of Proteins <b>3.3</b> Types of Amino acid <b>3.4:</b> Structure & Functions of Protein <b>3T.1: Tutorial Class</b> <b>3.5:</b> Process of protein synthesis <b>3.6:</b> Regularities in Protein Pathways <b>3.7</b> Cellular process <b>3.8:</b> Importance of amino acid <b>3T.2: Tutorial class</b> <b>3.9:</b> Protein synthesis pathway <b>3.10:</b> Positive Control and significance of Protein Synthesis <b>3T.3: Tutorial class</b>	3.1 Detection techniques of amino acids & proteins

**Suggested Assignments:** Proteins: Defined and Amino Acids, Protein Structure Regularities in Protein Pathways, Cellular Processes, Positive Control and significance of Protein Synthesis.



#### Unit IV

**CO- BP808T -4: To know about cell cycle, gene, Mitosis and Meiosis & Cellular activities**

Item	Approx Hrs
Lecture & Tutorial	8+3=11
Practical(P)	0
SW	1
SL	1
Total:	13

Session Outcomes(SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
<b>Theory</b> <b>SO4. 1: Basics of genes.</b> <b>SO4.2</b> Transgenics and <b>SO4.3</b> Genomic Analysis Mitosis and Meiosis		<b>4.1</b> Science of Genetics <b>4. 2.</b> Transgenics and Genomic Analysis <b>4.3</b> Importance of Genomic <b>4.4</b> Cell Cycle& cell division <b>4T1: Tutorial Class</b> <b>4.5</b> Mitosis <b>4.6:</b> Meiosis <b>4.7s</b> Cellular activities <b>4.8</b> Cell development process. <b>4T.2: Tutorial class</b>	<b>4.1:</b> Role of Genetics in pharmaceutical industry.

**Suggested Assignments:** Science of Genetics, Transgenic and Genomic Analysis, Cell Cycle analysis, Mitosis and Meiosis



## Unit V

**CO- BP808T -5: To understand the role of Cell Signals: Receptors for Cell Signals.**

Item	Approx Hrs
Lecture & Tutorial	7+3=10
Practical(P)	0
SW	1
SL	1
Total:	12

Session Outcomes(SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
<b>Theory</b> <b>SO5.1:</b> Cell Signals: <b>SO5.2:</b> Receptors for Cell Signals <b>SO5.3:</b> Signaling Pathways: Overview <b>SO5.4:</b> Misregulation of Signaling Pathways		<b>5.1</b> Introduction Cell Signals: <b>5.2</b> Understand the concept of cell signals <b>5.3:</b> Receptors with their types. <b>5.4</b> Receptors for Cell Signals <b>5T1: Tutorial class</b> <b>5.5:</b> Misregulation of Signaling Pathways <b>5.6</b> Signaling Pathways: Overview <b>5..7</b> Misregulation of Signaling Pathways <b>5..8</b> Protein-Kinases: Functioning <b>5T.2: Tutorial class</b>	<b>5.1: Cell signals importance.</b>

**Suggested Assignments:** Cell Signals: Introduction, Receptors for Cell Signals, Signaling Pathways: Overview, Misregulation of Signaling Pathways, Protein-Kinases: Functioning



### Brief of Hours suggested for the Course Outcome

Course Out comes	Class Lecture (Cl)	(L)	Sessional Work (SW)	Self Learning (Sl)	Total Hour (Cl+SW+ Sl+LI)
<b>Course Out comes:</b> <b>CO- BP808T -1:</b> To Know & understand the Cell & Cell organelles with their importance.	13	16	1	1	31
<b>CO- BP808T -2:</b> To Know & understand the Nucleic acid with their contents. Importance of DNA & RNA	13	8	1	1	23
<b>CO- BP808T -3:</b> To know the various types of Proteins, Protein Pathways,& significance of Protein Synthesis.	13	12	1	1	27
<b>CO- BP808T -4:</b> To know about cell cycle, gene, Mitosis and Meiosis & Cellular activities	10	8	1	1	20
<b>CO- BP808T -5:</b> To understand the role of Cell Signals: Receptors for Cell Signals.	10	0	1	1	12
<b>Total Hours</b>	<b>59</b>	<b>44</b>	<b>5</b>	<b>5</b>	<b>113</b>

### Suggestion for End Semester Assessment

#### Suggested Specification Table (For ESA)

Course Outcome	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
<b>CO- BP808T -1:</b>	To Know & understand the Cell & Cell organelles with their importance.	08	06	01	15
<b>CO- BP808T -2:</b>	To Know & understand the Nucleic acid with their contents. Importance of DNA & RNA	12	07	01	20
<b>CO- BP808T -3:</b>	To know the various types of Proteins, Protein Pathways,& significance of Protein Synthesis.	02	06	02	10
<b>CO- BP808T -4:</b>	To know about cell cycle, gene, Mitosis and Meiosis & Cellular activities	10	02	03	15
<b>CO- BP808T -5:</b>	To understand the role of Cell Signals: Receptors for Cell Signals.	05	07	03	15
<b>Total</b>		<b>37</b>	<b>28</b>	<b>10</b>	<b>75</b>



**Legend: R: Remember, U: Understand, A:Apply**

The end of semester assessment for Cell and Molecular Biology will be held with written examination of 75 marks

**Note.** Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks.

Teachers can also design different tasks as per requirement, for end semester assessment.

**Suggested Instructional/Implementation Strategies:**

1. Improved Lecture
2. Tutorial
3. Case Method
4. Group Discussion
5. Role Play
6. Demonstration

**Suggested Learning Resources:**

S. No.	Title	Author	Publisher	Edition & Year
1	Pharmaceutical Microbiology, Blackwell Scientific publications,	W.B. Hugo and A.D. Russel:	Oxford London	2nd Edition 2018
2	Industrial Microbiology,	Prescott and Dunn.,	4th edition, CBS Publishers & Distributors, Delhi.	Fifth edition 2022
3	Balliere Tindall and Cox: Pharmaceutical Microbiology	Malcolm Harris, Balliere Tindall and Cox:	-	6th Edition, 2014
4	Hinsdill et al: Fundamentals of Microbiology	Probisher, Hinsdill et al:	9th ed. Japan	2nd Edition, 2012
5	Tutorial Pharmacy	Cooper and Gunn's:	CBS Publisher and Distribution.	2nd Edition 2018

**Curriculum Development Team:**

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**Course Outcome, Program Specific Outcome& Program Outcome Mapping**

**Course Code: BP808ET**

**Course Name: Cell and Molecular Biology**

Course Outcome	Program Outcome											Program Specific outcome			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
	Pharmacy knowledge	Planning Abilities	Problem analysis	Modern tool usage	Leadership skills	Professional Identity	Pharmaceutical Ethics	Communication	The pharmacist and society	Environment and sustainability	Life-long learning	Knowledge of drug discovery	Quality Analysis of API's	MOA of Drug	Biological evaluation of drug
<b>CO-1:</b> To understand the Cell & Cell organelles with their importance	3	2	3	1	3	2	1	2	3	2	3	1	3	1	2
<b>CO-2:</b> Nucleic acid with their contents. Importance of DNA & RNA	2	3	1	3	1	2	1	1	2	3	3	3	2	1	3
<b>CO-3:</b> Proteins, Protein Pathways,& significance of Protein Synthesis	3	2	3	2	2	1	2	1	2	2	3	3	2	1	3
<b>CO-4:</b> cell cycle, gene, Mitosis and Meiosis & Cellular activities	2	3	2	3	1	3	2	2	3	3	3	3	2	1	3
<b>CO-5:</b> Role of Cell Signals: Receptors for Cell Signals.	3	3	1	1	1	3	1	3	1	2	3	2	2	2	2

**Legend: 1- Low, 2-Medium, 3-High**



### Course Curriculum Mapping

Pos& PSOs No	Cos No&	Title	SOs No	Class Room Instructions	Laboratory Instructions	Self learning
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	CO-BP 808.1ET	To Know & understand the Cell & Cell organelles with their importance.	SO1.1 SO1.2 SO1.3	1.1,1.2,1.3,1.4,1.5,1.6,1.7,1.8,1.9,1.10	-	SI-1.1 SI-1.2
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	CO- BP 808.2ET	To Know & understand the Nucleic acid with their contents. Importance of DNA & RNA	SO-2.1 SO-2.2 SO-2.3	2.1,2.2,2.3,2.4,2.5,2.6,2.7,2.8,2.9,2.10	-	SI-2.1 SI-2.2
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	CO- BP 808.3ET	To know the various types of Proteins, Protein Pathways,& significance of Protein Synthesis.	SO-3.1 SO-3.2	3.1,3.2,3.3,3.4,3.5,3.6,3.7,3.8,3.9,3.10	-	SI-3.1
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	CO- BP 808.4ET	To know about cell cycle, gene, Mitosis and Meiosis & Cellular activities	SO-4.1 SO-4.2 SO-4.3	4.1,4.2,4.3,4.4,4.5,4.6,4.7,4.8	-	SI-4.1 SI-4.2
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	CO- BP 808.5ET	To understand the role of Cell Signals: Receptors for Cell Signals.	SO-5.1 SO-5.2 SO-5.3	5.1,5.2,5.3,5.4,5.5,5.6,5.7	-	SI-5.1 SI-5.2





AKS University  
Faculty of Pharmaceutical Science & Technology  
Rajiv Gandhi Institute of Pharmacy  
Curriculum of B. Pharmacy (Cosmetic science) Program  
(Revised as on 01August2023)  
**Semester-VIII**

**Course Code:** BP809ET

**Course Title:** Cosmetic science

**Pre-requisite:** Students should have a basic knowledge Basic knowledge of anatomy and physiology is needed to understand the structure and function of the skin, hair, lips, teeth, and so on, to where products are Usually applied.

**Rationale/Objective s:** Upon completion of the course the student shall be able to

1. Classification of cosmetic and cosmeceutical products.
2. Cosmetic Excipients: Surfactants.
3. Rheology modifiers, humectants.
4. Emollients, preservatives. Classification and application.

**Course Out comes:**

**CO- BP809ET -1:** To understand the details of cosmetic excipients and basic structure and function of skin, basic structure of hair with described the Oral Cavity.

**CO- BP809ET -2:** To understand the Principles of formulation and building blocks of skin care product Anti-perspants & deodorants and Principles of formulation and building blocks of Hair care products.

**CO- BP809ET -3:** To acquired the knowledge of Role of herbs in cosmetics and Analytical cosmetics.

**CO- BP809ET -4:** To understand the Principles of Cosmetic Evaluation.

**CO- BP809ET -5:** Basic understanding of the terms cosmedogenic, dermatitis Cosmetic with explain Problems associated with Hair and scalp, Cosmetic problems associated with skin and Anti per spirant and Deodorants.



### Scheme of Studies

Scheme of Studies									
Course code	Title of the course	Program Name	TOTAL Number of contact hours/Week						Credit
			Classroom Instruction (A)		Practical (P)	SW	SL	Total Hours (H)	
			Lecture	Tutorial					
BP809ET	Cosmetic science (theory)	B. Pharmacy	3	1	0	1	1	6	4

**Legend: CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and other  
**LI:** Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)

**SW:** Sessional Work (includes assignment, seminar, mini project etc.),

**SL:** Self Learning, Credits.

**Note:** SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

### Theory Assessment

Board of Study	Course Code	Course Title	Scheme of Assessment ( Marks )					End Semester	Total Marks(A+B)
			Progressive Assessment ( PRA)						
			Academic activity, Any three (Quiz/ Assignment, open book test, filed work and seminar)	Student teacher interaction	Class Attendance	Total Marks (A)	Sessional Exam (B)		
Pharmacy	BP809 ET	Cosmetics Science	3	3	4	10	15	75	100

### Guidelines for the allotment of marks for attendance

### Percentage Attendance Theory/ Practical

Percentage of Attendance	Theory	Practical
95 – 100	4	2
90 – 94	3	1.5
85 – 89	2	1
80 – 84	1	0.5
Less than 80	0	0



**Course-Curriculum Detailing:**

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

**CO- BP809ET -1: To understand the details of Cosmetic Excipients and Basic structure and function of skin, Basic structure of hair with described the Oral Cavity.**

Item	Approx Hrs
Lecture & Tutorial	10+3=13
Practical(P)	0
SW	1
SL	2
Total:	16

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
<b>Theory</b> <b>SO1.1:</b> Cosmetic Excipients <b>SO1.2:</b> Basic structure and function Skin. <b>SO1.3:</b> Basic structure of hair. <b>SO1.4:</b> details of Oral Cavity	NA	<b>1.1</b> Classification of Cosmetic and cosmeceutical products. <b>1.2</b> Definition of cosmetics as per Indian and EU regulations. <b>1.3</b> Definition of cosmetics as per Indian and EU Regulations. <b>1T.1: Tutorial class</b> <b>1.4</b> Evolution of Cosmeceuticals from Cosmetics <b>1.5</b> cosmetics as quasi and OTC drugs <b>1.6</b> Surfactants, rheology, modifiers, modifiers, humectants, emollients, Preservatives Classification and <b>1.7</b> Basic structure and Function of skin. <b>1T.2: Tutorial class</b> <b>1.8</b> Basic structure of Hair. <b>1.9</b> Hair growth cycle. <b>1.10</b> Common problem associated With teeth and gums. <b>1T.3: Tutorial class</b>	<b>1.1</b> Study of the Cosmetic Excipients  <b>1.2</b> Basic structure and function Skin, hair, Common problem associated with teeth and gums.

**Suggested Assignments:**

1. Write the Classification of cosmetic and cosmeceutical products.
2. Write the detail about Cosmetic Excipients.
3. Explain Definition of cosmetics as per Indian and EU regulations.



## Unit II

**CO- BP809ET-2:** To understand the Principles of formulation and building blocks of skin care products, Antiperspirants & deodorants and Principles of formulation and building blocks of Hair care products.

Item	Approx Hrs
Lecture & Tutorial	10+3=13
Practical (P)	0
SW	1
SL	2
Total:	16

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
<b>Theory</b> <b>SO2.1</b> Principles of formulation and building blocks of skin care products. <b>SO2.2.</b> Antiperspirants & deodorants. <b>SO2.3.</b> Principles of formulation and building blocks of Hair care products.	NA	<b>2.1</b> Principles of Formulation and building blocks of skin care products: Face wash, Moisturizing cream. <b>2.2</b> Principles of Formulation and building blocks of skin care products Cold Cream, <b>2.3</b> Vanishing cream and their advantages and disadvantages. <b>2.4</b> Application of these products in formulation of cosmetics. <b>2T.1: Tutorial class</b> <b>2.5</b> Antiperspirants & deodorants- Actives & mechanism of action. <b>2.6</b> Principles of Formulation and building blocks of Hair care products: Conditioning shampoo, Hair conditioner. <b>2.7</b> Principles of Formulation and building blocks of Hair care products anti-dandruff shampoo. Hair oils. <b>2T.2: Tutorial class</b> <b>2.8</b> Chemistry and formulation of Para-phenylenediamine based hair dye. <b>2.9</b> Principles of Formulation and building blocks of oral care products Toothpaste for bleeding gums, sensitive teeth. <b>2.10</b> Principles of formulation and building blocks of oral care products Teeth whitening, Mouthwash, <b>2T.3: Tutorial class</b>	<b>2.1</b> Study of the Principles of formulation and building blocks of skin care products <b>2.2</b> Antiperspirants & deodorants, Principles of formulation and building blocks of Hair care products.

### Suggested Assignments:

1. Explain Chemistry and formulation of Para-phenylenediamine based hair dye.
2. Explain Principles of formulation and building blocks of Hair care products: Conditioning shampoo.
3. Write the detail about Principles of formulation and building blocks of skin care products: Face wash, Cold Cream, Vanishing cream.
4. Write the short notes of Teeth whitening, Mouthwash.



### Unit III

**CO- BP809ET -3:** To acquired the knowledge of Role of herbs in cosmetics and Analytical cosmetics.

Item	Approx Hrs
Lecture & Tutorial	10+3=13
Practical (P)	0
SW	1
SL	1
Total:	15

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
<b>SO3.1</b> Role of herbs in cosmetics. <b>SO3.2.</b> Analytical cosmetics	NA	3.1 Brief introduction of Suprotection. 3.2 Classification of Sunscreens 3.3 Classification of SPF. 3.4 Role of herbs in cosmetics Skin Care: Aloe. <b>3T.1: Tutorial class</b> 3.5 Role of herbs in cosmetics Skin Care: turmeric. 3.6 Role of herbs in cosmetics Hair care: Henna and Amla. 3.7 Role of herbs in cosmetics Oral care: Neem and clove. 3.8 Analytical cosmetics: BIS Specification and analytical methods for shampoo. <b>3T.2: Tutorial class</b> 3.9 analytical methods for skin-cream. 3.10 Analytical methods for toothpaste. <b>3T.3: Tutorial class</b>	3.1 Study of the Role of herbs in cosmetics and Analytical cosmetics

#### Suggested Assignments:

1. Write the Role of herbs in cosmetics: Skin Care: Aloe and turmeric.
2. Explain BIS specification.
3. Write the detail about sun protection and Classification of Sunscreens and SPF.



**Unit IV:****CO- BP809ET -4:** To understand the Principles of Cosmetic Evaluation.

Item	Approx Hrs
Lecture & Tutorial	8+3=11
Practical (P)	0
SW	1
SL	1
Total:	13

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
<b>SO4.1</b> To understand the Principles of Cosmetic Evaluation.	NA	4.1 Principles of sebumeter. 4.2 Principles of, corneometer. 4.3 Measurement of TEWL. 4.4 Measurement of Skin Color, <b>4T.1: Tutorial class</b> 4.5 Measurement of Hair tensile strength, 4.6 Measurement of Hair combing properties Soaps, <b>4T.2: Tutorial class</b> 4.7 Measurement of syndet bars. 4.8 Evolution and skin benefits. <b>4T.3: Tutorial class</b>	4.1 Study of the Principles of Cosmetic Evaluation.

**Suggested Assignments:**

1. Write the detail about Principles of sebumeter.
2. Explain the Hair combing properties Soaps, and syndet bars.
3. Explain the Evolution and skin benefits.

**Unit – V:-**

**CO- BP809ET -5:** Basic understanding of the terms Comedogenic, dermatitis with explain Cosmetic problems associated with Hair and scalp, Cosmetic problems associated with skin and Antiperspirants and Deodorants.

Item	Approx Hrs
Lecture & Tutorial	7+3=10
Practical (P)	0
SW	1
SL	2
Total:	13



Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
<b>SO5.1</b> To understand the Cosmetic problems associated with Hair and scalp. <b>SO5.2.</b> To understand the Cosmetic problems associated with skin. <b>SO5.3</b> To understand the Actives and mechanism of action Antiperspirants and Deodorants.	NA	5.1 Oily and dry skin causes leading to dry skin, skin miniaturization. 5.2 Basic understanding of the terms come androgenic, dermatitis. <b>5T.1 Tutorial Class</b> 5.3 Cosmetic problems associated with Hair and scalp: Dandruff, Hair fall causes. 5.4 Cosmetic problems associated with skin: blemishes, wrinkles. <b>5T.2 Tutorial Class</b> 5.5 Cosmetic problems associated with skin: prickly heat and body odor. 5.6 Actives and mechanism of action Antiperspirants. <b>5.7.</b> Actives and mechanism of action Deodorants. <b>5T.3 Tutorial Class</b>	1 Study of the Cosmetic problems associated with Hair and scalp, skin. 2 Actives and mechanism of action Antiperspirants and Deodorants.

### Suggested Sessional

#### work Assignments:

1. Explain the Actives and mechanism of action Antiperspirants and Deodorants.
2. Short note about Oily and dry skin.
3. Write the Basic understanding of the terms Comedogenic, dermatitis.
4. Write the details about Cosmetic problems associated with Hair and scalp: Dandruff, Hair fall cause



### Brief of Hours suggested for the Course Outcome

Course Out comes	Class Lecture (Cl)	(L)	Sessional Work (SW)	Self Learning (Sl)	Total Hour (Cl+S W+ Sl+LI)
<b>CO- BP809ET -1:</b> To understand the details of Cosmetic Excipients and Basic structure and function of skin, Basic structure of hair with described The Oral Cavity.	13	0	1	2	16
<b>CO- BP809ET -2:</b> To understand the Principle of formulation and building blocks of skin care products, Antiperspirants & deodorants and Principles of formulation and building Blocks of Hair care products.	13	0	1	2	16
<b>CO- BP809ET -3:</b> To acquired the knowledge of Role of herbs in cosmetics and Analytical cosmetics.	13	0	1	1	15
<b>CO- BP809ET -4:</b> To understand the Principles of Cosmetic Evaluation.	11	0	1	1	13
<b>CO- BP809ET -5:</b> Basic understanding of the terms comedogenic, dermatitis with explain cosmetic problems associated with Hair and scalp, cosmetic problems associated with skin and antiperspirants and deodorants.	10	0	1	2	13
<b>Total Hours</b>	60	0	05	08	73



**Suggestion for End Semester Assessment**  
Suggested Specification Table (For ESA)

Course Outcome	Unit Titles	Marks Distribution			Total Marks
		A	C	E	
<b>CO-BP809E T -1:</b>	To understand the details of Cosmetic Excipients and Basic structure and Function of skin, Basic structure of hair with described the Oral Cavity.	08	06	01	15
<b>CO-BP809E T -2:</b>	To understand the Principle of formulation and building blocks of skin care products, Antiperspirants & deodorants and Principles of formulation and building blocks of Hair care Products.	10	07	01	18
<b>CO-BP809 ET -3:</b>	To acquired the knowledge of Role of herbs in cosmetics and Analytical cosmetics.	02	06	02	10
<b>CO-BP809 ET -4:</b>	To understand the Principles of Cosmetic Evaluation.	10	03	02	15
<b>CO-BP809 ET -5:</b>	Basic understanding of the terms Comedogenic, dermatitis with explain Cosmetic problems associated with Hair and scalp, Cosmetic problems associated with skin and Antiperspirants and Deodorants	05	07	03	15
<b>Total</b>		<b>35</b>	<b>29</b>	<b>9</b>	<b>73</b>

**Legend: A: Analyse, C: Create, E: Evaluate**

The end of semester assessment for cosmetic science will be held with written examination of 75 marks.

**Note.** Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks.

Teachers can also design different tasks as per requirement, for end semester assessment.

**Suggested Instructional/Implementation Strategies:**

1. Improved Lecture
2. Tutorial
3. Case Method
4. Group Discussion
5. Role Play
6. Demonstration
7. ICT Based Teaching Learning (Video Demonstration/Tutorials CBT, Blog, Face book, Twitter, Whats app, Mobile, Online sources)
8. Brainstorming



### Suggested Learning Resources:

S. No.	Title	Author	Publisher	Edition & Year
1	Harry's Cosmeticology	Wilkinson, Moore	George Godwin	9 <sup>th</sup> Edition 2015
2	Cosmetics – Formulations, Manufacturing and Quality Control,	P.P. Sharma	Vandana Publications Pvt. Ltd., Delhi	6 <sup>th</sup> Edition 2021
3	Text book of cosmecology	Text book of cosmecology	Tata Publishers.	1 January 2008

#### Curriculum Development Team:

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**Course Outcome, Program Specific Outcome& Program Outcome Mapping**

**Course Code: BP809ET**

**Course Name: Cosmetic science**

Course Outcome	Program Outcome											Program Specific outcome			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
	Pharmacy knowledge	Planning Abilities	Problem analysis	Modern tool usage	Leadership skills	Professional Identity	Pharmaceutical Ethics	Communication	The pharmacist and society	Environment and sustainability	Life-long learning	Knowledge of drug discovery	Quality Analysis of API's	MOA of Drug	Biological evaluation of drug
<b>CO-1:</b> Function of skin, Basic structure of hair with described the oral cavity	3	2	3	1	3	2	1	2	3	2	3	1	3	1	2
<b>CO-2:</b> skin care products, Anti-perspirants & deodorants	2	3	1	3	2	2	1	1	2	3	3	3	2	1	3
<b>CO-3:</b> knowledge of Role of herbs in cosmetics and Analytical cosmetics	3	2	3	2	1	1	2	1	2	2	3	3	2	1	3
<b>CO-4:</b> To understand the Principles of cosmetic evaluation.	2	3	2	3	1	3	2	2	3	3	3	3	2	1	3
<b>CO-5:</b> Basic understanding of the terms comedogenic, dermatitis with explain cosmetic problems associated with hair and scalp, cosmetic problems	3	3	1	1	1	3	2	3	1	2	3	2	2	2	2

**Legend: 1- Low, 2-Medium, 3-High**



### Course Curriculum Mapping

Pos& PSOs No	Cos No&	Title	SOs No	Class Room Instructions	Laboratory Instructions	Self learning
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	CO-BP 809. 1ET	To understand the details of cosmetic excipients and skin structure and Function of skin, Basic structure of hair with described the oral cavity	SO1.1 SO1.2 SO1.3 <b>SO1.4</b>	1.1,1.2,1.3,1.4,1.5, 1.6,1.7,1.8,1.9,1.10	-	SI-1.1 SI-1.2
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	CO-BP 809. 2ET	To understand the Principle of formulation and building blocks of skin care products, Antiperspirants & deodorants and Principles of formulation and building blocks of Hair care Products	SO-2.1 SO-2.2 SO-2.3	2.1,2.2,2.3,2.4,2.5, 2.6,2.7,2.8,2.9,2.10	-	SI-2.1 SI-2.2
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	CO-BP 809. 3ET	To acquired the knowledge of Role of herbs in cosmetics and Analytical cosmetics.	SO-3.1 SO-3.2	3.1,3.2,3.3,3.4,3.5, 3.6,3.7,3.8,3.9,3.10	-	SI-3.1
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	CO-BP 809. 4ET	To understand the Principles of cosmetic evaluation.	SO-4.1	4.1,4.2,4.3,4.4,4.5, 4.6,4.7,4.8	-	SI-4.1
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	CO-BP 809. 5ET	Basic understanding of the terms comedogenic, dermatitis with explain cosmetic problems associated with hair and scalp, cosmetic problems associated with skin and Antiperspirants and Deodorants	SO-5.1 SO-5.2 SO-5.3	5.1,5.2,5.3,5.4,5.5, 5.6,5.7	-	SI-5.1 SI-5.2





AKS University  
Faculty of Pharmaceutical Science & Technology  
Rajiv Gandhi Institute of Pharmacy  
Curriculum of B. Pharmacy (Experimental Pharmacology) Program  
( Revised as on 01August2023)

**Semester-VIII**

**Course Code:** BP810 ET  
**Course Title :** Experimental Pharmacology  
**Pre- requisite:** Students should have basic knowledge of practical pharmacology.

**Rationale:** Upon completion of the course the student shall be able to, Appreciate the applications of various commonly used laboratory animals. Appreciate and demonstrate the various screening methods used in preclinical research, Appreciate and demonstrate the importance of biostatistics and research methodology. Design and execute a research hypothesis independently

**Course Outcomes:**

- CO- BP810 ET.1:** Appreciate the applications of various commonly used laboratory animals.
- CO-BP810 ET.2:** Appreciate and demonstrate the various screening methods used in preclinical research, animal dose calculation.
- CO-BP810 ET.3:** Appreciate and demonstrate the various screening methods used in preclinical research.
- CO-BP810 ET.4:** Appreciate and demonstrate the various screening methods used in preclinical research.
- CO-BP810 ET.5:** Appreciate and demonstrate the importance of biostatistics and research methodology



### Scheme of Studies:

Board of Study	Course Code	Course Title	Scheme of studies(Hours/Week)						Total Credits (C)
			CI		LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	
			L	T					
Pharmacy	BP810 ET	Experimental Pharmacology	3	0	1	1	1	6	4

**Legend:** **CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others),  
**LI:** Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)  
**SW:** Sessional Work (includes assignment, seminar, mini project etc.),  
**SL:** Self Learning,  
**C:** Credits.

**Note:** SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

### Scheme of Assessment:

#### Theory

Course code	Title of the course	Program Name	TOTAL Number of contact hours/Week						Credit
			Classroom Instruction (A)		Practical (P)	SW	SL	Total Hours (H)	
			Lecture	Tutorial					
BP701T	Experimental Pharmacology	B. Pharmacy	3	1	0	1	1	6	4



## Practical Assessment

Board of Study	Course Code	Course Title	Scheme of Assessment ( Marks )						
			Internal Assessment (A)			End Semester Examination(B)			Total Marks (A+B)
			Attendance	Record	Sessional exam	Synopsis	Experiment	Viva	
Pharmacy	BP810 ET	Experimental Pharmacology	2	3	10	5	25	5	50

## Guidelines for the allotment of marks for attendance

Percentage of Attendance	Theory	Practical
95 – 100	4	2
90–94	3	1.5
85–89	2	1
80–84	1	0.5
Less than 80	0	0



## Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

**CO-BP810 ET.1:** Appreciate the applications of various commonly used laboratory animals.

### Approximate Hours

Item	Appx Hrs
CI	10+3
LI	0
SW	1
SL	1
Total	15

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
<p><b>SO1.1</b> Understanding CPCSEA guidelines and OECD guidelines on behalf of animal</p> <p><b>SO1.2</b> Understand common laboratory animal Description and applications of different species and strains of animals and transgenic and mutant animals.</p> <p><b>SO1.3</b> Learn different Techniques for collection of blood</p> <p><b>SO1.4</b> Understands about the Routes of drug administration in laboratory animals</p> <p><b>SO1.5</b> Understanding Introduction to Platform technology.</p>		<p><b>Unit-1. . Laboratory Animals:</b></p> <p>1.1 Study of CPCSEA guidelines and OECD guidelines for maintenance and breeding.</p> <p>1.2 Study of CPCSEA guidelines for and OECD guidelines for conduct of experiments on laboratory</p> <p>1.3 Common lab animals.</p> <p><b>1T.1 Tutorial class.</b></p> <p>1.4 Description and applications of different species.</p> <p><b>1T.2 Tutorial class.</b></p> <p>1.5 Description and applications and strains of animals.</p> <p>1.6 Popular transgenic and mutant animals.</p> <p>1.7 Techniques for collection of blood.</p> <p><b>1T.3 Tutorial class.</b></p> <p>1.8 Routes of drug administration in laboratory animals.</p> <p>1.9 Techniques of blood collection and euthanasia.</p> <p><b>1T.4 Tutorial class.</b></p>	<p>1. 1 Different blood collection methods</p>

**a. Assignment.** Routes of drug administration in laboratory animals.



**CO-BP810 ET.2:** Appreciate and demonstrate the various screening methods used in preclinical research, animal dose calculation.

**Approximate Hours**

Item	Appx Hrs
CI	10+3
LI	0
SW	1
SL	1
Total	15

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
<p><b>SO2.1</b> To Understand Dose selection, calculation, Grouping of animals.</p> <p><b>SO2.2</b> Understand Rationale for selection of animal species and sex for the study.</p> <p><b>SO2.3</b> To learn about Study of screening animal models for Diuretics, Nootropics</p> <p><b>SO2.4</b> Antipyretic, anti-inflammatory General anaesthetics, sedative and hypnotics</p> <p><b>SO2.5</b> To learn about Antipsychotic, antidepressant Alzheimer's disease.</p>		<p><b>UNIT 2 : Preclinical screening models</b></p> <p>2.1 Introduction: Dose selection, calculation and conversions, preparation of drug solution/suspensions.</p> <p>2.2 Grouping of animals and importance of sham negative and positive control groups.</p> <p>2.3 Rationale for selection of animal species and sex for the study.</p> <p><b>2T.1 Tutorial class.</b></p> <p>2.4 Study of screening animal models for Diuretics, Nootropics.</p> <p>2.5 Antipyretic, anti-inflammatory.</p> <p><b>2T.2 Tutorial class.</b></p> <p>2.6 General anesthetics, sedative and hypnotics.</p> <p><b>2T.3 Tutorial class.</b></p> <p>2.7 Antipsychotic, antidepressant.</p> <p>2.8 Alzheimer's disease</p> <p><b>2T.4 Tutorial class.</b></p>	<p>2.1 Dose calculation for iv.</p> <p>2.2 Normal function of urine formation</p> <p>2.3 Inflammatory mediator and their role.</p>

**a. Assignment:** General anesthetics, sedative and hypnotics.



**CO-BP810 ET.3:** Appreciate and demonstrate the various screening methods used in preclinical research.

**Approximate Hours**

Item	Appx Hrs
CI	10+3
LI	0
SW	1
SL	1
Total	15

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
<p><b>SO3.1</b> Understand Preclinical screening models for ANS activity, sympathomimetics, sympatholytics</p> <p><b>SO3.2</b> To understand about Preclinical screening models for parasympathomimetics, parasympatholytics.</p> <p><b>SO3.3</b> To learn about Preclinical screening models for</p> <p><b>SO3.4</b> To Preclinical screening models for skeletal muscle relaxants</p> <p><b>SO3.4</b> Understand Preclinical screening models for drugs acting on eye, local anesthetics.</p>		<p><b>Unit 3: Preclinical screening models</b></p> <p>3.1 Preclinical screening models for ANS activity.</p> <p>3.2 Preclinical screening models for sympathomimetics.</p> <p>3.3 Preclinical screening models for sympatholytics.</p> <p><b>3T.1 Tutorial class</b></p> <p>3.4 Preclinical screening models for parasympathomimetics.</p> <p>3.5 Preclinical screening models for prasympatholytics.</p> <p>3.6 Preclinical screening models for skeletal muscle relaxants.</p> <p><b>3T.2 Tutorial class</b></p> <p>3.7 Preclinical screening models for drugs acting on eye.</p> <p>3.8 Preclinical screening models for local anesthetics.</p> <p><b>3T.3 Tutorial class</b></p>	<p>3.1 Lean basic function of ANS.</p> <p>3.2 Function of eye</p> <p>3.3 Action of local anesthetics</p>

a. **Assignment:** Preclinical screening models for parasympathomimetics



**CO-BP810 ET.4:** Appreciate and demonstrate the various screening methods used in preclinical research.

**Approximate Hours**

Item	Appx Hrs
CI	10+3
LI	0
SW	1
SL	1
Total	15

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
<p><b>SO4.1</b> Understand Preclinical screening models: for CVS activity- antihypertensives and diuretics.</p> <p><b>SO4.2</b> Understand preclinical screening models: for CVS activity- antiarrhythmic, antidyslepidemic, anti aggregatory, coagulants, and anticoagulants.</p> <p><b>SO4.3</b> Understand preclinical screening models for other important drugs like antiulcer and antidiabetic.</p> <p><b>SO4.4</b> Understand preclinical screening models for other important drugs like anticancer and antiasthmatics.</p>		<p><b>Unit-4 Preclinical screening models: for CVS activity-</b></p> <p>4.1 Preclinical screening models: for CVS activity- antihypertensives.</p> <p>4.2 Preclinical screening models: for CVS activity- Diuretics, antiarrhythmic.</p> <p>4.3 Preclinical screening models: for CVS activity- antidyslepidemic, anti aggregatory.</p> <p><b>4T.1 Tutorial</b></p> <p>4.4 Preclinical screening models for other important drugs like antiulcer.</p> <p>4.5 Preclinical screening models for other important drugs like antidiabetic.</p> <p>4.6 Preclinical screening models for other important drugs like anticancer.</p> <p><b>4T.2Tutorial class</b></p> <p>4.7 Preclinical screening models for other important drugs like antiasthmatics.</p> <p><b>4T.3 Tutorial class</b></p>	<p>4.1 Anatomy &amp; physiology of CVS</p> <p>4.2 Read about Autacoids pharmacology.</p>

- a. **Assignment::** Preclinical screening models: for CVS activity- antidyslepidemic, anti aggregatory.



**CO-BP810 ET.5:** Appreciate and demonstrate the importance of biostatistics and research methodology.

**Approximate Hours**

Item	Appx Hrs
CI	10+3
LI	0
SW	1
SL	1
Total	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
<p><b>SO5.1</b> Understand Research methodology and Bio-statistics in research.</p> <p><b>SO5.2</b> Learn about Selection of research topic, review of literature.</p> <p><b>SO5.3</b> Understands research hypothesis and study design.</p> <p><b>SO5.4</b> Understand Pre-clinical data analysis and interpretation using Students 't' test and One-way ANOVA.</p> <p><b>SO5.5</b> Evaluation of Graphical representation of data.</p>		<p><b>Unit 5: Research methodology and Bio-statistics:</b></p> <p>5.1 Selection of research topic, review of literature.</p> <p>5.2 Research hypothesis and study design</p> <p><b>5T.1 Tutorial class.</b></p> <p>5.3 Pre-clinical data analysis and interpretation using Students 't' test</p> <p>5.4 Pre-clinical data analysis and interpretation using One-way ANOVA</p> <p><b>5T.2 Tutorial class.</b></p> <p>5.5 . Graphical representation of data</p> <p><b>5 T.3 Tutorial class.</b></p>	<p>5.1 Read null and alternative hypothesis</p> <p>5.2 Suffering various data base.</p>

a .**Assignment:** Pre-clinical data analysis and interpretation using One-way ANOVA.



### Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (Cl)	Sessional Work (SW)	Self Learning (Sl)	Total hour (Cl+SW+Sl)
<b>CO-BP810 ET.1:</b> Appreciate the applications of various commonly used laboratory animals.	13	1	1	15
<b>CO-BP810 ET.2:</b> Appreciate and demonstrate the various screening methods used in preclinical research, animal dose calculation.	13	1	1	15
<b>CO-BP810 ET.3:</b> Appreciate and demonstrate the various screening methods used in preclinical research.	13	1	1	15
<b>CO-BP810 ET.4:</b> Appreciate and demonstrate the various screening methods used in preclinical research	11	1	1	13
<b>CO-BP810 ET.5:</b> Appreciate and demonstrate the importance of biostatistics and research methodology	10	1	1	12
<b>Total Hours</b>	60	5	5	70



## Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

Course Out comes	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-BP810 ET-1	Laboratory Animals	07	05	03	15
CO-BP810 ET-2	Preclinical screening models	10	03	02	15
CO-BP810 ET-3	Preclinical screening models	10	03	02	15
CO-BP810 ET-4	Preclinical screening models: for CVS activity	08	05	02	15
CO-BP810 ET-5	Research methodology and Bio-statistics	07	05	03	15
Total		42	21	12	75

**Legend:**      **R: Remember,**      **U: Understand,**      **A: Apply**

The end of semester assessment for PHARMACOLOGICAL SCREENING METHOD will be held with written examination of 75 marks

**Note.** Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks.

Teachers can also design different tasks as per requirement, for end semester assessment.

### Suggested Instructional/Implementation Strategies:

1. Improved Lecture
2. Tutorial
3. Case Method
4. Group Discussion
5. Role Play
6. Demonstration
7. ICT Based Teaching Learning (Video, Demonstration/Tutorials CBT, Blog, Facebook, Twitter, Whatsapp, Mobile, Online sources)
8. Brainstorming



### Suggested Learning Resources:

S. No.	Title	Author	Publisher	Edition & Year
1	Fundamentals of experimental Pharmacology	M.N.Ghosh	HILTON & COMPANY	Fifth edition & 2011
2	Hand book of Experimental Pharmacology	S.K.Kulakarni	VALLABH PRAKASHAN	1 January 2014
3	CPCSEA guidelines for laboratory animal facility	-----	Animal Husbandry and Dairying, Government of india	2023
4.	Drug discovery and Evaluation	Vogel H.G	SPRINGE	2nd edition & 2013
5.	Introduction to biostatistics and research methods	PSS Sundar Rao and J Richard	PHI Learning Pvt. Ltd.	5 <sup>th</sup> edition 2012

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## **Course Outcome & Program Outcome Mapping**

**Course Code:** BP810 ET



**Course Outcome, Program Specific Outcome& Program Outcome Mapping**

**Course Code: BP810 ET**

**Course Name: Experimental Pharmacology**

Course Outcome	Program Outcome											Program Specific outcome			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	SO2	PSO3	PSO4
	Pharmacy knowledge	Planning abilities	Problem analysis	Modern tool usage	Leadership skills	Professional Identity	Pharmaceutical Ethics	Communication	The Pharmacist and society	Environment and sustainability	Life-long learning	Knowledge of drug discovery	Quality Analysis of API's	MOA of Drugs	Biological evaluation of drug
<b>CO-1:</b> Laboratory Animals	3	2	3	1	3	2	1	2	3	2	3	1	3	1	2
<b>CO-2:</b> Preclinical screening models	2	3	1	3	1	2	1	1	2	3	3	3	2	1	3
<b>CO-3:</b> Preclinical screening models	3	2	3	2	2	1	2	1	2	2	3	3	2	1	3
<b>CO-4:</b> Preclinical screening models for CVS	2	3	2	3	1	3	2	2	3	3	3	3	2	1	3
<b>CO-5:</b> Research methodology and Bio-statistics	3	3	1	1	1	3	1	3	1	2	3	2	2	2	2

**Legend: 1- Low, 2-Medium, 3-High**



### Course Curriculum Mapping

Pos& PSOs No	Cos No	Title	SOs No	Class Room Instructions	Laboratory Instructions	Self learning
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	BP810 ET-1	Laboratory Animals	SO1.1 SO1.2 SO1.3 SO1.4 SO1.5	1.1,1.2,1.3,1.4,1.5,1.6,1.7,1.8,1.9.		SI-1.1
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	BP810 ET-2	Preclinical screening models	SO-2.1 SO2.2 SO2.3 SO2.4 SO2.5	2.1,2.2,2.3,2.4,2.5,2.6,2.7,2.8.		SI-2.1 SI-2.2 SI-2.3
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	BP810 ET-3:	Preclinical screening models	SO3.1 SO3.2 SO3.3 SO3.4	3.1,3.2,3.3,3.4,3.5,3.6,3.7,3.8.		SI3.1 SI3.2 SI3.3
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	BP810 ET-4	Preclinical screening models: for CVS activity	SO-4.1 SO-4.2 SO-4.3 SO-4.4	4.1,4.2,4.3,4.4,4.5,4.6,4.7.		SI-4.1 SI-4.2
Pos:1,2,3,4,5,6,7,8,9,10,11 PSOs:1,2,3,4,5,6	BP810 ET-5	Research methodology and Bio-statistics	SO-5.1 SO-5.2 SO-5.3 SO-5.4 SO-5.5	5.1,5.2,5.3,5.4,5.5.		SI-5.1 SI-5.2





AKS University  
Faculty of Pharmaceutical Science & Technology  
Rajiv Gandhi Institute of Pharmacy  
Curriculum of B. Pharmacy (Advanced Instrumentation Techniques) Program  
(Revised as on 01August2023)

**Semester-VIII**

<b>Course Code:</b>	<b>BP811ET</b>
<b>Course Title:</b>	<b>Advanced Instrumentation Techniques</b>
<b>Pre-requisite:</b>	Student should have basic knowledge of General Marketing, Pharma Marketing, Marketing management, Consumer behaviour.
<b>Rationale/Objective s:</b>	<p>Up on completion of the course student shall be able to</p> <ul style="list-style-type: none"><li>• To understand the advanced instruments used and its applications in drug analysis.</li><li>• To understand the chromatographic separation and analysis of drugs.</li><li>• To understand the calibration of various analytical instruments.</li><li>• To know analysis of drugs using various analytical instruments.</li></ul>

**Course Out comes:**

**CO-BP811-1:** To understand the Nuclear Magnetic Resonance spectroscopy & Mass Spectrometry.

**CO-BP811-2:** To acquired the knowledge of Thermal Methods of Analysis & X-Ray Diffraction Methods.

**CO-BP811-3:** To understanding the Calibration and validation.

**CO-BP811-4:** To familiarize with basic concept of Radio immune assay & Extraction techniques.

**CO-BP811-5:** To comprehend the basic concepts of Hyphenated techniques.



## Scheme of Studies

:Course code	Title of the course	Program Name	TOTAL Number of contact hours/Week						Credit
			Classroom		Practica l(P)	SW	SL	Total Hours (H)	
			Instruction (A)						
			Lecture	Tutorial					
BP811ET	Advanced Instrumentation Techniques	B. Pharmacy	3	1	4	1	1	10	6

**Legend:** **CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others),

**LI:** Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)

**SW:** Sessional Work (includes assignment, seminar, mini project etc.),

**SL:** Self Learning, Credits.

**Note:** SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

## Theory Assessment

			<b>Scheme of Assessment ( Marks )</b>		
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			Progressive Assessment ( PRA)						
			Academic activity, Any three (Quiz/ Assignment, open book test, filed work and seminar)	Student teacher interaction	Class Attendance (AT)	(A) Total Marks	Sessional Exam (B)	r Assessment	Total Marks (A+B+C)
Pharmacy	<b>BP805T</b>	Advanced Instrumentation Techniques	3	3	4	10	15	75	100



### Guidelines for the allotment of marks for attendance

Percentage of Attendance	Theory	Practical
95 – 100	4	2
90–94	3	1.5
85–89	2	1
80–84	1	0.5
Less than 80	0	0

### Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

### Unit I

**CO-BP811-1:** To understand the Nuclear Magnetic Resonance spectroscopy & Mass Spectrometry.

Item	Approx Hrs
Lecture & Tutorial	10+3=13
Practical(P)	0
SW	1
SL	1
Total:	15



<b>Theory</b> <b>SO1.1:</b> Nuclear Magnetic Resonance spectroscopy <b>SO1.2:</b> Mass Spectrometry	<b>NA</b>	1.1 Introduction to NMR 1.2 Principles of H-NMR and C-NMR, chemical shift 1.3 factors affecting chemical shift <b>1T.1</b> Tutorial Class 1.4 coupling constant, Spin - spin coupling, relaxation 1.5 instrumentation and Applications of NMR. 1.6 Introduction to Mass Spectrometry <b>1T.2</b> Tutorial Class 1.7 Principles, Fragmentation of Mass Spectrometry 1.8 Ionization techniques – Electron impact, chemical ionization 1.9 MALDI, FAB, Analyzers-Time of flight and Quadrupole 1.10 instrumentation and applications of Mass Spectrometry <b>1T.3</b> Tutorial Class	1.1: Application of NMR  1.2: Application of Mass Spectrometry
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**Suggested Assignments:**

1. Chemical shift
2. Spin - spin coupling
3. Ionization techniques
4. MALDI
5. FAB



## Unit II

**CO-BP811-2: To acquired the knowledge of Thermal Methods of Analysis & X-Ray Diffraction Methods.**

Item	Approx Hrs
Lecture & Tutorial	10+3=13
Practical(P)	0
SW	1
SL	1
Total:	15

Session Outcomes(SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
<b>Theory</b> <b>SO2.1:</b> Thermal Methods of Analysis <b>SO2.2:</b> X-Ray Diffraction Methods	NA	2.1 Principles of Thermogravimetric Analysis (TGA) 2.2 instrumentation of Thermogravimetric Analysis (TGA) 2.3 Applications of Thermogravimetric Analysis (TGA) <b>2T.1</b> Tutorial Class 2.4 Differential Thermal Analysis (DTA) 2.5 Differential Scanning Calorimetry (DSC) 2.6 Origin of X-rays & basic aspects of crystals <b>2T.2</b> Tutorial Class 2.7 X-ray Crystallography 2.8 Rotating crystal technique 2.9 Single crystal diffraction & powder Diffraction 2.10 structural elucidation and applications of X-Ray Diffraction Methods <b>2T.3</b> Tutorial Class <b>603</b>	2.1: Applications of Radio immuno assay  2.2: Origin of X-rays



**Suggested Assignments:** 1. Basic aspects of crystals 2. X-ray Crystallography, 3. Powder diffraction  
3. Differential Thermal Analysis (DTA) 5. Differential Scanning Calorimetry (DSC)

### Unit III

**CO-BP811-3: To understanding the Calibration and validation.**

		Item	Approx Hrs
		Lecture & Tutorial	10+3=13
		Practical(P)	0
		SW	1
		SL	1
		Total:	15
Session Outcomes(SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
<b>Theory</b> <b>SO3.1:</b> Calibration and validation <b>SO3.2:</b> Calibration of various Instruments	NA	3.1 Calibration as per ICH guidelines 3.2 Validation-as per ICH guidelines 3.3 Calibration as per USFDA guidelines 3.4 Validation as per USFDA guidelines <b>3T.1</b> Tutorial Class 3.5 Calibration of Electronic balance 3.6 Calibration of UV-Visible spectrophotometer 3.7 Calibration of IR spectrophotometer <b>3T.2</b> Tutorial Class 3.8 Calibration of Fluorimeter 3.9 Calibration of Flame Photometer 3.10 Calibration of HPLC and GC <b>3T.3</b> Tutorial Class	3.1: Calibration and validation-as per ICH guidelines 3.2: Calibration and validation-as per USFDA guidelines

**Suggested Assignments:** 1. ICH guidelines 2. USFDA guidelines 3. Electronic balance 4. Fluorimeter 5. Flame Photometer



## Unit IV

**CO-BP811-4: To familiarize with basic concept of Radio immune assay & Extraction techniques.**

Item	Approx Hrs
Lecture & Tutorial	08+3=11
Practical(P)	0
SW	1
SL	1
Total:	13

Session Outcomes(SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
<b>Theory</b> <b>SO4.1:</b> Radio immune assay <b>SO4.2:</b> Extraction techniques	NA	4.1 Importance & various components of Radio immuno assay 4.2 Principle of Radio immuno assay 4.3 Different methods of Radio immuno assay <b>4T.1</b> Tutorial Class 4.4 Limitation of Radio immuno assay 4.5 Applications of Radio immuno assay 4.6 General principle of Extraction techniques <b>4T.2</b> Tutorial Class 4.7 Procedure involved in the solid phase extraction 4.8 liquid-liquid extraction <b>4T.3</b> Tutorial Class	4.1: Applications of Radio immuno assay 4.2: liquid-liquid extraction

**Suggested Assignments:** 1. General principle of Extraction techniques  
 2. Applications of Radio immuno assay  
 3. Limitation of Radio immuno assay  
 4. Principle of Radio immuno assay  
 5. Different methods of Radio immuno assay



## Unit V

**CO-BP811-5:To Compare and the basic concepts of Hyphenated techniques.**

Item	Approx Hrs
Lecture & Tutorial	07+03=10
Practical(P)	0
SW	1
SL	1
Total:	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
<b>Theory</b> <b>SO5.1:</b> Hyphenated techniques <b>SO5.2:</b> LC-MS <b>SO5.3:</b> GC-MS <b>SO5.4:</b> HPTLC-MS		5.1 LC-MS 5.2 MS <b>5T.1</b> Tutorial Class 5.3 GC-MS 5.4 GC 5.5 HPTLC-MS <b>5T.2</b> Tutorial Class 5.6 HPTLC 5.7 Hyphenated techniques <b>5T.3</b> Tutorial Class	<b>5.1:</b> HPTLC <b>5. 2:</b> Liquid Chromatography

**Suggested Assignments:** 1. HPTLC 2. LC 3. MS 4. GC 5. Hyphenated techniques



### Brief of Hours suggested for the Course Outcome

Course Out comes	Class Lecture (Cl)	(LI)	Sessional l Work (SW)	Self Learning (Sl)	Total Hour (Cl+SW+Sl+LI)
<b>CO-BP811-1:</b> To understand the Nuclear Magnetic Resonance spectroscopy & Mass Spectrometry.	13	0	1	1	15
<b>CO-BP811-2:</b> To acquired the knowledge of Thermal Methods of Analysis & X-Ray Diffraction Methods.	13	0	1	1	15
<b>CO-BP811-3:</b> To understanding the Calibration and validation.	13	0	1	1	15
<b>CO-BP811-4:</b> To familiarize with basic concept of Radio immune assay & Extraction Techniques.	11	0	1	1	13
<b>CO-BP811-5:</b> To comprehend the Basic concepts of Hyphenated techniques.	10	0	1	1	12
<b>Total Hours</b>	60	0	5	5	70



## Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	To understand the Nuclear Magnetic Resonance spectroscopy & Mass Spectrometry.	08	06	01	15
CO-2	To acquired the knowledge of Thermal Methods of Analysis & X-Ray Diffraction Methods	8	7	1	16
CO-3	To understanding the Calibration and validation.	08	07	01	16
CO-4	To familiarize with basic concept of Radio immune assay & Extraction techniques.	07	06	01	14
CO-5	To comprehend the basic concepts of Hyphenated techniques.	08	07	01	16
Total		39	33	05	77

**Legend:     R: Remember,     U: Understand,     A: Apply**

The end of semester assessment for Advanced Instrumentation Techniques will be held with written examination of 75 marks

**Note.** Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks.

Teachers can also design different tasks as per requirement, for end semester assessment.

### **Suggested Instructional/Implementation Strategies:**

1. Improved Lecture
2. Tutorial
3. Case Method
4. Group Discussion
5. Role Play
6. Demonstration
7. ICT Based Teaching Learning (Video Demonstration/Tutorials CBT, Blog, Face book, Twitter, Whats app, Mobile, Online sources)
8. Brainstorming



**Suggested Learning Resources:**

S. No.	Title	Author	Publisher	Edition & Year
1	Instrumental Methods of Chemical Analysis	B.K Sharma	--	--
2	Organic spectroscopy	Y.R Sharma	--	--
3	Text book of Pharmaceutical Analysis	Kenneth A. Connors	--	--
4	Vogel's Text book of Quantitative Chemical Analysis	A.I. Vogel	--	--
5	Practical Pharmaceutical Chemistry	A.H. Beckett and J.B. Stenlake	--	--
6	Organic Chemistry	I. L. Finar	--	--
7	Organic spectroscopy	William Kemp	--	--
8	Quantitative Analysis of Drugs	D. C. Garrett	--	--
9	Quantitative Analysis of Drugs in Pharmaceutical Formulations	P. D. Sethi	--	--
10	Spectrophotometric identification of Organic Compounds	Silverstein	--	--

**Curriculum Development Team:**

1. **Prof. SP Gupta**, Director, RGIP, AKS University
2. **Mr Satyendra Garg**, Assistant professor, RGIP, AKS University
3. **Ms Neha Goel**, Associate Professor, RGIP, AKS University



**Course Outcome, Program Specific Outcome& Program Outcome Mapping**

**Course Code: BP811ET**

**Course Name: Advanced Instrumentation Techniques**

Course Outcome	Program Outcome											Program Specific outcome			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	SO2	PSO3	PSO4
	Pharmacy knowledge	Planning abilities	Problem analysis	Modern tool usage	Leadership skills	Professional Identity	Pharmaceutical Ethics	Communication	the pharmacist and society	Environment and sustainability	Life-long learning	Knowledge of drug discovery	Quality Analysis of API's	MOA of Drug	Biological evaluation of drug
<b>CO-1:</b> Cosmetic Excipients and Basic structure and Function of skin,	3	2	3	1	3	2	1	2	3	2	3	1	3	1	2
<b>CO-2:</b> Anti-perspirants & deodorants and Principles of formulation and building blocks of Hair care Products	2	3	1	3	1	2	0	1	2	3	3	3	2	1	3
<b>CO-3:</b> Role of herbs in cosmetics and Analytical cosmetics	3	2	3	2	1	1	2	1	2	2	3	3	2	1	3
<b>CO-4:</b> To understand the Principles of Cosmetic Evaluation.	2	3	2	3	1	3	2	2	3	3	3	3	2	1	3
<b>CO-5:</b> Cosmedogenic, dermatitis with explain Cosmetic problems associated with Hair and scalp	3	3	1	1	1	3	2	3	1	2	3	2	2	2	2



### Course Curriculum Mapping

Pos& PSOs No	Cos No&	Title	SOs No	Class Room Instructions	Laboratory Instructions	Self learning
<b>Pos:1,2,3,4,5,6,7,8,9,10,11</b> <b>PSOs:1,2,3,4,5,6</b>	CO- BP 809.1ET	To understand the details of Cosmetic Excipients and Basic structure and Function of skin, Basic structure of hair with described the Oral Cavity	SO1.1 SO1.2 SO1.3 <b>SO1.4</b>	1.1,1.2,1.3,1.4,1.5,1.6,1.7,1.8,1.9,1.10	-	SI-1.1 SI-1.2
<b>Pos:1,2,3,4,5,6,7,8,9,10,11</b> <b>PSOs:1,2,3,4,5,6</b>	CO- BP 809.2ET	To understand the Principle of formulation and building blocks of skin care products, Anti-perspirants & deodorants and Principles of formulation and building blocks of Hair care Products	<b>SO-2.1</b> <b>SO-2.2</b> <b>SO-2.3</b>	2.1,2.2,2.3,2.4,2.5,2.6,2.7,2.8,2.9,2.10	-	SI-2.1 SI-2.2
<b>Pos:1,2,3,4,5,6,7,8,9,10,11</b> <b>PSOs:1,2,3,4,5,6</b>	CO- BP 809.3ET	To acquired the knowledge of Role of herbs in cosmetics and Analytical cosmetics.	SO-3.1 SO-3.2	3.1,3.2,3.3,3.4,3.5,3.6,3.7,3.8,3.9,3.10	-	SI-3.1
<b>Pos:1,2,3,4,5,6,7,8,9,10,11</b> <b>PSOs:1,2,3,4,5,6</b>	CO- BP 809.4ET	To understand the Principles of Cosmetic Evaluation.	SO-4.1	4.1,4.2,4.3,4.4,4.5,4.6,4.7,4.8	-	SI-4.1
<b>Pos:1,2,3,4,5,6,7,8,9,10,11</b> <b>PSOs:1,2,3,4,5,6</b>	CO- BP 809.5ET	Basic understanding of the terms Comedogenic, dermatitis with explain Cosmetic problems associated with Hair and scalp, Cosmetic problems associated with skin and Antiperspirants and Deodorants	SO-5.1 SO-5.2 SO-5.3	5.1,5.2,5.3,5.4,5.5,5.6,5.7	-	SI-5.1 SI-5.2





AKS University  
Faculty of Pharmaceutical Science & Technology  
Rajiv Gandhi Institute of Pharmacy  
Curriculum of B. Pharmacy (Dietary Supplements and nutraceuticals) Program  
(Revised as on 01August2023)  
**Semester-VIII**

**Course Code:** BP812ET

**Course Title:** Dietary Supplements and nutraceuticals

**Pre-requisite:** The Student should have basic knowledge of Basic diet, mineral, vitamins and biochemistry.

**Rationale/Objective s:**

- Up on completion of the course student shall be able to
- Understand the need of supplements by the different group of people to maintain healthy life.
- Understand the outcome of deficiencies in dietary supplements.
- Appreciate the components in dietary supplements and the application.
- Appreciate the regulatory and commercial aspects of dietary supplements including health claims.

**Course Out comes:**

- CO-BP812ET-1:** To understand the importance of public health nutrition and healthy diet with source.
- CO-BP812ET-2:** To gain the knowledge about phyto-chemicals, their occurrence and characteristics.
- CO-BP812ET-3:** Understand about the free radicals and dietary fibres with significance
- CO-BP812ET-4:** Understand about the involvement of free radicals in diseases and Functional food for chronic diseases prevention
- CO-BP812ET-5:** Understand about the regulatory aspects on food safety.



## Scheme of Studies

:Course code	Title of the course	Program Name	TOTAL Number of contact hours/Week						Credit
			Classroom Instruction (A)		Practica l(P)	SW	SL	Total Hours (H)	
			Lecture	Tutorial					
BP812ET	Dietary SupplementsAnd Nutraceutic Als	B. Pharmacy	3	1	0	1	1	6	4

**Legend:** **CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others),

**LI:** Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)

**SW:** Sessional Work (includes assignment, seminar, mini project etc.),

**SL:** Self Learning, Credits.

**Note:** SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

### Theory Assessment

Board of Study	Course Code	Course Title	Scheme of Assessment ( Marks )						
			Progressive Assessment ( PRA)						
			Academic activity, Any three (Quiz/ Assignment, open book test, filed work and seminar)	Student teacher interaction	Class Attendance (AT)	(A)  Total Marks	Sessional Exam (B)		
Pharmacy	BP812 ET	Dietary Supplements and Nutra ceuticals	3	3	4	10	15	75	100

### Guidelines for the allotment of marks for attendance

Percentage of Attendance	Theory	Practical
95 – 100	4	2
90 – 94	3	1.5
85 – 89	2	1
80 – 84	1	0.5
Less than 80	0	0



**Course-Curriculum Detailing:**

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

**CO-BP812ET-1: To understand the importance of public health nutrition and healthy diet with source.**

Item	Approx Hrs
Lecture & Tutorial	7+2=9
Practical(P)	0
SW	1
SL	1
Total:	11

Session Outcomes(SOs)	Laboratory Instruction (LI)	Class room Instruction(CI)	Self Learning (SL)
Theory SO1.1: Understand the Definitions of Functional foods, Nutraceuticals and Dietary supplements SO1.2: Study about Source, Name of marker compounds and their chemical nature		1.1: Definitions of functional foods, Nutraceuticals and Dietary supplements. Classification of Nutraceuticals, 1.2: Health problems and diseases that can be prevented or cured by Nutraceuticals i.e. weight control, diabetes, cancer, 1.3: heart disease, stress, osteoarthritis, hypertension etc. 1T.1: Tutorial 1.4: Public health nutrition, maternal and child nutrition 1.5: nutrition and ageing, nutrition education in community 1.6: Source, Name of marker compounds and their chemical nature 1.7: Medicinal uses and health benefits of following used as nutraceuticals/functional foods: Spirulina, Soyabean, Ginseng, Garlic, Broccoli, Ginkgo, Flaxseeds 1T.2: Tutorial	1.1: To study and prepare a comparative chart of medicinal use of Soyabean, Ginseng, Garlic 1.2: to study about the nutraceuticals working principle for prevention of disease.

**Suggested Assignments:** Definitions of Functional foods, Nutrition and ageing, nutrition education in community



## Unit II

**CO-BP812ET-2: To gain the knowledge about photochemical, their occurrence and characteristics.**

Item	Approx Hrs
Lecture & Tutorial	15+3=18
Practical (P)	0
SW	1
SL	1
Total:	20

Session Outcomes(SOs)	Laboratory Instruction(LI)	Class room Instruction(CI)	Self Learning (SL)
<p>Theory</p> <p><b>SO2.1:</b> Understand Phytochemicals as nutraceuticals: Occurrence and characteristic features(chemical nature medicinal benefits) of following a) Carotenoids-<math>\alpha</math> and <math>\beta</math>-Carotene</p> <p><b>SO2.2:</b> Allyl trisulfide</p> <p>Polyphenolics: Resveratrol</p> <p><b>SO2.3:</b> Anthocyanidins, catechins, Flavones.</p> <p>SO2.4: Anthocyanidins, catechins, Flavones</p> <p>SO2.5: coffee, tea and the like</p>		<p>2.1: Phytochemicals as nutraceuticals: Occurrence and characteristic features(chemical nature medicinal benefits) of following a) Carotenoids-<math>\alpha</math> and <math>\beta</math>-Carotene</p> <p>2.2: Lycopene, Xanthophylls, leutin</p> <p>2.3: Sulfides: Diallyl sulfides.</p> <p>2.4: Allyl trisulfide</p> <p>2.5: Polyphenolics: Resveratrol</p> <p>2.1: Tutorial</p> <p>2.6: Flavonoids- Rutin, Naringin, Quercetin</p> <p>2.7: Anthocyanidins, catechins, Flavones:</p> <p>2.8: Prebiotics/ Probiotics.: Fructo oligosaccharides, Lactobacillum</p> <p>2.9 Phyto estrogens : Isoflavones, daidzein</p> <p>2.10: Geestustin, lignin</p> <p>2T.2: Tutorial</p> <p>2.11: Tocopherols</p> <p>Proteins</p> <p>2.12: vitamins, minerals, cereal, vegetables</p> <p>2.13: beverages as functional foods: oats</p> <p>2.14: wheat bran, rice bran, sea foods</p> <p>2.15: coffee, tea and the like</p> <p>2T.3: Tutorial</p>	<p>2.1: Study about the importance of nutraceuticals and developing their preparation.</p>

**Suggested Assignments:** Carotenoids-  $\alpha$  and  $\beta$ -Carotene and Lycopene.



**Unit-III****CO-BP812ET-3: Understand about the free radicals and dietary fibres with significance .**

Item	Approx Hrs
Lecture & Tutorial	7+2=9
Practical(P)	0
SW	1
SL	1
Total:	11

Session Outcomes(SOs)	Laboratory Instruction (LI)	Class room Instruction(CI)	Self Learning(SL)
Theory SO3.1: understand Introduction to free radicals: Free radicals SO3.2: damaging reactions of free radicals on lipid SO3.3: complex carbohydrates as functional food ingredients		3.1: Introduction to free radicals: Free radicals 3.2: reactive oxygen species 3.3: production of free radicals in cells, 3.4: damaging reactions of free radicals on lipid 3T.1: Tutorial 3.5: Proteins, Carbohydrates, nucleic acids 3.6 :Dietary fibres 3.7: complex carbohydrates as functional food ingredients. 3T.2: Tutorial	3.1: Study the free radicals effects .

**Suggested Assignments:** damaging reactions of free radicals on lipids, proteins, Carbohydrates, nucleic acids



## Unit -IV

**CO-BP812ET-4: Understand about the involvement of free radicals in diseases and functional food for chronic diseases prevention.**

Item	Approx Hrs
Lecture & Tutorial	10+3=13
Practical(P)	0
SW	1
SL	1
Total:	15

Session Outcomes(SOs)	Laboratory Instruction (LI)	Class room Instruction(CI)	Self Learning (SL)
Theory SO4.1: Understand Free radicals in Diabetes mellitus, Inflammation, Ischemic reperfusion injury SO4.2: kidney damage, muscle damage. Free radicals involvement in other disorders SO4.3: Antioxidants: Endogenous antioxidants – enzymatic and nonenzymatic antioxidant defence, Superoxid SO4.4: Functional foods for chronic disease prevention		4.1: Free radicals in Diabetes mellitus, Inflammation, Ischemic reperfusion injury 4.2: Cancer, Atherosclerosis, Free radicals in brain metabolism and pathology, 4.3: kidney damage, muscle damage. Free radicals involvement in other disorders 4.4: Free radicals theory of ageing. 4T1: Tutorial 4.5: Antioxidants: Endogenous antioxidants – enzymatic and nonenzymatic antioxidant defence, Superoxid 4.6: dismutase, catalase, Glutathione peroxidase, Glutathione 4.7: Vitamin C, Vitamin E, $\alpha$ - Lipoic acid, melatonin 4T.2: Tutorial 4.8: Synthetic antioxidants: Butylated hydroxy Toluene 4.9; Butylated hydroxy Anisol 4.10: Functional foods for chronic disease prevention 4T .3: Tutorial	<b>4.1:</b> comparative study of free radicals effects in various disease.

**Suggested Assignments:** Free radicals in Diabetes mellitus



**Unit V****CO-BP104-5: Understand about the regulatory aspects on food safety .**

Item	Approx Hrs
Lecture & Tutorial	6+2=8
Practical(P)	0
SW	1
SL	1
Total:	10

Session Outcomes(SOs)	Laboratory Instruction (LI)	Class room Instruction(CI)	Self Learning(SL)
Theory SO5.1: Understand : Effect of processing, storage interactions of various environmental factors on the potential of nutraceuticals.  SO5.2: Pharmacopoeial Specifications for dietary supplements and nutraceuticals	NA	5.1: Effect of processing, storage 5.2: interactions of various environmental factors on the potential of nutraceuticals. 5.3: Regulatory Aspects; FSSAI, FDA, FPO, MPO, 5.4: AGMARK. HACCP 5T1: Tutorial Class 5.5: GMPs on Food Safety. Adulteration of foods. 5.6: ) Pharmacopoeial Specifications for dietary supplements and nutraceuticals. . 5T.2: Tutorial	5.1: Study about the importance of various regulatory aspects in pharmaceutical manufacturing.

**Suggested Assignments:** FSSAI & FDA study.



### Brief of Hours suggested for the Course Outcome

Course Out comes	Class Lecture (CI)	(LI)	Sessional Work (SW)	Self Learning (SI)	Total Hour (CI+SW+SI+LI)
<b>CO-BP812ET-1:</b> To understand the importance of public health nutrition and healthy diet with source.	9	0	1	1	11
<b>CO-BP812ET-2:</b> To gain the knowledge about phytochemicals, their occurrence and characteristics	18	0	1	1	20
<b>CO-BP812ET-3:</b> Understand about the free radicals and dietary fibres with significance.	9	0	1	1	11
<b>CO-BP812ET-4:</b> Understand about the involvement of free radicals in diseases and functional food for chronic disease prevention.	13	0	1	1	15
<b>CO-BP812ET-5:</b> Understand about the regulatory aspects on food safety.	8	0	1	1	10
<b>Total Hours</b>	<b>57</b>	<b>0</b>	<b>5</b>	<b>5</b>	<b>67</b>



**Suggestion for End Semester Assessment**  
Suggested Specification Table (For ESA)

Course Outcome	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
<b>CO-BP812ET-1:</b>	To understand the importance of public health nutrition and healthy diet with source.	08	06	01	15
<b>CO-BP812ET-2:</b>	To gain the knowledge about phytochemicals, their occurrence and characteristics	12	07	01	20
<b>CO-BP812ET-3:</b>	Understand about the free radicals and dietary fibres with significance	02	06	02	10
<b>CO-BP812ET-4:</b>	Understand about the involvement of free radicals in diseases and functional food for chronic disease Prevention.	10	02	03	15
<b>CO-BP812ET-5:</b>	Understand about the regulatory aspects on food safety.	05	07	03	15
<b>Total</b>		<b>37</b>	<b>28</b>	<b>10</b>	<b>75</b>

**Legend: R: Remember, U: Understand, A: Apply**

The end of semester assessment for Pharmaceutical analysis-I will be held with written examination of 75 marks

**Note.** Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks. Teachers can also design different tasks as per requirement, for end semester assessment.

**Suggested Instructional/Implementation Strategies:**

1. Improved Lecture
2. Tutorial
3. Case Method
4. Group Discussion
5. Role Play
6. Demonstration
7. ICT Based Teaching Learning (Video Demonstration/Tutorials CBT, Blog, Face book, Twitter, Whats app, Mobile, Online sources)
8. Brainstorming



### Suggested Learning Resources:

S. No.	Title	Author	Publisher	Edition & Year
1	Role of dietary fibers and neutraceuticals in preventing diseases	K.T Agustian and P.Faizal	BS Publication	1 Edition
2	The Food Pharmacy	Jean Carper, Simon & Schuster	UK Ltd.	7 <sup>th</sup> edition 1998
3	Functional foods Wood head	G. Gibson and C.williams	Publ.Co. London	3 <sup>rd</sup> edition 2000
4	Functional Foods	Goldberg, I	. Chapman and Hall, New York.	6 <sup>th</sup> edition 1994
5	Handbook of Nutraceuticals and Functional Foods	Robert E.C. Wildman Richard S.Bruno	CRC Press	Third Edition (Modern Nutritio)
6	Modern Nutrition in Health and Disease.	Shils, ME, Olson, JA, Shike, M	Lea and Febiger	Eighth edition.

### Curriculum Development Team:

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**Course Outcome, Program Specific Outcome& Program Outcome Mapping**

**Course Code: BP812ET**

**Course Name: Dietary Supplements and nutraceuticals**

Course Outcome	Program Outcome											Program Specific outcome			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
	Pharmacy knowledge	Planning Abilities	Problem analysis	Modern tool usage	Leadership skills	Professional Identity	Pharmaceutical Ethics	Communication	The pharmacist and society	Environment and sustainability	Life-long learning	Knowledge of drug discovery	Quality Analysis of API's	MOA of Drug	Biological evaluation of drug
<b>CO-1:</b> To know the importance of public health nutrition and healthy diet with source	3	2	3	1	3	2	1	2	3	2	3	1	3	1	2
<b>CO-2:</b> Phyto-chemicals, their occurrence	2	3	1	3	2	2	1	1	2	3	3	3	2	1	3
<b>CO-3:</b> Free radicals and dietary fibers	3	2	3	2	1	1	2	1	2	2	3	3	2	1	3
<b>CO-4:</b> The involvement of free radicals in diseases	2	3	2	3	1	3	2	2	3	3	3	3	2	1	3
<b>CO-5:</b> Regulatory aspects on food safety	3	3	1	1	1	3	1	3	1	2	3	2	2	2	2

**Legend: 1- Low, 2-Medium, 3-High**



### Course Curriculum Mapping

Pos& PSOs No	Cos No&	Title	SOs No	Class Room Instructions	Laboratory Instructions	Self learning
Pos: 1,2,3,4,5,6,7,8,9,10,11 PSOs: 1,2,3,4,5,6	<b>CO-BP812 ET-1</b>	To understand the importance of public health nutrition and healthy diet with source	SO1.1 SO1.2	1.1,1.2,1.3,1.4,1.5,1.6,1.7		SI-1.1 SI-1.2
Pos: 1,2,3,4,5,6,7,8,9,10,11 PSOs: 1,2,3,4,5,6	<b>CO-BP812 ET-2</b>	To gain the knowledge about phytochemicals, their occurrence and harateristics	<b>SO-2.1</b> <b>SO-2.2</b> <b>SO-2.3</b> <b>SO-2.4</b> <b>SO-2.5</b>	2.1,2.2,2.3,2.4,2.5,2.6,2.7,2.8,2.9,2.10,2.11,2.12,2.13,2.14,2.15		SI-2.1
Pos: 1,2,3,4,5,6,7,8,9,10,11 PSOs: 1,2,3,4,5,6	<b>CO-BP812 ET-3</b>	Understand about the free radicals and dietary fibres with significance	<b>SO-3.1</b> <b>SO-3.2</b> <b>SO-3.3</b>	3.1,3.2,3.3,3.4,3.5,3.6,3.7		SI-3.1
Pos: 1,2,3,4,5,6,7,8,9,10,11 PSOs: 1,2,3,4,5,6	<b>CO-BP812E T-4</b>	Understand about the involvement of free radicals in diseases and functional food for chronic disease prevention.	<b>SO-4.1</b> <b>SO-4.2</b> <b>SO-4.3</b> <b>SO-4.4</b>	4.1,4.2,4.3,4.4,4.5,4.6,4.7,4.8,4.9,4.10		SI-4.1
Pos: 1,2,3,4,5,6,7,8,9,10,11 PSOs: 1,2,3,4,5,6	<b>CO-BP812 ET-5</b>	Understand about the regulatory aspects on food safety.	SO-5.1 SO-5.2	5.1,5.2,5.3,5.4,5.5,5.6	-	<b>SI-5.1</b>