Faculty of Medical, Paramedical
&
Allied Health Sciences

Syllabus

For

Bachelor in Pharmacy

(Program Code: HS0241)

(2022-23)

Approved by the Academic Council vide resolution no 44.03 and dated 30.09.2022

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1. INTRODUCTION

The quality of higher education in B.Pharmacy should be improved in such a manner that young minds are able to compete in this field globally in terms of their knowledge and skills, for this purpose Learning Outcome-based Curriculum Framework (LOCF) is developed.

Incorporation of Learning Outcome-based Curriculum Framework (LOCF)in the undergraduate B.Pharmacy programme makes it student-centric, interactive and outcome-oriented to achievewell-defined aims, objectives and goals. The learning outcomes are attained by students through skills acquired during aprogramme of study.Programme learning outcomes will include subject-specific skills and generic skills, including transferable global skills and competencies. It would also focus on knowledge and skills that prepare students for further study, employment and society development. LOCF help ensure comparability of learning levels and academic standards across colleges/universities.

At present, the goal of higher education in B.Pharmacy may be achieved using the following measures:

a) Curriculum reform based on learning outcome-based curriculum framework (LOCF).

b) Improving learning environment and academic resources.

c) Elevating the quality of teaching and research.

d) Involving students in discussions, problem-solving and out of box thinking aboutvarious ideas and their applicability, which may lead to empowerment and enhancement of the social welfare.

e) Motivating the learners to understand various concepts of their educational programme keeping in view the regional context.

f) Enabling learners to create research atmospherein their colleges/institutes/universities.

g) Teach courses based on Choice Based Credit System (CBCS).

2. LEARNING OUTCOME-BASED APPROACH TO CURRICULUM PLANNING

The Bachelor's Degree in pharmacy (B.Pharmacy) is awarded to the students on the basis of knowledge, understanding, skills, values and academic achievements. Hence, the learning outcomes of this programme are aimed at facilitating the learners to acquire these attributes, keeping in view of their preferences and aspirations for knowledge.

The LOCF have designed courses of B.Pharmacy.in the light of graduate attributes, description of qualifications, courses and programme learning outcomes. It may lead to all round development and delivery of complete curriculum planning. Hence, it provides specific guidelines to the learners to acquire sufficient knowledge during this programme.

The programme has been planned in such manner that there is scope of flexibility and innovation in

a) Modifications of prescribed syllabi.

b) Teaching-learning methodology.

c) Assessment technique of students and knowledge levels.

d) Learning outcomes of courses.

e) Addition of new elective courses subject to availability of experts incolleges/institutes/universities across the country.

2.1. Nature and Extent of Bachelor's Degree Programme

As a part of effort to enhance employability of B.Pharmacy graduates expected learning outcomes are very essential in present day perspective. Therefore, higher education degrees must formulate Graduate Attributes (GAs), qualification descriptors, learning outcomes and course learning outcomes which will help in curriculum planning and development in the form of design and delivery of courses. The overall formulation of the degree programme must equip learner to have competencies to provide deliverables to the industry.

2.2. Aims of Bachelor's Degree programme in Pharmacy (B.Pharmacy)

The overall aims of B.Pharmacy are to

1. Create deep interest in Pharmacy learning.
2. Develop broad and balanced knowledge and understanding of definitions, concepts andprinciples.
3. Familiarize the students with suitable tools related to B.Pharmacyprogramme.
4. Enhance the ability of learners to apply the knowledge and skills acquired by themduring the B.Pharmacy programmeto solve specific problems of their courses.
5. Provide learners sufficient knowledge and skills enabling them to undertakefurther studies in Pharmacy Science and its allied areas.
6. Encourage the students to develop a range of generic skills helpful in employment,internships and social activities.

2.3. Motive behind curriculum planning and development

The committee considered and discussed the following factors for LOCF for the graduates:

1. Framing of syllabi
2. Learners attributes
3. Qualification descriptors
4. Programme learning outcomes
5. Course learning outcomes
6. Necessity of having elective courses
7. Academic standards

3. PROGRAM EDUCATIONAL OBJECTIVES (PEOs):

PEO1: To produce pharmacy graduates with strong fundamental concepts and high technical competence in pharmaceutical sciences and technology, who shall be able to use these tools in pharmaceutical industry and/or institutes where ever necessary for success.

PEO2: To provide students with a strong and well defined concepts in the various fields of pharmaceutical sciences viz., pharmaceutics, pharmaceutical chemistry, pharmacology and pharmacognosy according to the requirement of pharmaceutical industries, community and Hospital Pharmacy and also to develop a sense of teamwork and awareness amongst students towards the importance of interdisciplinary approach for developing competence in solving complex problems in the area of Pharmaceutical Sciences.

PEO3: To promote the development of trained human resource in Pharmaceutical Sciences for dissemination of quality education with highly professional and ethical attitude, strong communication skills, effective skills to work in a team with a multidisciplinary approach.

PEO4: To generate potential knowledge pools with interpersonal and collaborative skills to identify, assess and formulate problems and execute the solution in closely related pharmaceutical industries.

4. GRADUATE ATTRIBUTES (GAs)

The graduate attributes of B.Pharmacy are the summation of the expected course learning outcomes mentioned at the end of each course. Some of them are stated below.

Patient counseling and Pharmaceutical Care

- Provide high quality, evidence-based, patient-centered care in cooperation with patients,prescribers and members of the interprofessional health care team
- Promote health and wellness and disease prevention
- Provide pharmaceutical care including, but not limited to, Medication TherapyManagement (MTM), vaccinations and drug therapy monitoring in all practice areas(e.g., inpatient, ambulatory and community practice)
- Provide culturally competent pharmaceutical care and demonstrate cultural competencein all interactions
- Appropriately address patient-specific and population-specific needs

Medical and Science Foundations

- Demonstrate mastery and application of core knowledge and skills in relation to theevolving biomedical, clinical, epidemiological and social-behavioral sciences. Thisincludes competency in areas supporting high quality pharmacy practice (e.g.,pharmaceutics, medicinal chemistry, pharmacokinetics, pharmacodynamics,pharmacology, pathophysiology, pharmacotherapeutics, and pharmaceutical care)
- Demonstrate the ability to use critical analysis and problem solving skills for theprovision of high quality, evidence-based pharmacy services and patient care

Practice Based Learning and Improvement

- Evaluate practice and care, and promote continuous improvement in one's own patientcare and pharmacy services

- Demonstrate self-calibration skills and a commitment to the lifelong learning needed toprovide high quality care
- Locate, appraise and assimilate evidence from scientific studies to enhance the quality ofcare and services
- Effectively utilize information, informatics and technology to optimize learning andpatient care

Interpersonal and Communication Skills

- Demonstrate effective interpersonal written and verbal skills, adapt to socioeconomic andcultural factors as well as situational applications
- Effectively educate families, patients, caregivers and other HCPs
- Function effectively in a team
- Act in a consultative position for other members of the health care team, regulatoryagencies and policy makers

Professionalism

- Demonstrate exemplary professional, ethical and legal behaviors, complying with allfederal, state and local laws and regulations related to pharmacy practice
- Contribute to the training of pharmacy students, future colleagues, and the growth andsuccess of the profession
- Demonstrate the respect for patient privacy and autonomy, as well as sensitivity andresponsiveness to diverse patient populations
- Demonstrate a high degree of integrity, truthfulness and fairness
- Demonstrate initiative, reliability and follow-through in fulfilling commitments

Systems Based Practice and Management

- Demonstrate awareness and responsiveness to the system of health care, effectivelyutilizing systems of care to provide cost-effective, optimal care
- incorporate cost awareness and risk-benefit analysis in patient and/or population-basedcare; this includes applying pharmacoeconomic principles to health outcomes and patientcare
- Effectively manage medication use systems
- Prioritize patient safety and public health
- Advocate for quality patient care and optimal health care
- Work on interprofessional teams to enhance quality and safety
- Participate in identifying system errors.

GA1. **Pharmacy Knowledge:** The students shall exhibit knowledge and comprehension of the core and basic knowledge in the field of pharmacy and allied subjects of life sciences.

GA2. **Planning Abilities:** The students will exhibit effective planning abilities including time management, organizational skills. Develop and implement plans and organize work .

GA3. **Problem analysis:** The students will exhibit the ability **to** find, analyze, evaluate and apply information systematically and shall make defensible decisions.

GA4. **Modern tool usage:** The students will implement newly implemented software to solve the problems in the various areas like ability to learn, select and apply appropriate procedure, resources in the area of Manufacturing, Marketing and Quality control.

GA5. **Research-related skills:**Develop a sense of inquiry and capability for asking relevant and intelligent questions, problematizing, synthesizing and articulating; ability to recognize and establish cause-and-effect relationships, define problems, formulate hypotheses, test hypotheses, analyse, interpret and draw conclusions from data, establish hypotheses, predict cause-and-effect relationships; ability to plan, execute and report the results of an experiment or investigation.

GA6. **Leadership skills:** Understand and consider leadership and team building when planning changes required for fulfillment of practice, professional and societal responsibilities. Assume participatory role as responsible citizens or leadership roles when appropriate to facilitate improvement in health and well-being.

GA7. **Professional Identity:** Understand, analyze and communicate the value of their professional roles in society (e.g.Ashealth care professionals, as promoters of health, as educators, as managers, as employers & as employees).

GA8. **Pharmaceutical Ethics:** The students shall maintain the high professional identity and render the services in the society as per the ethics and moral value given in Pharmacy oath and pharmaceutical jurisprudence.

GA9. **Communication:** Communicate effectively with the pharmacy community and with society regarding the drugs & diseases.

GA10. **Environment and sustainability:** The students will understand and communicate the importance of the professional pharmacy solutions in societal and environmental contexts.

GA11. **Lifelong learning:** The graduate students will exhibit confidence for self education and ability for lifelong learning.Self- access and use feedback effectively from others to identify learning needs and to satisfy these needs on an ongoing basis.

GA12. **Employability Options:** This programme will also help students to enhance their employability for jobs in different sectors.

5. QUALIFICATION DESCRIPTORS (QDs)

The qualification descriptor suggests the generic outcomes and attributes to be obtained while obtaining the degree of B.Pharmacy. The qualification descriptors indicate the academic standards on the basis of following factors:

1. Level of knowledge
2. Understanding
3. Skills
4. Competencies and attitudes
5. Values.

These parameters are expected to be attained and demonstrated by the learners after becoming graduates in this programme. The learning experiences and assessment procedures should be so designed that every graduate may achieve the programme

learning outcomes with equal opportunity irrespective of the class, gender, community and regions. Each graduate in Pharmacy should be able to:

- Demonstrate fundamental systematic knowledge and its applications. It should also enhancethe subject specific knowledge and help in creating jobs in various sectors.
- Demonstrate educational skills in areas of their programme.
- Apply knowledge, understanding and skills to identify the difficult/unsolved problemsin courses of theirprogramme and to collect the required information in possible range of sourcesand try to analyse and evaluate these problems using appropriate methodologies.
- Apply one's disciplinary knowledge and skills in newer domains and uncharted areas.
- Identify challenging problems and obtain well-defined solutions.
- Exhibit subject-specific transferable knowledge relevant to job trends and employment opportunities.

6. PROGRAMME LEARNING OUTCOMES (POs)

The aim of the course is to provide comprehensive, individually focused training that prepares the students for providing a quality, so that at the end of the course he/she will be able to perform the following:

PO1: Capability of demonstrating comprehensive knowledge of B.Pharmacy programme.

PO2: Ability to employ critical thinking in understanding the concepts in every area of B.Pharmacy programme.

PO3: Ability to analyze the results and apply them in various problems.

PO4: Capability to solve problems by using research-based knowledge and research methods.

PO5: Create, select, and apply appropriate techniques, resources, and modern science and IT tools.

PO6: Ability to work independently and do in-depth study of various notions of courses.

PO7: Ability to communicate various concepts of B.Pharmacy programmeeffectively using examples and their pharmaceutical visualizations.

PO8: Possess knowledge of the values and beliefs of multiple cultures and a global perspective; and capability to effectively engage in a multicultural society and interact respectfully with diverse groups.

PO9: Self-motivating and inspiring team members to engage with the team objectives by using management skills.

PO10: Ability to think, acquire knowledge and skills through logical reasoning and to inculcate the habit of self-learning.

PO11: Ability to identify unethical behavior and adopting objective, unbiased and truthful actions in all aspects of their programme.

PO12: This programme will also help students to enhance their employability for jobs in different sectors.

Mapping of Graduate Attributes (GAs) and Programme Learning Outcomes (POs):

	GA1	GA2	GA3	GA4	GA5	GA 6	GA7	GA 8	GA 9	GA 10	GA 11	GA 12
PO1	■											
PO2		■										
PO3			■									
PO4				■								
PO5					■							
PO6						■						
PO7							■					
PO8								■				
PO9									■			
PO10										■		
PO11											■	
PO12												■

7. PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO1. **Education:** Students will be having sound capacity in pharmaceutical sciences and will be equipped with knowledge required in Drug store,Pharmaceutical industries and/or institutes.

PSO2. **Technical Skill Competencies:** To provide students with competence of technical skills in various subjects include Pharmaceutics, Pharmaceutical Chemistry, Pharmacology and Pharmacognosy enabling them to fulfill the requirements of Drug store, Pharmaceutical Industries, Community and Hospital Pharmacy and also to pursue higher studies.

PSO3. **Evaluation:** Students will be able to assess pros and cons, benefits and deficiencies of the subject matters to learned pharmaceutical technologies they studied and they observed in the field of pharmaceutical sciences.

8. TYPES OF COURSES

1. Courses in a programme may be of four kinds: Core, Elective, Ability Enhancement and Skill **Enhancement**.

a) Core Course:-

There may be a Core Course in every semester. This is the course which is to be compulsorily studied by a student as a requirement to complete the programme in a said discipline of study.

b) Elective Course:-

Elective course is a course which can be chosen from a pool of papers. It may be

- Supportive to the discipline of study

- Providing an expanded scope
- Enabling an exposure to some other discipline/domain
- Nurturing student's proficiency/skill.

An Elective Course may be 'Discipline Centric/Specific' & Generic Elective

(i) Discipline Centric/Specific Elective (DSE): Elective courses offered under the main discipline/subject of study is referred to as Discipline Centric/Specific.

(ii) Generic/Open Elective (GE): An elective course chosen from an unrelated discipline/subject is called Generic/Open Elective. These electives will be focusing on those courses which add generic proficiency of students.

c) Ability Enhancement Compulsory Courses (AECC):-

AECC courses are based upon the content that leads to knowledge enhancement, for example: English Communication, Environment Science/ Studies, etc.

d) Skill Enhancement Courses (SEC):-

SEC Courses provide value based and/or skill based knowledge and may content both Theory and Lab/Training/Field Work. The main purpose of these courses is to provide students life- skills in hands- on mode so as to increase their employability.

e) Anandam Courses:

University has taken initiative for "Fostering Social Responsibility & Community Engagement. Anandam Courses provided a holistic and functional approach to community engagement, encompassing all the three functions of HEIs—teaching, research and service.

f) Jeevan Kaushal Courses:

The program aims to turn the students into professionals who can succeed in today`s complex environment by having mastery in all the relevant areas mentioned in the course structure of Life Skills Module.

g) MOOC's Courses:

Moocs (Massive open online courses) provide an affordable and flexible way to learn new skills, advance your career and deliver quality educational experiences at scale.

2. LIST OF COURSES (B.Pharma)

A. Core Courses

- Human Anatomy and Physiology I– Theory
- Pharmaceutical Analysis I – Theory
- Pharmaceutics I – Theory
- Pharmaceutical Inorganic Chemistry –Theory
- Human Anatomy and Physiology–Practical
- Pharmaceutical AnalysisI–Practical
- PharmaceuticsI–Practical
- PharmaceuticsI–Practical
- Human Anatomy and Physiology II – Theory

- Pharmaceutical Organic Chemistry I – Theory
- Biochemistry – Theory
- Pathophysiology – Theory
- Human Anatomy and PhysiologyII–Practical
- Pharmaceutical Organic Chemistry-I–Practical
- Biochemistry– Practical
- Computer Applications in Pharmacy–Practical*
- Physical Pharmaceutics I – Theory
- Pharmaceutical Microbiology – Theory
- Pharmaceutical Engineering – Theory
- Pharmaceutical Organic Chemistry II–Practical
- Physical Pharmaceutics I– Practical
- Pharmaceutical Microbiology– Practicl
- Pharmaceutical Engineering– Practical
- Pharmaceutical Organic Chemistry III– Theory
- Medicinal Chemistry I – Theory
- Physical Pharmaceutics II – Theory
- Pharmacology I – Theory
- Pharmacognosy and Phytochemistry I– Theory
- Medicinal Chemistry I–Practical
- Physical Pharmaceutics II– Practical
- PharmacologyI–Practical
- Pharmacognosy I– Practical
- Medicinal Chemistry II – Theory
- Industrial PharmacyI– Theory
- Pharmacology II – Theory
- Pharmacognosy and Phytochemistry II– Theory
- Pharmaceutical Jurisprudence – Theory
- Industrial Pharmacy I–Practical
- Pharmacology II– Practical
- Pharmacognosy and Phytochemistry-II– Practical
- Medicinal Chemistry III – Theory
- Pharmacology III – Theory
- Herbal Drug Technology – Theory
- Bio-pharmaceutics and Pharmacokinetics –Theory
- Pharmaceutical Biotechnology – Theory
- Quality Assurance –Theory
- Medicinal chemistry III–Practical

- Pharmacology III–Practical
- Herbal Drug Technology–Practical
- Instrumental Methods of Analysis – Theory
- Industrial Pharmacy II – Theory
- Pharmacy Practice – Theory
- Novel Drug Delivery System – Theory
- Instrumental Methods of Analysis–Practical
- Practice School*
- Bio-statistics and Research Methodology
- Social and Preventive Pharmacy

B. Elective Courses (Discipline Centric)

- Remedial Biology
- Remedial Mathematics – Theory*
- Communication skills–Practical*
- Remedial Biology–Practical*
- Pharma Marketing Management
- Pharmaceutical Regulatory Science
- Pharmacovigilance
- Quality Control and Standardization of Herbals
- Computer Aided Drug Design
- Cell and Molecular Biology
- Cosmetic Science
- Experimental Pharmacology
- Advanced Instrumentation Techniques
- Dietary Supplements and Nutraceutical

C. Ability Enhancement Compulsory Course (AECC)

- Communication skills – Theory *
- Universal Human Values
- Leadership & Management Skills
- Environmental sciences – Theory
- Professional Skills

D. CEC COURCE

- ANANDAM

E. Skill Enhancement Course (SEC)

- Computer Applications in Pharmacy – Theory *
- Computer Applications in Pharmacy–Practical*

9. PROGRAM STRUCTURE (B.PHARM.)

Semester – I

Code No.	Paper	Type	Internal Marks	External Marks	Total Marks	L	T/P	Credit
BP101T	Human Anatomy and Physiology I– Theory	CORE	25	75	100	3	1	4
BP102T	Pharmaceutical Analysis I – Theory	CORE	25	75	100	3	1	4
BP103T	Pharmaceutics I – Theory	CORE	25	75	100	3	1	4
BP104T	Pharmaceutical Inorganic Chemistry –Theory	CORE	25	75	100	3	1	4
BP105T	Communication skills – Theory *	AECC	15	35	50	2	-	2
BP106RBT	Remedial Biology	ELECTIVE	15	35	50	2	-	2
BP106RMT	Remedial Mathematics – Theory*	ELECTIVE	15	35	50	2	-	2
BP107P	Human Anatomy and Physiology– Practical	CORE	15	35	50	4	-	2
BP108P	Pharmaceutical AnalysisI–Practical	CORE	15	35	50	4	-	2
BP109P	PharmaceuticsI– Practical	CORE	15	35	50	4	-	2
BP110P	Pharmaceutical Inorganic Chemistry– Practical	CORE	15	35	50	4	-	2
BP111P	Communication skills–Practical*	ELECTIVE	10	15	25	2	-	1
BP112RBP	Remedial Biology– Practical*	ELECTIVE	10	15	25	2	-	1
BP 113	ANANDAM	CEC	50	50	100	1	-	2
	TOTAL		**235/250$/260#**	**540/575$/590#**	**775/825$/850#**			**29/31$/32#**

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

$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)**

Semester - II

Code No.	Paper	Type	Internal Marks	External Marks	Total Marks	L	T/P	Credit
BP201T	Human Anatomy and Physiology II – Theory	CORE	25	75	100	3	1	4
BP202T	Pharmaceutical Organic Chemistry I – Theory	CORE	25	75	100	3	1	4
BP203T	Biochemistry – Theory	CORE	25	75	100	3	1	4
BP204T	Pathophysiology – Theory	CORE	25	75	100	3	1	4
BP205T	Computer Applications in Pharmacy – Theory *	SEC	25	50	75	3	-	3
BP206T	Environmental sciences – Theory *	AECC	25	50	75	3	-	3
BP207P	Human Anatomy and PhysiologyII–Practical	CORE	15	35	50	4	-	2
BP208P	Pharmaceutical Organic Chemistry-I–Practical	CORE	15	35	50	4	-	2
BP209P	Biochemistry– Practical	CORE	15	35	50	4	-	2
BP210P	Computer Applications in Pharmacy–Practical*	SEC	10	15	25	2	-	1
BP 211	ANANDAM	CEC	50	50	100	1	-	2
	TOTAL		255	570	825			31

Semester - III

Code No.	Paper	Type	Internal Marks	External Marks	Total Marks	L	T/P	Credit
BP301T	Pharmaceutical Organic Chemistry II – Theory	CORE	25	75	100	3	1	4
BP302T	Physical Pharmaceutics I – Theory	CORE	25	75	100	3	1	4
BP303T	Pharmaceutical Microbiology – Theory	CORE	25	75	100	3	1	4
BP304T	Pharmaceutical Engineering – Theory	CORE	25	75	100	3	1	4
BP305P	Pharmaceutical Organic Chemistry II–Practical	CORE	15	35	50	4	-	2
BP306P	Physical Pharmaceutics I– Practical	CORE	15	35	50	4	-	2
BP307P	Pharmaceutical Microbiology– Practical	CORE	15	35	50	4	-	2
BP308P	Pharmaceutical Engineering– Practical	CORE	15	35	50	4	-	2
BP309	Universal Human Values	AECC	30	70	100	2	-	2
BP310	Leadership & Management Skills	AECC	30	70	100	2	-	2
BP 311	ANANDAM	CEC	50	50	100	1	-	2
	Total		**270**	**630**	**900**			**30**

Semester - IV

Code No.	Paper	Type	Internal Marks	External Marks	Total Marks	L	T/P	Credit
BP401T	Pharmaceutical Organic Chemistry III– Theory	CORE	25	75	100	3	1	4
BP402T	Medicinal Chemistry I – Theory	CORE	25	75	100	3	1	4
BP403T	Physical Pharmaceutics II – Theory	CORE	25	75	100	3	1	4
BP404T	Pharmacology I – Theory	CORE	25	75	100	3	1	4
BP405T	Pharmacognosy and Phytochemistry I– Theory	CORE	25	75	100	3	1	4
BP406P	Medicinal Chemistry I– Practical	CORE	15	35	50	4	-	2
BP407P	Physical Pharmaceutics II– Practical	CORE	15	35	50	4	-	2
BP408P	PharmacologyI–Practical	CORE	15	35	50	4	-	2
BP409P	Pharmacognosy I– Practical	CORE	15	35	50	4	-	2
BP 410	ANANDAM	CEC	50	50	100	1	-	2
BP 411	Research Methodology & Biostatics	CORE	50	50	100	1	-	2
	TOTAL		**285**	**615**	**900**			**32**

Semester - V

Code No.	Paper	Type	Internal Marks	External Marks	Total Marks	L	T/P	Credit
BP501T	Medicinal Chemistry II – Theory	CORE	25	75	100	3	1	4
BP502T	Industrial PharmacyI– Theory	CORE	25	75	100	3	1	4
BP503T	Pharmacology II – Theory	CORE	25	75	100	3	1	4
BP504T	Pharmacognosy and Phytochemistry II– Theory	CORE	25	75	100	3	1	4
BP505T	Pharmaceutical Jurisprudence – Theory	CORE	25	75	100	3	1	4
BP506P	Industrial Pharmacy I– Practical	CORE	15	35	50	4	-	2
BP507P	Pharmacology II– Practical	CORE	15	35	50	4	-	2
BP508P	Pharmacognosy and Phytochemistry-II– Practical	CORE	15	35	50	4	-	2
BP509	Professional Skills	AECC	30	70	100	2	-	2
BP 510	ANANDAM	CEC	50	50	100	1	-	2
	Total		**250**	**600**	**850**			**30**

Semester - VI

Code No.	Paper	Type	Internal Marks	External Marks	Total Marks	L	T/P	Credit
BP601T	Medicinal Chemistry III – Theory	CORE	25	75	100	3	1	4
BP602T	Pharmacology III – Theory	CORE	25	75	100	3	1	4
BP603T	Herbal Drug Technology – Theory	CORE	25	75	100	3	1	4
BP604T	Bio-pharmaceutics and Pharmacokinetics –Theory	CORE	25	75	100	3	1	4
BP605T	Pharmaceutical Biotechnology – Theory	CORE	25	75	100	3	1	4
BP606T	Quality Assurance –Theory	CORE	25	75	100	3	1	4
BP607P	Medicinal chemistry III– Practical	CORE	15	35	50	4	-	2
BP608P	Pharmacology III–Practical	CORE	15	35	50	4	-	2
BP609P	Herbal Drug Technology– Practical	CORE	15	35	50	4	-	2
BP 610	ANANDAM	CEC	50	50	100	1	-	2
	TOTAL		**245**	**605**	**850**			**32**

Semester - VII

Code No.	Paper	Type	Internal Marks	External Marks	Total Marks	L	T/P	Credit
BP701T	Instrumental Methods of Analysis – Theory	CORE	25	75	100	3	1	4
BP702T	Industrial Pharmacy II – Theory	CORE	25	75	100	3	1	4
BP703T	Pharmacy Practice – Theory	CORE	25	75	100	3	1	4
BP704T	Novel Drug Delivery System – Theory	CORE	25	75	100	3	1	4
BP705P	Instrumental Methods of Analysis –Practical	CORE	15	35	50	4	-	2
BP706PS	Practice School*	CORE	25	125	150	12	-	6
BP 707	ANANDAM	CEC	50	50	100	1	-	2
	TOTAL		**190**	**510**	**700**			**26**

* Non University Examination (NUE)

Semester - VIII

Code No.	Paper	Type	Internal Marks	External Marks	Total Marks	L	T/P	Credit
BP801T	Bio-statistics and Research Methodology	CORE	25	75	100	3	1	4
BP802T	Social and Preventive Pharmacy	CORE	25	75	100	3	1	4
BP803ET	Pharma Marketing Management	ELECTIVE	50	150	200	6	2	8
BP804ET	Pharmaceutical Regulatory Science	ELECTIVE						
BP805ET	Pharmacovigilance	ELECTIVE						
BP806ET	Quality Control and Standardization of Herbals	ELECTIVE						
BP807ET	Computer Aided Drug Design	ELECTIVE						
BP808ET	Cell and Molecular Biology	ELECTIVE						
BP809ET	Cosmetic Science	ELECTIVE						
BP810ET	Experimental Pharmacology	ELECTIVE						
BP811ET	Advanced Instrumentation Techniques	ELECTIVE						
BP812ET	Dietary Supplements and Nutraceutical	ELECTIVE						
BP813PW	Project Work		-	150	150	12		6
BP 814	ANANDAM	CEC	50	50	100	1	-	2
	TOTAL		**150**	**500**	**650**			**24**

Table-IX: Semester wise credits distribution

Semester	Credit Points
I	**29/31$/32#**
II	31
III	30
IV	32
V	30
VI	32
VII	26
VIII	24
Extracurricular/ Co curricular activities	01*
Total credit points for the program	**235/237$/238#**

* 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**.**

Note:

- A student is required to obtain min. 50% marks in individual paper to pass.
- The total credit of **B.Pharm** Programme is **233/235$/236#**. The minimum credit required for award of degree shall be **233/235$/236#** respectively
- The credit relaxation will be applicable only on the elective course (i.e. the student can opt out only elective subject).
- Out of the total credits, 20% of the credits may be earned by the student through MOOCs (SWAYAM, NPTEL, Coursera etc.). However, the choice of online courses to be approved in advance by Dean/ HoD and Coordinator SWAYAM keeping in view the latest guidelines of the UGC/ respective regulatory body guidelines.

10. COURSE-WISE LEARNING OBJECTIVES, STRUCTURES AND OUTCOMES (CLOSOs)

Course learning outcomes of each course in B.Pharmacy as a subject have been enshrined in the end of course contents of each course with their objectives those are in the beginning of the every course.

Programme scheme with the Core Course, Elective Course, Ability Enhancement Compulsory Courses, Skill Enhancement Courses etc.

Semester – I

Code No.	Paper	Type	Internal Marks	External Marks	Total Marks	L	T/P	Credit
BP101T	Human Anatomy and Physiology I– Theory	CORE	25	75	100	3	1	4
BP102T	Pharmaceutical Analysis I – Theory	CORE	25	75	100	3	1	4
BP103T	Pharmaceutics I – Theory	CORE	25	75	100	3	1	4
BP104T	Pharmaceutical Inorganic Chemistry –Theory	CORE	25	75	100	3	1	4
BP105T	Communication skills – Theory *	AECC	15	35	50	2	-	2
BP106RBT	Remedial Biology	ELECTIVE	15	35	50	2	-	2
BP106RMT	Remedial Mathematics – Theory*	ELECTIVE	15	35	50	2	-	2
BP107P	Human Anatomy and Physiology– Practical	CORE	15	35	50	4	-	2
BP108P	Pharmaceutical AnalysisI–Practical	CORE	15	35	50	4	-	2
BP109P	PharmaceuticsI– Practical	CORE	15	35	50	4	-	2
BP110P	Pharmaceutical Inorganic Chemistry– Practical	CORE	15	35	50	4	-	2
BP111P	Communication skills–Practical*	ELECTIVE	10	15	25	2	-	1
BP112RBP	Remedial Biology– Practical*	ELECTIVE	10	15	25	2	-	1
BP 113	ANANDAM	CEC	50	50	100	1	-	2
	TOTAL		**235/250$/260#**	**540/575$/590#**	**775/825$/850#**			**29/31$/32#**

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

$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)**

BP101T. HUMAN ANATOMY AND PHYSIOLOGY-I (Theory)

45 Hours

Scope/Objective:

This subject is designed to impart fundamental knowledge on the structure andfunctions of the various systems of the human body. It also helps in understanding both homeostatic mechanis ms. The subject provides the basic knowledge required to understand the various disciplines of pharmacy.

Course Content: **10 hours**

Unit I

Introduction to human body: Definition and scope of anatomy and physiology, levels of structural organization and body systems, basic life processes, homeostasis, basic anatomical terminology.

Cellular level of organization: Structure and functions of cell, transport across cell membrane, cell division, cell junctions. General principles of cell communication, intracellular signaling pathway activation by extracellular signal molecule, Forms of intracellular signaling: a) Contact-dependent b) Paracrine c) Synaptic d) Endocrine

Tissue level of organization: Classification of tissues, structure, location and functions of epithelial, muscular and nervous and connective tissues.

Unit II **10 hours**

Integumentary system Structure and functions of skin

Skeletal system: Divisions of skeletal system, types of bone, salient features and functions of bones of axial and appendicular skeletal systemOrganization of skeletal muscle, physiology of muscle contraction, neuromuscular junction

JointsStructural and functional classification, types of joints movements and its articulation

Unit III **10 hours**

Body fluids and blood : Body fluids, composition and functions of blood, hemopoeisis, formation of hemoglobin, anemia, mechanisms of coagulation, blood grouping, Rh factors, transfusion, its significance and disorders of blood, Reticulo endothelial system.

Lymphatic system: Lymphatic organs and tissues, lymphatic vessels, lymph circulation and functions of lymphatic system

Unit IV **08 hours**

Peripheral nervous system: Classification of peripheral nervous system: Structure and functions of sympathetic and parasympathetic nervous system. Origin and functions of spinal and cranial nerves.

Special senses: Structure and functions of eye, ear, nose and tongue and their disorders.

Unit V **07 hours**

Cardiovascular system : Heart – anatomy of heart, blood circulation, blood vessels, structure and functions of artery, vein and capillaries, elements of conduction system of heart and heart beat, its regulation by autonomic nervous system, cardiac output, cardiac cycle. Regulation of blood pressure, pulse, electrocardiogram and disorders of heart.

Recommended Books (Latest Editions)

1. Essentials of Medical Physiology by K. Sembulingam and P. Sembulingam. Jaypee brother's medical publishers, New Delhi.
2. Anatomy and Physiology in Health and Illness by Kathleen J.W. Wilson, Churchill Livingstone, New York
3. Physiological basis of Medical Practice-Best and Tailor. Williams & Wilkins Co,Riverview,MI USA
4. Text book of Medical Physiology- Arthur C,Guyton andJohn.E. Hall. Miamisburg, OH, U.S.A.
5. Principles of Anatomy and Physiology by Tortora Grabowski. Palmetto, GA, U.S.A.
6. Textbook of Human Histology by Inderbir Singh, Jaypee brother's medical publishers, New Delhi.
7. Textbook of Practical Physiology by C.L. Ghai, Jaypee brother's medical publishers, New Delhi.
8. Practical workbook of Human Physiology by K. Srinageswari and Rajeev Sharma, Jaypee brother's medical publishers, New Delhi.

Reference Books (Latest Editions)

1. Physiological basis of Medical Practice-Best and Tailor. Williams & Wilkins Co, Riverview, MI USA
2. Text book of Medical Physiology- Arthur C, Guyton and John. E. Hall. Miamisburg, OH, U.S.A.
3. Human Physiology (vol 1 and 2) by Dr. C.C. Chatterrje ,Academic Publishers Kolkata

COURSE OUTCOMES-

By the end of this course, students will be able to:

CO	Statements
CO1	To understand basic terminologies used in Anatomy and physiology as well as prefixes and suffixes used to identify body parts and directional terms.
CO2	To identify the various tissues and organs of the different systems of the human body
CO3	An ability to describe the structure and functions of various organs of the human body
CO4	Understand the composition and functions of blood component and mechanism of bloodcoagulation.
CO5	Understand the anatomy, physiology & disorders of skeletal muscle, smooth muscle, cardiovascular system, lymphatic system and digestivesystem.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Anatomy LAB
CD3	Seminars
CD4	Self- learning advice using Internets
CD5	Hospital visit & OPD

Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Learning Outcomes

Course Outcomes	BLOOMS LEVEL	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	P0 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1	L1	H	M	M	-	H	H	H	-	H	H	-	L	M	H	M
CO2	L3	H	H	M	-	M	M	H	-	H	H	-	L	H	M	M
CO3	L4	H	M	_	L	-	M	H	-	M	H	-	L	H	L	L
CO4	L4	H	H	_	L	M	M	H	-	H	H	-	L	M	M	L
CO5	L3	H	M	_	-	M	L	H	-	M	H	-	L	H	L	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3
CD2	Anatomy LAB	CO2
CD3	Seminars	CO1, CO5
CD4	Self- learning advice using Internets	CO1
CD5	Hospital visit & OPD	CO2,CO3,CO4

BP102T. PHARMACEUTICAL ANALYSIS (Theory)

45 Hours

Scope/Objective:

This course deals with the fundamentals of analytical chemistry and principles ofelectrochemical analysis of drugs

Course Content:

Unit-I **10 Hours**

(a) Pharmaceutical analysis- Definition and scope

i) Different techniques of analysis

ii) Methods of expressing concentration

iii) Primary and secondary standards.

iv) Preparation and standardization of various molar and normal solutions-Oxalic acid, sodium hydroxide, hydrochloric acid, sodium thiosulphate, sulphuric acid, potassium permanganate and ceric ammonium sulphate

(b) **Errors:** Sources of errors, types of errors, methods of minimizing errors,accuracy, precision and significant figures

(c) Pharmacopoeia, Sources of impurities in medicinal agents, limit tests.

Unit-II **10 Hours**

Acid base titration: Theories of acid base indicators, classification ofacid base titrations and theory involved in titrations of strong, weak, and very weak acids and bases, neutralization curves

Non aqueous titration: Solvents, acidimetry and alkalimetry titration andestimation of Sodium benzoate and Ephedrine HCl

Unit-III **10 Hours**

Precipitation titrations: Mohr's method, Volhard's, Modified Volhard's, Fajans method, estimation of sodium chloride.

Complexometric titration: Classification, metal ion indicators, maskingand demasking reagents, estimation of Magnesium sulphate, and calcium gluconate.

Gravimetry: Principle and steps involved in gravimetric analysis. Purityof the precipitate: co-precipitation and post precipitation, Estimation of barium sulphate.Basic Principles, methods and application of diazotisation titration.

Unit-IV **08 Hours**

Redox titrations

(a) Concepts of oxidation and reduction

(b) Types of redox titrations (Principles and applications)

Cerimetry, Iodimetry, Iodometry, Bromatometry, Dichrometry, Titration with potassium iodate

Unit-V **07 Hours**

Electrochemical methods of analysis

Conductometry- Introduction, Conductivity cell, Conductometrictitrations, applications.

Potentiometry - Electrochemical cell, construction and workingof reference (Standard hydrogen, silver chloride electrode and calomel electrode) and indicator electrodes (metal electrodes and glass electrode), methods to determine end point of potentiometric titration and applications.

Polarography - Principle, Ilkovic equation, construction andworking of dropping mercury electrode and rotating platinum electrode, application.

Recommended Books: (Latest Editions)

1. A.H. Beckett & J.B. Stenlake's, Practical Pharmaceutical Chemistry Vol I & II, Stahlone Press of University of London
2. A.I. Vogel, Text Book of Quantitative Inorganic analysis
3. P. Gundu Rao, Inorganic Pharmaceutical Chemistry
4. Bentley and Driver's Textbook of Pharmaceutical Chemistry
5. John H. Kennedy, Analytical chemistry principles
6. Indian Pharmacopoeia.

COURSE OUTCOMES-

By the end of this course, students will be able to:

CO	**Statements**
CO1	Illuminate relevance & significance of Analytical Chemistry to Pharmaceutical Sciences.
CO2	Clarify basic principles of data treatment and datahandling.
CO3	Explain basic concepts and principles of aqueous acid base titrations and clarify need of non-aqueous acid basetitrations.
CO4	Clarify different terms, basic principles and reaction conditions of precipitation, Complexion and redoxreaction.
CO5	Understand and explain the difference between precipitation and gravietricanalysis.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Physiology LAB
CD3	Seminars
CD4	Self- learning advice using Internets
CD5	Industrial lab visit

Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Learning Outcomes

POs/COs	**Blooms Level**	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO10**	**PO11**	**PO12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	L1	H	-	-	M	H	-	M	L	M	H	-	M	M	L	M
CO2	L2	H	M	H	H	H	M	H	M	H	H	-	-	M	M	L
CO3	L2	M	H	H	-	H	-	M	L	H	M	L	-	H	L	L
CO4	L3	H	M	-	-	H	H	-	-	H	H	-	H	M	M	L
CO5	L3	H	-	-	M	-	-	M	-	-	M	-	-	M	L	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2
CD2	Physiology LAB	CO1,CO5
CD3	Seminars	CO1, CO2
CD4	Self- learning advice using internets	CO1,CO2
CD5	Industrial lab visit	CO4,CO3,CO5

BP103T. PHARMACEUTICS- I (Theory)

45 Hours

Scope/Objective: This course is designed to impart a fundamental knowledge on the preparatorypharmacy with arts and science of preparing the different conventional dosage forms.

Course Content: **10 Hours**

Unit – I

Historical background and development of profession of pharmacy: Historyof profession of Pharmacy in India in relation to pharmacy education, industry and organization, Pharmacy as a career, Pharmacopoeias: Introduction to IP, BP, USP and Extra Pharmacopoeia.

Dosage forms: Introduction to dosage forms, classification and definitions

Prescription: Definition, Parts of prescription, handling of Prescription andErrors in prescription.

Posology: Definition, Factors affecting posology. Pediatric dose calculationsbased on age, body weight and body surface area.

Unit – II **10 Hours**

Pharmaceutical calculations: Weights and measures–Imperial & Metricsystem, Calculations involving percentage solutions, alligation, proof spirit and isotonic solutions based on freezing point and molecular weight.

Powders: Definition, classification, advantages and disadvantages,Simple &compound powders – official preparations, dusting powders, effervescent, efflorescent and hygroscopic powders, eutectic mixtures. Geometric dilutions.

Liquid dosage forms: Advantages and disadvantages of liquid dosage forms.Excipients used in formulation of liquid dosage forms. Solubility enhancement techniques

Unit – III **08 Hours**

Monophasic liquids: Definitions and preparations of Gargles, Mouthwashes, Throat Paint, Eardrops, Nasal drops, Enemas, Syrups, Elixirs, Liniments and Lotions.

Biphasic liquids:

Suspensions: Definition, advantages and disadvantages, classifications, Preparation of suspensions; Flocculated and Deflocculated suspension & stability problems and methods to overcome.

Emulsions: Definition, classification, emulsifying agent, test for the identificationof type ofEmulsion, Methods of preparation & stability problems and methods to overcome.

Unit – IV **08 Hours**

Suppositories: Definition, types, advantages and disadvantages, types of bases, methods of preparations. Displacement value & its calculations, evaluation of suppositories.

Pharmaceutical incompatibilities: Definition, classification, physical, chemicaland therapeutic incompatibilities with examples.

UNIV – V **07 Hours**

Semisolid dosage forms: Definitions, classification, mechanisms and factorsinfluencing dermal penetration of drugs. Preparation of ointments, pastes, creams and gels. Excipients used in semi solid dosage forms. Evaluation of semi solid dosages forms.

Recommended Books: (Latest Editions)

1. H.C. Ansel et al., Pharmaceutical Dosage Form and Drug Delivery System, Lippincott Williams and Walkins, New Delhi.
2. Carter S.J., Cooper and Gunn's-Dispensing for Pharmaceutical Students, CBS publishers, New Delhi.
3. M.E. Aulton, Pharmaceutics, The Science& Dosage Form Design, Churchill Livingstone, Edinburgh.
4. Indian pharmacopoeia.
5. British pharmacopoeia.
6. Lachmann. Theory and Practice of Industrial Pharmacy,Lea& Febiger Publisher, The University of Michigan.
7. Alfonso R. Gennaro Remington. The Science and Practice of Pharmacy, Lippincott Williams, New Delhi.
8. Carter S.J., Cooper and Gunn's. Tutorial Pharmacy, CBS Publications, New Delhi.
9. E.A. Rawlins, Bentley's Text Book of Pharmaceutics, English Language Book Society, Elsevier Health Sciences, USA.
10. Isaac Ghebre Sellassie: Pharmaceutical Pelletization Technology, Marcel Dekker, INC, New York.
11. Dilip M. Parikh: Handbook of Pharmaceutical Granulation Technology, Marcel Dekker, INC, New York.
12. Francoise Nieloud and Gilberte Marti-Mestres: Pharmaceutical Emulsions and Suspensions, Marcel Dekker, INC, New York.

COURSE OUTCOMES-

By the end of this course, students will be able to:

CO1	Know the history of profession of pharmacy
CO2	Understand the basics of different dosage forms, pharmaceutical incompatibilities and pharmaceutical calculations.
CO3	Students will learn aboutthe professional way of handling the prescription
CO4	Students will gain knowledge about fundamentals of Pharmaceutics.
CO5	Understand themethods of preparation of various conventional dosage forms.

Course Delivery Methods (CD)	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Experiments, Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table: Mapping of Course Outcomes with Program Learning Outcomes

CO	Bloom Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L2	H	H	H	-	-	-	-	M	M	-	H	L	H	H	M
CO2	L2	H	M	H	L	L	-	-	M	L	-	H	L	M	M	L
CO3	L3	H	H	H	L	M	-	-	M	M	-	H	M	H	H	M
CO4	L3	H	M	H	L	M	-	-	M	M	-	H	H	M	M	L
CO5	L3	M	M	M	L	M	-	L	M	L	-	M	H	M	L	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD:

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1, CO2, CO3, CO4, CO5
CD3	Experiments, Seminars	CO3, CO4, CO5
CD4	Self- learning advice using internets	CO4, CO5
CD5	Industrial visit	CO5

BP104T. PHARMACEUTICAL INORGANIC CHEMISTRY (Theory)

45 Hours

Scope/Objective:

This subject deals with the monographs of inorganic drugs and pharmaceuticals.

Course Content:

Unit I **10 Hours**

Impurities in pharmaceutical substances: History of Pharmacopoeia, Sources and types of impurities, principle involved in the limit test for Chloride, Sulphate, Iron, Arsenic, Lead and Heavy metals, modified limit test for Chloride and Sulphate

General methods of preparation, assay for the compounds superscripted

With **asterisk (*),** properties and medicinal uses of inorganic compounds belonging to the following classes

Unit II **10 Hours**

Acids, Bases and Buffers: Buffer equations andbuffers in pharmaceutical systems, preparation, solutions, measurements of tonicity, calculations isotonicity.buffer capacity in general, stability, buffered isotonic and methods of adjusting

Major extra and intracellular electrolytes: Functions of majorphysiological ions, Electrolytes used in the replacement therapy: Sodium chloride*, Potassium chloride, Calcium gluconate* and Oral Rehydration Salt (ORS), Physiological acid base balance.

Dental products: Dentifrices, role of fluoride in the treatment of dentalcaries, Desensitizing agents, Calcium carbonate, Sodium fluoride, and Zinc eugenol cement.

Unit III **10 Hours**

Gastrointestinal agents

Acidifiers: Ammonium chloride* and Dil. HCl

Antacid: Ideal properties of antacids, combinations of antacids, Sodium Bicarbonate*, Aluminum hydroxide gel, Magnesium hydroxide mixture

Cathartics: Magnesium sulphate, Sodium orthophosphate, Kaolin andBentonite

Antimicrobials: Mechanism, classification, Potassium permanganate, Boricacid, Hydrogen peroxide*, Chlorinated lime*, Iodine and its preparations

Unit IV **08 Hours**

Miscellaneous compounds

Expectorants: Potassium iodide, Ammonium chloride*.

Emetics: Copper sulphate*, Sodium potassium tartarate

Haematinics: Ferrous sulphate*, Ferrous gluconate

Poison and Antidote: Sodium thiosulphate*, Activated charcoal, Sodiumnitrite333

Astringents: Zinc Sulphate, Potash Alum

Unit V **07 Hours**

Radiopharmaceuticals: Radio activity, Measurement of radioactivity,Properties of α, β, γ radiations, Half life, radio isotopes and study of radio isotopes - Sodium iodide I^{131}, Storage conditions, precautions & pharmaceutical application of radioactive substances.

Recommended Books (Latest Editions)

1. A.H. Beckett & J.B. Stenlake's, Practical Pharmaceutical Chemistry Vol I & II, Stahlone Press of University of London, 4th edition.
2. A.I. Vogel, Text Book of Quantitative Inorganic analysis
3. P. Gundu Rao, Inorganic Pharmaceutical Chemistry, 3rd Edition
4. M.L Schroff, Inorganic Pharmaceutical Chemistry
5. Bentley and Driver's Textbook of Pharmaceutical Chemistry
6. Anand & Chatwal, Inorganic Pharmaceutical Chemistry
7. IndianPharmacopoeia

COURSE OUTCOMES-

By the end of this course, students will be able to:

CO1	Understand the importance of medicinal and pharmaceutical importance of inorganic compounds.
CO2	Understand the chemistry of drugs with respect to their biological activity.
CO3	Students will learn about inorganic chemistry&Know the different properties of inorganic chemicals.
CO4	Students will understand the sources of impurities and methods to determine the impurities in inorganic drugs and pharmaceuticals.
CO5	Understand the importance of inorganic chemicals in pharmacy.

Course Delivery Methods (CD)	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Experiments, Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table: Mapping of Course Outcomes with Program Learning Outcomes

CO	Bloom Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L2	H	H	H	-	-	-	-	M	M	-	H	L	M	L	M
CO2	L2	H	M	H	L	L	-	-	M	L	-	H	L	M	L	L
CO3	L3	H	H	H	L	M	-	-	M	M	-	H	M	H	H	-
CO4	L3	H	M	H	L	M	-	-	M	M	-	H	H	M	L	L
CO5	L3	M	M	M	L	M	-	L	M	L	-	M	H	M	L	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD:

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1, CO2, CO3, CO4, CO5
CD3	Experiments, Seminars	CO3, CO4, CO5
CD4	Self- learning advice using internets	CO4, CO5
CD5	Industrial visit	CO5

BP105T.COMMUNICATION SKILLS (Theory)

30 Hours

Scope/Objective:

This course will prepare the young pharmacy student to interact effectively withdoctors, nurses, dentists, physiotherapists and other health workers. At the end of this course the student will get the soft skills set to work cohesively with the team as a team player and will add value to the pharmaceutical business.

Course content:

Unit – I **07 Hours**

Communication Skills: Introduction, Definition, The Importance of Communication, The Communication Process – Source, Message, Encoding, Channel, Decoding, Receiver, Feedback, Context

Barriers to communication: Physiological Barriers, Physical Barriers, CulturalBarriers, Language Barriers, Gender Barriers, Interpersonal Barriers, Psychological Barriers, Emotional barriers

Perspectives in Communication: Introduction, Visual Perception, Language, Otherfactors affecting our perspective - Past Experiences, Prejudices, Feelings, Environment

Unit – II **07 Hours**

Elements of Communication: Introduction, Face to Face Communication - Tone ofVoice, Body Language (Non-verbal communication), Verbal Communication, Physical Communication

Communication Styles: Introduction, The Communication Styles Matrix with examplefor each - Direct Communication Style, Spirited Communication Style, Systematic Communication Style, Considerate Communication Style

Unit – III **07 Hours**

Basic Listening Skills: Introduction, Self-Awareness, Active Listening, Becoming anActive Listener, Listening in Difficult Situations

Effective Written Communication: Introduction, When and When Not to Use WrittenCommunication - Complexity of the Topic, Amount of Discussion' Required, Shades of Meaning, Formal Communication

Writing Effectively: Subject Lines, Put the Main Point First, Know Your Audience, Organization of the Message

Unit – IV **05 Hours**

Interview Skills: Purpose of an interview, Do's and Dont's of an interview

Giving Presentations: Dealing with Fears, Planning your Presentation, Structuring YourPresentation, Delivering Your Presentation, Techniques of Delivery

Unit – V **04 Hours**

Group Discussion: Introduction, Communication skills in group discussion, Do's andDont's of group discussion.

Recommended Books: (Latest Edition)

1. Basic communication skills for Technology, Andreja. J. Ruther Ford, 2nd Edition, Pearson Education, 2011
2. Communication skills, Sanjay Kumar, Pushpalata, 1stEdition, Oxford Press, 2011
3. Organizational Behaviour, Stephen .P. Robbins, 1stEdition, Pearson, 2013
4. Brilliant- Communication skills, Gill Hasson, 1stEdition, Pearson Life, 2011
5. The Ace of Soft Skills: Attitude, Communication and Etiquette for success, Gopala Swamy Ramesh, 5thEdition, Pearson, 2013
6. Developing your influencing skills, Deborah Dalley, Lois Burton, Margaret, Green hall, 1st Edition Universe of Learning LTD, 2010
7. Communication skills for professionals, Konar nira, 2ndEdition, New arrivals – PHI, 2011
8. Personality development and soft skills, Barun K Mitra, 1stEdition, Oxford Press, 2011
9. Soft skill for everyone, Butter Field, 1st Edition, Cengage Learning india pvt.ltd, 2011
10. Soft skills and professional communication, Francis Peters SJ, 1stEdition, Mc Graw Hill Education, 2011
11. Effective communication, John Adair, 4thEdition, Pan Mac Millan,2009
12. Bringing out the best in people, Aubrey Daniels, 2ndEdition, Mc Graw Hill, 1999

COURSE OUTCOMES-

By the end of this course, students will be able to:

CO1	Understanding 'Listening' in a prolific manner.Improve listening,observational skills and problems solving capabilities. Grasp the importance and meaning marvelously.
CO2	Improve the fluency in spoken English.Enhance communication skills through grammar vocabulary with emphasis on skills.
CO3	Develop communication skill through various language learning activities.
CO4	Learn an ability to put ideas in a proper sequence.Build the language proficiency of the students in English with emphasis on English.
CO5	Show an understanding of opportunities in the field of communication,Use current technology related to the communication field.

Course Delivery Methods (CD)	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets

Table: Mapping of Course Outcomes with Program Learning Outcomes

Course Outcomes	Blooms Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P010	PO11	PO12	PSO1	PSO2	PSO3
CO1	L1	H	M	M	-	H	-	H	H	H	H	-	L	M	M	M
CO2	L6	H	H	M	-	M	-	M	H	H	H	-	L	M	L	L
CO3	L6	H	M	_	L	-	-	M	H	M	H	-	L	H	H	M
CO4	L1	H	H	_	L	M	-	M	H	H	H	-	L	M	M	-
CO5	L6	H	M	_	-	M	-	L	H	M	H	-	L	M	L	-

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD:

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1, CO2, CO3, CO4
CD3	Seminars	CO2,CO3,CO5
CD4	Self- learning advice using internets	CO1,CO2,CO3,CO4,CO5

BP 106RBT.REMEDIAL BIOLOGY (Theory)

30 Hours

Scope/Objective:

To learn and understand the components of living world, structure and functionalsystem of plant and animal kingdom.

Course Contents:

Unit I **07 Hours**

Living world:

Definition and characters of living organisms, Diversity in the living world, Binomial nomenclature, five kingdoms of life and basis of classification. Salient features of Monera, Potista, Fungi, Animalia and Plantae, Virus,

Morphology of Flowering plants

Morphology of different parts of flowering plants – Root, stem, inflorescence, flower, leaf, fruit, seed.General Anatomy of Root, stem, leaf of monocotyledons & Dicotylidones.

Unit II **07 Hours**

Body fluids and circulation

Composition of blood, blood groups, coagulation of blood, Composition and functions of lymph, Human circulatory system, Structure of human heart and blood vessels, Cardiac cycle, cardiac output and ECG

Digestion and Absorption

Human alimentary canal and digestive glands, Role of digestive enzymes, Digestion, absorption and assimilation of digested food

Breathing and respiration

Human respiratory system, Mechanism of breathing and its regulation, Exchange of gases, transport of gases and regulation of respiration, Respiratory volume.

Unit III **07 Hours**

Excretory products and their elimination

Modes of excretion, Human excretory system- structure and function, Urine formation, Rennin angiotensin system

Neural control and coordination

Definition and classification of nervous system, Structure of a neuron, Generation and conduction of nerve impulse, Structure of brain and spinal cord, Functions of cerebrum, cerebellum, hypothalamus and medulla oblongata

Chemical coordination and regulation

Endocrine glands and their secretions, Functions of hormones secreted by endocrine glands.

Human reproduction

Parts of female reproductive system, Parts of male reproductive system, Spermatogenesis and Oogenesis, Menstrual cycle.

Unit IV **05 Hours**

Plants and mineral nutrition:

Essential mineral, macro and micronutrients, Nitrogen metabolism, Nitrogen cycle, biological nitrogen fixation

Photosynthesis

Autotrophic nutrition, photosynthesis, Photosynthetic pigments, Factors affecting photosynthesis.

Unit V **04 Hours**

Plant respiration: Respiration, glycolysis, fermentation (anaerobic).

Plant growth and development

Phases and rate of plant growth, Condition of growth,Introduction to plant growthregulators

Cell - The unit of life

Structure and functions of cell and cell organelles.Cell division

Tissues

Definition, types of tissues, location and functions.

Text Books

a. Text book of Biology by S. B. Gokhale

b. A Text book of Biology by Dr. Thulajappa and Dr. Seetaram.

Reference Books

1. A Text book of Biology by B.V. Sreenivasa Naidu
2. A Text book of Biology by Naidu and Murthy
3. Botany for Degree students By A.C.Dutta.
4. Outlines of Zoology by M. Ekambaranatha ayyer and T. N. Ananthakrishnan.
5. A manual for pharmaceutical biology practical by S.B. Gokhale and C. K. Kokate.

COURSE OUTCOMES-

By the end of this course, students will be able to:

Course Outcome: At the end of the course, Students will be able :

CO	Statements
CO1	To understand basic terminologies used in Biology as well as prefixes and suffixes used to identify body& plants parts and directional terms.
CO2	To identify the various tissues and organs of the different systems of the human body& Plants.
CO3	An ability to describe the structure and functions of various organs of the human body/various parts of plants
CO4	Understand the composition and functions of different parts.
CO5	Understand the anatomy, physiology & disorders of various systems

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Biology Lab,
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Lab Visit ,Botanical garden visit

Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Learning Outcomes

Course Outcomes	Bloom s Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	P01 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO1	L1	H	M	M	-	H	H	H	-	H	H	-	L	M	M	M
CO2	L6	H	H	M	-	M	M	H	-	H	H	-	L	M	L	L
CO3	L6	H	M	_	L	-	M	H	-	M	H	-	L	H	H	M
CO4	L1	H	H	_	L	M	M	H	-	H	H	-	L	M	M	-
CO5	L6	H	M	_	-	M	L	H	-	M	H	-	L	M	L	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3
CD2	Anatomy LAB	CO2
CD3	Seminars	CO1, CO5
CD4	Self- learning advice using internets	CO1
CD5	Lab Visit ,Botanical garden visit	CO2,CO3,CO4

BP 106RMT. REMEDIAL MATHEMATICS (Theory)

30 Hours

Scope/Objective: This is an introductory course in mathematics. This subject deals with theintroduction to Partial fraction, Logarithm, matrices and Determinant, Analytical geometry, Calculus, differential equation and Laplace transform.

Course Content:

UNIT – I **06 Hours**

- **Partial fraction**

Introduction, Polynomial, Rational fractions, Proper and Improper fractions, Partial fraction , Resolving into Partial fraction, Application of Partial Fraction in Chemical Kinetics and Pharmacokinetics

- **Logarithms**

Introduction, Definition, Theorems/Properties of logarithms, Common logarithms, Characteristic and Mantissa, worked examples, application of logarithm to solve pharmaceutical problems.

- **Function***:*

Real Valued function, Classification of real valued functions,

- **Limits and continuity** :

Introduction , Limit of a function, Definition of limit of a function ($\in$ - δ definition) , $\lim_{x\to a}\frac{x^n - a^n}{x-a} = na^{n-1}$, $\lim_{\theta\to 0}\frac{\sin\theta}{\theta} = 1$,

Unit-II **06 Hours**

Matrices and Determinant: Introduction matrices, Types of matrices, Operationon matrices, Transpose of amatrix, Matrix Multiplication, Determinants, Properties of determinants, Product of determinants, Minors and co-Factors, Adjointor adjugate of a square matrix, Singular and non-singular matrices,Inverse of a matrix, Solution of system of linear of equations using matrixmethod, Cramer's rule, Characteristic equation and roots of a squarematrix, Cayley–Hamilton theorem,Applicationof Matrices in solving,Pharmacokinetic equations

Unit – III **06 Hours**

Calculus

Differentiation : Introductions, Derivative of a function, Derivative of aconstant, Derivative of a product of a constant and a function , Derivative of the sum or difference of two functions, Derivative of the product of two functions (product formula), Derivative of the quotient of two functions (Quotient formula) –**Without Proof**, Derivative of x^n*w.r.t*x,where *n* is any rational number, Derivative of e^x,, Derivative of $\log_e x$, Derivative of a^x, Derivative of trigonometric functions from first principles**(withoutProof)**, Successive Differentiation, Conditions for a function to be amaximum or a minimum at a point. Application

Unit – IV **06 Hours**

Analytical Geometry

Introduction: Signs of the Coordinates, Distance formula,

Straight Line: Slope or gradient of a straight line, Conditions forparallelism and perpendicularity of two lines, Slope of a line joining two points, Slope – intercept form of a straight line

Integration:

Introduction, Definition, Standard formulae, Rules of integration, Method of Substitution, Method of Partial fractions, Integration by parts, definite integrals, application

Unit-V **06 Hours**

Differential Equations: Some basic definitions, Order and degree, Equations in separable form, Homogeneous equations, Linear Differential equations, exact equations, Application in solvingPharmacokinetic equations

Laplace Transform : Introduction, Definition, Properties of Laplacetransform, Laplace Transforms of elementary functions, Inverse Laplace transforms, Laplace transform of derivatives, Application to solve Linear differential equations, Application in solving Chemicalkinetics and Pharmacokinetics equations

Recommended Books (Latest Edition)

1. Differential Calculus by Shanthinarayan
2. Pharmaceutical Mathematics with application to Pharmacy by Panchaksharappa Gowda D.H.
3. Integral Calculus by Shanthinarayan
4. Higher Engineering Mathematics by Dr.B.S.Grewal

COURSE OUTCOMES-

By the end of this course, students will be able to:

CO1	Recognize the mathematical objects called groups.
CO2	Link the fundamental concepts of groups and Subgroups.
CO3	Explain the significance of the notions of cosets, normal subgroups, and factor groups. Analyze consequences of Lagrange's theorem
CO4	Familiarize with the concept of Ring,
CO5	Integral domain and Fields.

Course Delivery Methods (CD)	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets

Table: Mapping of Course Outcomes with Program Learning Outcomes

CO	Bloom s Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	L3	H	H	H	H	H	H	H	H	L	H	L	H	M	M	L
CO2	L4	M	H	M	H	M	M	M	H	M	H	M	H	M	L	L
CO3	L4	L	H	H	M	L	H	H	M	L	H	L	H	H	H	M
CO4	L3	H	H	H	H	H	H	H	H	M	H	M	H	M	M	L
CO5	L2	H	H	H	H	H	H	H	H	M	H	M	H	M	M	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4
CD2	Tutorials/Assignments	CO1, CO2, CO3, CO4
CD3	Seminars	CO3,CO5
CD4	Self- learning advice using internets	CO3

BP107P. HUMAN ANATOMY AND PHYSIOLOGY (Practical)

4 Hours/week

Scope/Objective: Practical physiology is complimentary to the theoretical discussions in physiology. Practicals allow the verification of physiological processes discussed in theory classes through experiments on living tissue, intact animals or normal human beings. This is helpful for developing an insight on the subject**.**

1. Study of compound microscope.
2. Microscopic study of epithelial and connective tissue
3. Microscopic study of muscular and nervous tissue
4. Identification of axial bones
5. Identification of appendicular bones
6. Introduction to hemocytometry.
7. Enumeration of white blood cell (WBC) count
8. Enumeration of total red blood corpuscles (RBC) count
9. Determination of bleeding time
10. Determination of clotting time
11. Estimation of hemoglobin content
12. Determination of blood group.
13. Determination of erythrocyte sedimentation rate (ESR).
14. Determination of heart rate and pulse rate.
15. Recording of blood pressure.

Recommended Books (Latest Editions)

1. Essentials of Medical Physiology by K. Sembulingam and P. Sembulingam. Jaypee brothers medical publishers, New Delhi.
2. Anatomy and Physiology in Health and Illness by Kathleen J.W. Wilson, Churchill Livingstone, New York
3. Physiological basis of Medical Practice-Best and Tailor. Williams & Wilkins Co,Riverview,MI USA
4. Text book of Medical Physiology- Arthur C,Guyton andJohn.E. Hall. Miamisburg, OH, U.S.A.
5. Principles of Anatomy and Physiology by Tortora Grabowski. Palmetto, GA, U.S.A.
6. Textbook of Human Histology by Inderbir Singh, Jaypee brother's medical publishers, New Delhi.
7. Textbook of Practical Physiology by C.L. Ghai, Jaypee brother's medical publishers, New Delhi.
8. Practical workbook of Human Physiology by K. Srinageswari and Rajeev Sharma, Jaypee brother's medical publishers, New Delhi.

Reference Books (Latest Editions)

1. Physiological basis of Medical Practice-Best and Tailor. Williams & Wilkins Co, Riverview, MI USA
2. Text books of Medical Physiology- Arthur C, Guyton and John. E. Hall. Miamisburg, OH, U.S.A.
3. Human Physiology (vol 1 and 2) by Dr. C.C. Chatterrje ,Academic Publishers Kolkata

COURSE OUTCOMES-

By the end of this course, students will be able to:

CO	Statements
CO1	To understand basic terminologies used in Anatomy and physiology as well as prefixes and suffixes used to identify body parts and directional terms.
CO2	To identify the various tissues and organs of the different systems of the human body
CO3	An ability to describe the structure and functions of various organs of the human body
CO4	Understand the composition and functions of blood component and mechanism of bloodcoagulation.
CO5	Understand the anatomy, physiology & disorders of skeletal muscle, smooth muscle, cardiovascular system, lymphatic system and digestivesystem.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Anatomy LAB
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Hospital visit

Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Learning Outcomes

Course Outcomes	Bloom s Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	P01 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO1	L1	H	M	M	-	H	H	H	-	H	H	-	L	H	M	L
CO2	L6	H	H	M	-	M	M	H	-	H	H	-	L	M	L	L
CO3	L6	H	M	_	L	-	M	H	-	M	H	-	L	H	H	M
CO4	L1	H	H	_	L	M	M	H	-	H	H	-	L	M	M	L
CO5	L6	H	M	_	-	M	L	H	-	M	H	-	L	M	L	-

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3
CD2	Anatomy LAB	CO2
CD3	Seminars	CO1, CO5
CD4	Self- learning advice using internets	CO1
CD5	Hospital visit	CO2,CO3,CO4

108P. PHARMACEUTICAL ANALYSIS (Practical)

4 Hours / Week

Scope/Objective: This course deals with the fundamentals of analytical chemistry and principles ofelectrochemical analysis of drugs

I **Limit Test of the following**

(1) Chloride

(2) Sulphate

(3) Iron

(4) Arsenic

II **Preparation and standardization of**

(1) Sodium hydroxide

(2) Sulphuric acid

(3) Sodium thiosulfate

(4) Potassium permanganate

(5) Ceric ammonium sulphate

III **Assay of the following compounds along with Standardization of Titrant**

(1) Ammonium chloride by acid base titration

(2) Ferrous sulphate by Cerimetry

(3) Copper sulphate by Iodometry

(4) Cacium gluconate by complexometry

(5) Hydrogen peroxide by Permanganometry

(6) Sodium benzoate by non-aqueous titration

(7) Sodium Chloride by precipitation titration

IV **Determination of Normality by electro-analytical methods**

(1) Conductometric titration of strong acid against strong base

(2) Conductometric titration of strong acid and weak acid against strong base

(3) Potentiometric titration of strong acid against strong base

Recommended Books: (Latest Editions)

1. A.H. Beckett & J.B. Stenlake's, Practical Pharmaceutical Chemistry Vol I & II, Stahlone Press of University of London

2 .A.I. Vogel, Text Book of Quantitative Inorganic analysis

3. P. Gundu Rao, Inorganic Pharmaceutical Chemistry

4. Bentley and Driver's Textbook of Pharmaceutical Chemistry

5. John H. Kennedy, Analytical chemistry principles

6. Indian Pharmacopoeia.

COURSE OUTCOMES-

By the end of this course, students will be able to:

CO	**Statements**
CO1	Illuminate relevance & significance of Analytical Chemistry to Pharmaceutical Sciences.
CO2	Clarify basic principles of data treatment and datahandling.
CO3	Explain basic concepts and principles of aqueous acid base titrations and clarify need of non-aqueous acid basetitrations.
CO4	Clarify different terms, basic principles and reaction conditions of precipitation, Complexation and redoxreaction.
CO5	Understand and explain the difference between precipitation and gravimetricanalysis.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Physiology LAB
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial lab visit

Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Learning Outcomes

POs/COs	Blooms Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L2	H	-	-	M	H	-	M	L	M	H	-	M	M	L	-
CO2	L3	H	M	H	H	H	M	H	M	H	H	-	-	M	-	M
CO3	L4	M	H	H	-	H	-	M	L	H	M	L	-	H	H	H
CO4	L4	H	M	-	-	H	H	-	-	H	H	-	H	M	M	L
CO5	L1	H	-	-	M	-	-	M	-	-	M	-	-	M	L	-

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2
CD2	Physiology LAB	CO1,CO5
CD3	Seminars	CO1, CO2
CD4	Self- learning advice using internets	CO1,CO2
CD5	Industrial lab visit	CO4,CO3,CO5

BP109P. PHARMACEUTICS-I (Practical)

3 Hours / week

Scope/Objective: This course is designed to impart a fundamental knowledge on the preparatorypharmacy with arts and science of preparing the different conventional dosage forms.

1. Syrups

a) Syrup IP'66

b) Compound syrup of Ferrous Phosphate BPC'68

2. Elixirsa) Piperazine citrate elixir

(a) Paracetamol pediatric elixir

3. Linctus

a) Terpin Hydrate Linctus IP'66

b) Iodine Throat Paint (Mandles Paint)

4. Solutions

a) Strong solution of ammonium acetate

b) Cresol with soap solution

c) Lugol's solution

5. Suspensions

a) Calamine lotion

b) Magnesium Hydroxide mixture

c) Aluminimum Hydroxide gel

6. Emulsions

a) Turpentine Liniment

b) Liquid paraffin emulsion

7. Powders and Granules

a) ORS powder (WHO)

b) Effervescent granules

c) Dusting powder

d) Divded powders

8. Suppositories

a) Glycero gelatin suppository

b) Coca butter suppository

c) Zinc Oxide suppository

9. Semisolids

a) Sulphur ointment

b) Non staining-iodine ointment with methyl salicylate

c) Carbopal gel

10. Gargles and Mouthwashes

a) Iodine gargle

b) Chlorhexidine mouthwash

Recommended Books: (Latest Editions)

1. H.C. Ansel et al., Pharmaceutical Dosage Form and Drug Delivery System, Lippincott Williams and Walkins, New Delhi.
2. Carter S.J., Cooper and Gunn's-Dispensing for Pharmaceutical Students, CBS publishers, New Delhi.
3. M.E. Aulton, Pharmaceutics, The Science& Dosage Form Design, Churchill Livingstone, Edinburgh.
4. Indian pharmacopoeia.
5. British pharmacopoeia.
6. Lachmann. Theory and Practice of Industrial Pharmacy,Lea& Febiger Publisher, The University of Michigan.
7. Alfonso R. Gennaro Remington. The Science and Practice of Pharmacy, Lippincott Williams, New Delhi.
8. Carter S.J., Cooper and Gunn's. Tutorial Pharmacy, CBS Publications, New Delhi.
9. E.A. Rawlins, Bentley's Text Book of Pharmaceutics, English Language Book Society, Elsevier Health Sciences, USA.
10. Isaac Ghebre Sellassie: Pharmaceutical Pelletization Technology, Marcel Dekker, INC, New York.
11. Dilip M. Parikh: Handbook of Pharmaceutical Granulation Technology, Marcel Dekker, INC, New York.
12. Francoise Nieloud and Gilberte Marti-Mestres: Pharmaceutical Emulsions and Suspensions, Marcel Dekker, INC, New York.

COURSE OUTCOMES-

By the end of this course, students will be able to:

CO1	Know the history of profession of pharmacy
CO2	Understand the basics of different dosage forms, pharmaceutical incompatibilities and pharmaceutical calculations.
CO3	Students will learn aboutthe professional way of handling the prescription
CO4	Students will gain knowledge about fundamentals of Pharmaceutics.
CO5	Understand themethods of preparation of various conventional dosage forms.

Course Delivery Methods (CD)	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Experiments, Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table: Mapping of Course Outcomes with Program Learning Outcomes

CO	Bloom Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L2	H	H	H	-	-	-	-	M	M	-	H	L	H	M	M
CO2	L2	H	M	H	L	L	-	-	M	L	-	H	L	M	L	L
CO3	L3	H	H	H	L	M	-	-	M	M	-	H	M	H	H	H
CO4	L3	H	M	H	L	M	-	-	M	M	-	H	H	M	M	L
CO5	L3	M	M	M	L	M	-	L	M	L	-	M	H	M	L	-

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD:

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1, CO2, CO3, CO4, CO5
CD3	Experiments, Seminars	CO3, CO4, CO5
CD4	Self- learning advice using internets	CO4, CO5
CD5	Industrial visit	CO5

BP110P. PHARMACEUTICAL INORGANIC CHEMISTRY (Practical)

4 Hours / Week

Scope/Objective: This subject deals with the monographs of inorganic drugs and pharmaceuticals.

I **Limit tests for following ions** : Limit test for Chlorides and Sulphates Modified limit test for Chlorides and Sulphates, Limit test for Iron,Limit test for Heavy metals,Limit test for Lead,Limit test for Arsenic

II **Identification test** Magnesium hydroxide Ferrous sulphate Sodium bicarbonate Calcium gluconate Copper sulphate

III **Test for purity** : Swelling power of BentoniteNeutralizing capacity of aluminum hydroxide gelDetermination of potassium iodate and iodine in potassium Iodide

IV**Preparation of inorganic pharmaceuticals**

a) Boric acid

b) Potash alum

c) Ferrous sulphate

Recommended Books (Latest Editions)

1. A.H. Beckett & J.B. Stenlake's, Practical Pharmaceutical Chemistry Vol I & II, Stahlone Press of University of London, 4th edition.

2. A.I. Vogel, Text Book of Quantitative Inorganic analysis

3. P. Gundu Rao, Inorganic Pharmaceutical Chemistry, 3rd Edition

4. M.L Schroff, Inorganic Pharmaceutical Chemistry

5. Bentley and Driver's Textbook of Pharmaceutical Chemistry

6. Anand & Chatwal, Inorganic Pharmaceutical Chemistry

7. IndianPharmacopoeia

COURSE OUTCOMES-

By the end of this course, students will be able to:

CO1	Understand the importance of medicinal and pharmaceutical importance of inorganic compounds.
CO2	Understand the chemistry of drugs with respect to their biological activity.
CO3	Students will learn about inorganic chemistry&Know the different properties of inorganic chemicals.
CO4	Students will understand the sources of impurities and methods to determine the impurities in inorganic drugs and pharmaceuticals.
CO5	Understand the importance of inorganic chemicals in pharmacy.

Course Delivery Methods (CD)	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Experiments, Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table: Mapping of Course Outcomes with Program Learning Outcomes

CO	Bloom Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L2	H	H	H	-	-	-	-	M	M	-	H	L	M	L	-
CO2	L2	H	M	H	L	L	-	-	M	L	-	H	L	M	-	M
CO3	L3	H	H	H	L	M	-	-	M	M	-	H	M	H	H	H
CO4	L3	H	M	H	L	M	-	-	M	M	-	H	H	M	M	L
CO5	L3	M	M	M	L	M	-	L	M	L	-	M	H	M	L	-

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD:

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1, CO2, CO3, CO4, CO5
CD3	Experiments, Seminars	CO3, CO4, CO5
CD4	Self- learning advice using internets	CO4, CO5
CD5	Industrial visit	CO5

BP111P.COMMUNICATION SKILLS (Practical)

2 Hours / week

Scope/Objective: This course will prepare the young pharmacy student to interact effectively withdoctors, nurses, dentists, physiotherapists and other health workers. At the end of this course the student will get the soft skills set to work cohesively with the team as a team player and will add value to the pharmaceutical business.

Thefollowing learning modules are to be conducted using Wordsworth® English language lab software

Basic communication covering the following topics

Meeting People

Asking Questions

Making Friends

What did you do?

Do's and Dont's

Pronunciations covering the following topics

Pronunciation (Consonant Sounds)

Pronunciation and Nouns

Pronunciation (Vowel Sounds)

Advanced Learning

Listening Comprehension / Direct and Indirect Speech

Figures of Speech

Effective Communication

Writing Skills

Effective Writing

Interview Handling Skills

E-Mail etiquette

Presentation Skills

Recommended Books: (Latest Edition)

1. Basic communication skills for Technology, Andreja. J. Ruther Ford, 2nd Edition, Pearson Education, 2011

2. Communication skills, Sanjay Kumar, Pushpalata, 1stEdition, Oxford Press, 2011

3. Organizational Behaviour, Stephen .P. Robbins, 1stEdition, Pearson, 2013

4. Brilliant- Communication skills, Gill Hasson, 1stEdition, Pearson Life, 2011

5. The Ace of Soft Skills: Attitude, Communication and Etiquette for success, Gopala Swamy Ramesh, 5thEdition, Pearson, 2013

6. Developing your influencing skills, Deborah Dalley, Lois Burton, Margaret, Green hall, 1st Edition Universe of Learning LTD, 2010

7. Communication skills for professionals, Konar nira, 2ndEdition, new arrivals – PHI, 2011

8. Personality development and soft skills, Barun K Mitra, 1stEdition, Oxford Press, 2011

9. Soft skill for everyone, Butter Field, 1st Edition, Cengage Learning India pvt.ltd, 2011

10. Soft skills and professional communication, Francis Peters SJ, 1stEdition, Mc Graw Hill Education, 2011

11. Effective communication, John Adair, 4thEdition, Pan Mac Millan, 2009

12. Bringing out the best in people, Aubrey Daniels, 2ndEdition, Mc Graw Hill, 1999

COURSE OUTCOMES-

By the end of this course, students will be able to:

CO	Statements
CO1	Understanding 'Listening' in a prolific manner.Improve listening,observational skills and problems solving capabilities. Grasp the importance and meaning marvelously.
CO2	Improve the fluency in spoken English.Enhance communication skills through grammar vocabulary with emphasis on skills.
CO3	Develop communication skill through various language learning activities.
CO4	Learn an ability to put ideas in a proper sequence.Build the language proficiency of the students in English with emphasis on English.
CO5	Show an understanding of opportunities in the field of communication, Use current technology related to the communication field.

Course Delivery Methods (CD)	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets

Table: Mapping of Course Outcomes with Program Learning Outcomes

Course Outcomes	Blooms Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	P010	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	L1	H	M	M	-	H	-	H	H	H	H	-	L	H	M	L
CO2	L6	H	H	M	-	M	-	M	H	H	H	-	L	M	M	M
CO3	L6	H	M	_	L	-	-	M	H	M	H	-	L	H	H	H
CO4	L1	H	H	_	L	M	-	M	H	H	H	-	L	H	M	L
CO5	L6	H	M	_	-	M	-	L	H	M	H	-	L	M	L	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD:

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1, CO2, CO3, CO4
CD3	Seminars	CO2,CO3,CO5
CD4	Self- learning advice using internets	CO1,CO2,CO3,CO4,CO5

BP112RBP.REMEDIAL BIOLOGY (Practical)

30 Hours

Scope/Objective: To learn and understand the components of living world, structure and functionalsystem of plant and animal kingdom.

1. Introduction to experiments in biology
    a) Study of Microscope
    b) Section cutting techniques
    c) Mounting and staining
    d) Permanent slide preparation
2. Study of cell and its inclusions
3. Study of Stem, Root, Leaf, seed, fruit, flower and their modifications
4. Detailed study of frog by using computer models
5. Microscopic study and identification of tissues pertinent to Stem, Root Leaf, seed, fruit and flower
6. Identification of bones
7. Determination of blood group
8. Determination of blood pressure
9. Determination of tidal volume

Reference Books

1. Practical human anatomy and physiology by S.R.Kale and R.R.Kale.
2. A Manual of pharmaceutical biology practical by S.B.Gokhale, C.K.Kokate and S.P.Shriwastava.
3. Biology practical manual according to National core curriculum .Biology forum of Karnataka. Prof .M.J.H.Shafi.

COURSE OUTCOMES-

By the end of this course, students will be able to:

CO	Statements
CO1	To understand basic terminologies used in Biology as well as prefixes and suffixes used to identify body& plants parts and directional terms.
CO2	To identify the various tissues and organs of the different systems of the human body& Plants.
CO3	An ability to describe the structure and functions of various organs of the human body/various parts of plants
CO4	Understand the composition and functions of different parts.
CO5	Understand the anatomy, physiology & disorders of various systems

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Biology Lab,
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Lab Visit ,Botanical garden visit

Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Learning Outcomes

Course Outcomes	Blooms Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P010	PO11	PO12	PSO1	PSO2	PSO3
CO1	L1	H	M	M	-	H	H	H	-	H	H	-	L	M	L	-
CO2	L6	H	H	M	-	M	M	H	-	H	H	-	L	H	-	L
CO3	L6	H	M	_	L	-	M	H	-	M	H	-	L	H	H	H
CO4	L1	H	H	_	L	M	M	H	-	H	H	-	L	M	M	L
CO5	L6	H	M	_	-	M	L	H	-	M	H	-	L	M	L	-

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3
CD2	Anatomy LAB	CO2
CD3	Seminars	CO1, CO5
CD4	Self- learning advice using internets	CO1
CD5	Lab Visit ,Botanical garden visit	CO2,CO3,CO4

BP 113: ANANDAM

Objectives:

- To instil the joy of giving in young people, turning them into responsible citizens to build up a better society.
- To inculcate the habit of service in students across the University.
- A compulsory course of 2 credits per semester to be included in each program of University.
- Students to be expected to engage in individual and group acts of service and goodness.

Action Plan:

Students will be expected to

- Do at least one act of individual service each day
- Record this act of service in a dedicated Register / Personal Diary
- Share this Register / Personal Diary day in the Anandam Class scheduled per week. The class interaction will include Personal Diary check, Showing of Community based motivation videos, Community based presentations by students, Role playing etc.
- Undertake one group service project for 64 hours every semester (outside college hours)
- Upload the report on the group project on the Anandam platform
- Participate in a sharing and presentation on the group service in the discussion sessions held once in week
- There will be some suggested projects and organizations that students can work with. Students can also suggest their own projects which others can join

Each student will finish the year with a portfolio of giving. This will include their Register / Personal Diaries and their reports on group service projects.

Semester - II

Code No.	Paper	Type	Internal Marks	External Marks	Total Marks	L	T/P	Credit
BP201T	Human Anatomy and Physiology II – Theory	CORE	25	75	100	3	1	4
BP202T	Pharmaceutical Organic Chemistry I – Theory	CORE	25	75	100	3	1	4
BP203T	Biochemistry – Theory	CORE	25	75	100	3	1	4
BP204T	Pathophysiology – Theory	CORE	25	75	100	3	1	4
BP205T	Computer Applications in Pharmacy – Theory *	SEC	25	50	75	3	-	3
BP206T	Environmental sciences – Theory *	AECC	25	50	75	3	-	3
BP207P	Human Anatomy and PhysiologyII–Practical	CORE	15	35	50	4	-	2
BP208P	Pharmaceutical Organic Chemistry-I–Practical	CORE	15	35	50	4	-	2
BP209P	Biochemistry– Practical	CORE	15	35	50	4	-	2
BP210P	Computer Applications in Pharmacy–Practical*	SEC	10	15	25	2	-	1
BP 211	ANANDAM	CEC	50	50	100	1	-	2
	TOTAL		255	570	825			31

Semester II

BP 201T. HUMAN ANATOMY AND PHYSIOLOGY-II (Theory)

45 Hours

Scope/Objective: This subject is designed to impart fundamental knowledge on the structure andfunctions 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.

Course Content:

Unit I **10 hours**

Nervous system

Organization of nervous system, neuron, neuroglia, classification and properties of nerve fibre, electrophysiology, action potential, nerve impulse, receptors, synapse, neurotransmitters.

Central nervous system: Meninges, ventricles of brain and cerebrospinal fluid.structure and functions of brain (cerebrum, brain stem, and cerebellum), spinal cord (gross structure, functions of afferent and efferent nerve tracts, reflex activity)

Unit II **06 hours**

Digestive system

Anatomy of GI Tract with special reference to anatomy and functions of stomach, (Acid production in the stomach, regulation of acid production through parasympathetic nervous system, pepsin role in protein digestion) small intestine.

and large intestine, anatomy and functions of salivary glands, pancreas and liver, movements of GIT, digestion and absorption of nutrients and disorders of GIT.

Energetics

Formation and role of ATP, Creatinine Phosphate and BMR.

Unit III **10 hours**

Respiratory system

Anatomy of respiratory system with special reference to anatomy of lungs, mechanism of respiration, regulation of respiration,Lung Volumes and capacities transport of respiratory gases, artificial respiration, and resuscitation methods.

Urinary system

Anatomy of urinary tract with special reference to anatomy of kidney and nephrons, functions of kidney and urinary tract, physiology of urine formation, micturition reflex and role of kidneys in acid base balance, role of RAS in kidney and disorders of kidney.

Unit IV **10 hours**

Endocrine system

Classification of hormones, mechanism of hormone action, structure and functions of pituitary gland, thyroid gland, parathyroid gland, adrenalgland, pancreas, pineal gland, thymus and their disorders.

Unit V **09 hours**

Reproductive system

Anatomy of male and female reproductive system, Functions of male and female reproductive system, sex hormones, physiology of menstruation, fertilization, spermatogenesis, oogenesis, pregnancy and parturition

Introduction to genetics

Chromosomes, genes and DNA, protein synthesis, genetic pattern of inheritance.

Recommended Books (Latest Editions)

1. Essentials of Medical Physiology by K. Sembulingam and P. Sembulingam. Jaypee brother's medical publishers, New Delhi.
2. Anatomy and Physiology in Health and Illness by Kathleen J.W. Wilson, Churchill Livingstone, New York
3. Physiological basis of Medical Practice-Best and Tailor. Williams & Wilkins Co,Riverview,MI USA
4. Text book of Medical Physiology- Arthur C,Guyton andJohn.E. Hall. Miamisburg, OH, U.S.A.
5. Principles of Anatomy and Physiology by Tortora Grabowski. Palmetto, GA, U.S.A.
6. Textbook of Human Histology by Inderbir Singh, Jaypee brother's medical publishers, New Delhi.
7. Textbook of Practical Physiology by C.L. Ghai, Jaypee brother's medical publishers, New Delhi.
8. Practical workbook of Human Physiology by K. Srinageswari and Rajeev Sharma, Jaypee brother's medical publishers, New Delhi.

COURSE OUTCOMES-

By the end of this course, students will be able to:

CO	Statements
CO1	Understandthe basic fundamentals structural features of neurons, mechanism ofneurotransmitters along with processes of neuroconduction and neurotransmission.
CO2	Demonstrate knowledge in human anatomy as in necessary for the study.
CO3	Clarify the anatomy and physiology of various sense organs involved in body homeostasis.
CO4	Understand the organs and mechanism involve in respiration along with disorders of respiratorysystem
CO5	Understand the essential organs ofurinary systems and process of urineformation.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Anatomy LAB
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Hospital visit

Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Learning Outcomes

Course Outcome	Bloom's level	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L2	H	M	H	L	-	-	L	M	L	-	L	-	H	L	**L**
CO2	L3	H	H	M	H	M	M	M	-	-	L	H	M	M	-	M
CO3	L4	M	H	L	M	M	M	M	-	H	L	M	M	H	H	H
CO4	L4	L	-	M	M	H	M	M	L	M	L	M	H	M	M	L
CO5	L3	M	-	H	L	L	-	-	L	-	L	L	L	M	L	-

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3
CD2	Anatomy LAB	CO2
CD3	Seminars	CO1, CO5
CD4	Self- learning advice using internets	CO1
CD5	Hospital visit & OPD	CO2,CO3,CO4

BP202T. PHARMACEUTICAL ORGANIC CHEMISTRY –I (Theory)

45 Hours

Scope/Objective:

This subject deals with classification and nomenclature of simple organiccompounds, structural isomerism, intermediates forming in reactions, important physical properties, reactions and methods of preparation of these compounds. The syllabus also emphasizes on mechanisms and orientation of reactions.

Course Content:

General methods of preparation and reactions of compounds superscripted with asterisk (*) to be explained

To emphasize on definition, types, classification, principles/mechanisms, applications, examples and differences

Unit-I **07 Hours**

Classification, nomenclature and isomerism Classification of Organic Compounds Common and IUPAC systems of nomenclature of organic compounds(up to 10 Carbons open chain and carbocyclic compounds) Structural isomerisms in organic compounds

Unit-II **10 Hours**

Alkanes*, Alkenes* and Conjugated dienes*

SP^3 hybridization in alkanes, Halogenation of alkanes, uses of paraffins.Stabilities of alkenes, SP^2 hybridization in alkenes E_1 and E_2 reactions – kinetics, order of reactivity of alkyl halides, rearrangement of carbocations, Saytzeffs orientation and evidences. E_1 verses E_2 reactions, Factors affecting E_1 and E_2 reactions. Ozonolysis, electrophilic addition reactions of alkenes, Markownikoff's orientation, free radical addition reactions of alkenes, Anti Markownikoff's orientation. Stability of conjugated dienes, Diel-Alder, electrophilic addition, free radical addition reactions of conjugated dienes, allylic rearrangement

Unit-III **10 Hours**

Alkyl halides*

SN_1 and SN_2 reactions - kinetics, order of reactivity of alkyl halides, stereochemistry and rearrangement of carbocations. SN_1 versus SN_2 reactions, Factors affecting SN_1 and SN_2 reactions Structure and uses of ethylchloride, Chloroform, trichloroethylene, tetrachloroethylene, dichloromethane, tetrachloromethane and iodoform.

Alcohols*- Qualitative tests, Structure and uses of Ethyl alcohol, Methyl alcohol,chlorobutanol, Cetosteryl alcohol, Benzyl alcohol, Glycerol, Propylene glycol

Unit-IV **10 Hours**

Carbonyl compounds* (Aldehydes and ketones)

Nucleophilic addition, Electromeric effect, aldol condensation, Crossed Aldol condensation, Cannizzaro reaction, Crossed Cannizzaro reaction, Benzoin condensation, Perkin condensation, qualitative tests, Structure and uses of Formaldehyde, Paraldehyde, Acetone, Chloral hydrate, Hexamine, Benzaldehyde, Vanilin, Cinnamaldehyde.

Unit-V **08 Hours**

Carboxylic acids*

Acidity of carboxylic acids, effect of substituents on acidity, inductive effect and qualitative tests for carboxylic acids, amide and ester

Structure and Uses of Acetic acid, Lactic acid, Tartaric acid, Citric acid, Succinic acid. Oxalic acid, Salicylic acid, Benzoic acid, Benzyl benzoate, Dimethyl phthalate, Methyl salicylate and Acetyl salicylic acid

Aliphatic amines* - Basicity, effect of substituent on Basicity. Qualitative test, Structure anduses of Ethanolamine, Ethylenediamine, Amphetamine.

Recommended Books (Latest Editions)

1. Organic Chemistry by Morrison and Boyd
2. Organic Chemistry by I.L. Finar , Volume-I
3. Textbook of Organic Chemistry by B.S. Bahl & Arun Bahl.
4. Organic Chemistry by P.L.Soni
5. Practical Organic Chemistry by Mann and Saunders.
6. Vogel's text book of Practical Organic Chemistry
7. Advanced Practical organic chemistry by N.K.Vishnoi.
8. Introduction to Organic Laboratory techniques by Pavia, Lampman and Kriz.
9. Reaction and reaction mechanism by Ahluwaliah/Chatwal.

COURSE OUTCOMES-

By the end of this course, students will be able to:

CO1	Gain knowledge about atomic structure and behavior, interactions between matter and energy at both the atomic and molecular level.
CO2	Understand about chemical bonding and molecular structure.
CO3	learn about Stereochemistry
CO4	Gain knowledge about fundamentals of organic chemistry.
CO5	Understand the physical and chemical properties of Aliphatic Hydrocarbons.

Course Delivery Methods (CD)	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Experiments, Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table: Mapping of Course Outcomes with Program Learning Outcomes

CO	Bloom Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L2	H	H	H	-	-	-	-	M	M	-	H	L	M	L	-
CO2	L2	H	M	H	L	L	-	-	M	L	-	H	L	M	-	M
CO3	L3	H	H	H	L	M	-	-	M	M	-	H	M	H	H	H
CO4	L3	H	M	H	L	M	-	-	M	M	-	H	H	M	M	L
CO5	L3	M	M	M	L	M	-	L	M	L	-	M	H	M	L	-

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD:

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1, CO2, CO3, CO4, CO5
CD3	Experiments, Seminars	CO3, CO4, CO5
CD4	Self- learning advice using internets	CO4, CO5
CD5	Industrial visit	CO5

BP203 T. BIOCHEMISTRY (Theory)

45 Hours

Scope/Objective:
Biochemistry deals with complete understanding of the molecular levels of thechemical process associated with living cells. The scope of the subject is providing biochemical facts and the principles to understand metabolism of nutrient molecules in physiological and pathological conditions. It is also emphasizing on genetic organization of mammalian genome and hetero & autocatalytic functions of DNA.

Course Content:

Unit I **08 Hours**

Biomolecules

Introduction, classification, chemical nature and biological role of carbohydrate, lipids, nucleic acids, amino acids and proteins.

Bioenergetics

Concept of free energy, endergonic and exergonic reaction, Relationship between free energy, enthalpy and entropy; Redox potential. Energy rich compounds; classification; biological significances of ATP and cyclic AMP

Unit II **10 Hours**

Carbohydrate metabolism

Glycolysis – Pathway, energetics and significance Citric acid cycle- Pathway, energetics and significance

HMP shunt and its significance; Glucose-6-Phosphate dehydrogenase (G6PD) deficiency

Glycogen metabolism Pathways and glycogen storage diseases (GSD) Gluconeogenesis- Pathway and its significance

Hormonal regulation of blood glucose level and Diabetes mellitus

Biological oxidation

Electron transport chain (ETC) and its mechanism.

Oxidative phosphorylation & its mechanism and substrate level phosphorylation Inhibitors ETC and oxidative phosphorylation/Uncouplers

Unit III **10 Hours**

Lipid metabolism

β-Oxidation of saturated fatty acid (Palmitic acid) Formation and utilization of ketone bodies; ketoacidosis De novo synthesis of fatty acids (Palmitic acid) Biological significance of cholesterol and conversion of cholesterol into bile acids, steroid hormone and vitamin D

Disorders of lipid metabolism: Hypercholesterolemia, atherosclerosis, fatty liver and obesity.

Amino acid metabolism

General reactions of amino acid metabolism: Transamination, deamination & decarboxylation, urea cycle and its disorders

Catabolism of phenylalanine and tyrosine and their metabolic disorders (Phenyketonuria, Albinism, alkeptonuria, tyrosinemia)

Synthesis and significance of biological substances; 5-HT, melatonin, dopamine, noradrenaline, adrenaline

Catabolism of heme; hyperbilirubinemia and jaundice

Unit IV **10 Hours**

Nucleic acid metabolism and genetic information transfer Biosynthesis of purine and pyrimidine nucleotides

Catabolism of purine nucleotides and Hyperuricemia and Gout disease Organization of mammalian genome

Structure of DNA and RNA and their functions DNA replication (semi conservative model) Transcription or RNA synthesis

Genetic code, Translation or Protein synthesis and inhibitors.

Unit V **7 Hours**

Enzymes

Introduction, properties, nomenclature and IUB classification of enzymes Enzyme kinetics (Michaelis plot, Line Weaver Burke plot)

Enzyme inhibitors with examples

Regulation of enzymes: enzyme induction and repression, allosteric enzymes regulation

Therapeutic and diagnostic applications of enzymes and isoenzymes Coenzymes –Structure and biochemical functions.

Recommended Books (Latest Editions)

1. Principles of Biochemistry by Lehninger.
2. Harper's Biochemistry by Robert K. Murry, Daryl K. Granner and Victor W. Rodwell.
3. Biochemistry by Stryer.
4. Biochemistry by D. Satyanarayan and U.Chakrapani
5. Textbook of Biochemistry by Rama Rao.
6. Textbook of Biochemistry by Deb.
7. Outlines of Biochemistry by Conn and Stumpf
8. Practical Biochemistry by R.C. Gupta and S. Bhargavan.
9. Introduction of Practical Biochemistry by David T. Plummer. (3rd Edition)
10. Practical Biochemistry for Medical students by Rajagopal and Ramakrishna.
11. Practical Biochemistry by Harold Varley.

COURSE OUTCOMES-

By the end of this course, students will be able to:

CO	**Statements**
CO1	Understand the catalytic role of enzymes, importance of enzyme inhibitors in design of new drugs, therapeutic and diagnostic applications of enzymes.
CO2	Understand the metabolism of nutrient molecules in physiological and pathological conditions.
CO3	Understand the genetic organization of mammalian genome and functions of DNA in the synthesis of RNAs and proteins.
CO4	Understand basics like chemistry, function, classification, biological importance, qualitative tests & applications of various biomolecules. e.g. proteins, carbohydrates and lipids,etc
CO5	Clarify the fundamentals of metabolism, process, steps involved in metabolism of carbohydrates, lipids, protein and nucleicacid.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Lab visit

Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Learning Outcomes

Course Outcome	Bloom's Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L3	H	M	H	H	M	M	M	L	L	-	H	M	M	L	M
CO2	L1	M	M	H	L	L	L	-	L	-	L	L	L	H	-	M
CO3	L2	M	M	H	L	L	L	-	-	L	-	L	L	M	H	H
CO4	L3	M	H	H	H	H	H	H	M	M	M	H	H	M	M	L
CO5	L4	H	M	L	M	H	H	H	M	H	L	M	H	M	L	M

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1,CO2
CD2	Tutorials/Assignments	CO1,CO2
CD3	Seminars	CO1,CO2,CO3
CD4	Self- learning advice using internets	CO1,CO2
CD5	Lab Visit	CO4,CO5

BP 204T.PATHOPHYSIOLOGY (THEORY)

45 Hours

Scope/Objective:

Pathophysiology is the study of causes of diseases and reactions of the body tosuch 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.

Course content:

Unit I **10 Hours**

Basic principles of Cell injury and Adaptation: Introduction, definitions, Homeostasis, Components and Types of Feedback systems, Causes of cellular injury**,** Pathogenesis (Cell membrane damage, mitochondrial damage,

Ribosome damage, Nuclear damage)**,** Morphology of cell injury – Adaptive changes (Atrophy, Hypertrophy, hyperplasia, Metaplasia, Dysplasia)**,** Cell swelling, Intra cellular accumulation, Calcification, Enzyme leakage and Cell Death Acidosis &Alkalosis, Electrolyte imbalance

Basic mechanism involved in the process of inflammation and repair: Introduction, Clinical signs of inflammation, Different types of Inflammation,Mechanism of Inflammation – Alteration in vascular permeability and blood flow, migration of WBC's,Mediators of inflammation,Basic principles of wound healing in the skin,Pathophysiology of Atherosclerosis

Unit II **10 Hours**

Cardiovascular System: Hypertension, congestive heart failure, ischemic heart disease (angina, myocardial infarction, atherosclerosis and arteriosclerosis)

Respiratory system: Asthma, Chronic obstructive airways diseases.

Renal system: Acute and chronic renal failure.

Unit II **10 Hours**

Haematological Diseases: Iron deficiency, megaloblastic anemia (Vit B12 and folic acid), sickle cell anemia, thalasemia, hereditary acquired anemia, hemophilia

Endocrine system: Diabetes, thyroid diseases, disorders of sex hormones

Nervous system: Epilepsy, Parkinson's disease, And stroke, psychiatric disorders: depression, schizophrenia and Alzheimer's disease.

Gastrointestinal system: Peptic Ulcer

Unit IV **8 Hours**

Inflammatory bowel diseases, jaundice, hepatitis (A, B, C, D, E, F) alcoholic liver disease.

Disease of bones and joints: Rheumatoid arthritis, osteoporosis and gout

Principles of cancer: classification, etiology and pathogenesis of cancer

Diseases of bones and joints: Rheumatoid Arthritis, Osteoporosis, Gout

Principles of Cancer: Classification, etiology and pathogenesis of Cancer

Unit V **7 Hours**

Infectious diseases: Meningitis, Typhoid, Leprosy, Tuberculosis Urinary tract infections

Sexually transmitted diseases: AIDS, Syphilis, Gonorrhea

Recommended Books (Latest Editions)

1. Vinay Kumar, Abul K. Abas, Jon C. Aster; Robbins &Cotran Pathologic Basis of Disease; South Asia edition; India; Elsevier; 2014.
2. Harsh Mohan; Text book of Pathology; 6th edition; India; Jaypee Publications; 2010.
3. Laurence B, Bruce C, Bjorn K. ; Goodman Gilman's The Pharmacological Basis of Therapeutics; 12th edition; New York; McGraw-Hill; 2011.
4. Best, Charles Herbert 1899-1978; Taylor, Norman Burke 1885-1972; West, John B (John Burnard); Best and Taylor's Physiological basis of medical practice; 12th ed; united states;
5. William and Wilkins, Baltimore; 1991 [1990 printing].
6. Nicki R. Colledge, Brian R. Walker, Stuart H. Ralston; Davidson's Principles and Practice of Medicine; 21st edition; London; ELBS/Churchill Livingstone; 2010.
7. Guyton A, John .E Hall; Textbook of Medical Physiology; 12th edition; WB Saunders Company; 2010.
8. Joseph DiPiro, Robert L. Talbert, Gary Yee, Barbara Wells, L. Michael Posey; Pharmacotherapy: A Pathophysiological Approach; 9th edition; London; McGraw-Hill Medical; 2014.
9. V. Kumar, R. S. Cotran and S. L. Robbins; Basic Pathology; 6th edition; Philadelphia; WB Saunders Company; 1997.
10. Roger Walker, Clive Edwards; Clinical Pharmacy and Therapeutics; 3rd edition; London; Churchill Livingstone publication; 2003.

Recommended Journals

1. The Journal of Pathology. ISSN: 1096-9896 (Online)
2. The American Journal of Pathology. ISSN: 0002-9440
3. Pathology. 1465-3931 (Online)
4. International Journal of Physiology, Pathophysiology and Pharmacology. ISSN: 1944-8171 (Online)
5. Indian Journal of atholoPgy and Microbiology. ISSN-0377-4929.

COURSE OUTCOMES-

By the end of this course, students will be able to:

CO	Statements
CO1	Describe the etiology and pathogenesis of the selected disease states;
CO2	Demonstrate knowledge of the physiology and pathophysiology of the majororgan systems under investigation in clinicalbiochemistry.
CO3	Name the signs and symptoms of the diseases.
CO4	Discuss the role of clinical biochemistry investigations in diagnosis, monitoringand treatment ofdisease.
CO5	Mention the complications of the diseases.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	LAB
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Hospital visit & OPD

Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Learning Outcomes

Course Outcome	Bloom's Level	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L1	H	M	H	L	L	L	M	-	L	-	L	L	H	L	M
CO2	L2	H	L	H	M	L	L	-	-	L	-	M	L	H	-	M
CO3	L2	H	-	H	M	L	-	-	-	-	L	M	L	M	H	-
CO4	L3	M	H	M	H	M	M	M	L	-	-	H	M	-	M	L
CO5	L3	M	M	M	L	M	M	M	L	L	L	L	M	L	L	M

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2
CD2	LAB	CO1,CO5
CD3	Seminars	CO1, CO2
CD4	Self- learning advice using internets	CO1,CO2
CD5	Hospital visit & OPD	CO4,CO3,CO5

BP205 T. COMPUTER APPLICATIONS IN PHARMACY (Theory)

30 Hrs (2 Hrs/Week)

Scope/Objective:

This subject deals with the introduction Database, Database Management system, computer application in clinical studies and use of databases.

Course content:

Unit – I **06 hours**

Number system: Binary number system, Decimal number system, Octalnumber system, Hexadecimal number systems, conversion decimal to binary, binary to decimal, octal to binary etc, binary addition, binary subtraction – One's complement ,Two's complement method, binary multiplication, binary division

Concept of Information Systems and Software: Information gathering, requirement and feasibility analysis, data flow diagrams, process specifications, input/output design, process life cycle, planning and managing the project.

Unit –II **06 hours**

Web technologies: Introduction to HTML, XML, CSS and Programming languages, introduction to web servers and Server Products

Introduction to databases, MYSQL, MS ACCESS, Pharmacy Drug database.

Unit – III **06 hours**

Application of computers in Pharmacy –Drug information storage andretrieval, Pharmacokinetics, Mathematical model in Drug design, Hospital and Clinical Pharmacy, Electronic Prescribing and discharge (EP) systems, barcode medicine identification and automated dispensing of drugs, mobile technology and adherence monitoring

Diagnostic System, Lab-diagnostic System, Patient Monitoring System, Pharma Information System.

Unit – IV **06 hours**

Bioinformatics: Introduction, Objective of Bioinformatics, BioinformaticsDatabases, Concept of Bioinformatics, Impact of Bioinformatics in Vaccine Discovery

Unit-V **06 hours**

Computers as data analysis in Preclinical development: Chromatographic dada analysis(CDS), Laboratory Information management System (LIMS) and Text Information Management System(TIMS).

Recommended books (Latest edition):

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, INC., Publication, USA
3. Bioinformatics (Concept, Skills and Applications) – S.C.Rastogi-CBS Publishers and Distributors, 4596/1- A, 11 Darya Gani, New Delhi – 110 002(INDIA)
4. Microsoft office Access - 2003, Application Development Using VBA, SQL Server, DAP and Infopath – Cary N.Prague – Wiley Dreamtech India (P) Ltd., 4435/7, Ansari Road, Daryagani, New Delhi – 110002

COURSE OUTCOMES-

By the end of this course, students will be able to:

CO	Statements
CO1	Understand the various types of application of computers in pharmacy
CO2	Understand the various types of databases
CO3	Have the knowledge of MS-Access as a database tool to manage the organization information and know the various applications of databases in pharmacy
CO4	Understand the the Bioinformatics Databases
CO5	Understand the data analysis in preclinical developments

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Computer lab visit

Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcomes

Course out Come	Bloom level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L3	H	H	H	H	H	M	H	M	L	H	M	H	H	L	M
CO2	L4	M	H	M	M	H	M	H	H	M	M	M	H	-	M	M
CO3	L3	H	H	M	H	H	M	L	H	M	M	M	H	M	H	H
CO4	L4	M	M	H	H	M	M	L	M	M	M	L	M	M	-	L
CO5	L1	L	H	H	H	H	H	L	H	M	M	L	M	M	L	M

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1,CO2,CO3
CD2	Tutorials/Assignments	CO1,CO2,CO3
CD3	Seminars	CO3, CO4,CO5,
CD4	Self- learning advice using internets	CO1, CO5
CD5	Computer lab visit	CO2,CO1,

BP 206 T. ENVIRONMENTAL SCIENCES (Theory)

30 hours

Scope/Objective:

Environmental Sciences is the scientific study of the environmental system andthe status of its inherent or induced changes on organisms. It includes not only the study of physical and biological characters of the environment but also the social and cultural factors and the impact of man on environment.

Course content:

Unit-I **10 hours**

The Multidisciplinary nature of environmental studies, Natural Resources, Renewable and non-renewable resources, Natural resources and associated problems

a) Forest resources; b) Water resources; c) Mineral resources; d) Food resources; e) Energy resources; f) Land resources: Role of an individual in conservation of natural resources.

Unit-II **10 hours**

Ecosystems: Concept of an ecosystem, Structure and function of an ecosystem. Introduction, types, characteristic features, structure and function of the ecosystems: Forest ecosystem; Grassland ecosystem; Desert ecosystem; Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

Unit-III **10 hours**

Environmental Pollution: Air pollution; Water pollution; Soil pollution

Recommended Books (Latest edition):

1. Y.K. Sing, Environmental Science, New Age International Pvt, Publishers, Bangalore
2. Agarwal, K.C. 2001 Environmental Biology, Nidi Publ. Ltd. Bikaner.
3. Bharucha Erach, The Biodiversity of India, Mapin Pu blishing Pvt. Ltd., Ahmedabad – 380 013, India,
4. Brunner R.C., 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480p
5. Clark R.S., Marine Pollution, Clanderson Press Oxford
6. Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T. 2001, Environmental Encyclopedia, Jaico Publ. House, Mumbai, 1196p
7. De A.K., Environmental Chemistry, Wiley Eastern Ltd.
8. Down of Earth, Centre for Science and Environment.

COURSE OUTCOMES-

By the end of this course, students will be able to:

CO1	Appreciate concepts and methods from ecological and physical sciences and their application in environmental problem solving. Ecosystem Links between environmental components and their role, types, values and conservation of biodiversity.
CO2	Concept of non Conventional energy resources, types and various applications of renewable resources and current potentials of energy resources.
CO3	Basic Structure of atmosphere and their functions Current problems related issues Students will apply knowledge of the sciences within an interdisciplinary context in solving environmental issues such as environmental health, food and agriculture, energy, waste and pollution, climate change,disaster management.
CO4	Composition of solid waste, sources of generation, collection and disposal methods of solid waste, recycling, reuse of wastes.
CO5	Sustainable development, urban problems related to energy, Water conservation, and Rain water harvesting water shed management, Resettlement and rehabilitation, Public awareness and Environmental Education, various environmental Acts.

Course Delivery Methods (CD)	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets

Table: Mapping of Course Outcomes with Program Learning Outcomes

CO	Bloom's Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L2	L	M	H	-	L	L	-	M	H	H	H	M	M	L	M
CO2	L1	H	M	M	L	M	-	-	M	H	H	H	M	H	-	M
CO3	L2	H	M	M	M	1	M	M	-	H	H	H	H	M	H	-
CO4	L2	H	M	M	M	M	-	L	M	H	L	L	H	H	M	H
CO5	L3	H	M	M	H	H	M	H	M	H	H	M	H	M	L	M

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD:

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1, CO2, CO3, CO4, CO5
CD3	Seminars	CO3
CD4	Self- learning advice using internets	CO2

BP 207 P. HUMAN ANATOMY AND PHYSIOLOGY (Practical)

4 Hours/week

Scope/Objective:

Practical physiology is complimentary to the theoretical discussions in physiology. Practicals allow the verification of physiological processes discussed in theory classes through experiments on living tissue, intact animals or normal human beings. This is helpful for developing an insight on the subject**.**

1. To study the integumentary and special senses using specimen, models, etc.,
2. To study the nervous system using specimen, models, etc.,
3. To study the endocrine system using specimen, models, etc
4. To demonstrate the general neurological examination
5. To demonstrate the function of olfactory nerve
6. To examine the different types of taste.
7. To demonstrate the visual acuity
8. To demonstrate the reflex activity
9. Recording of body temperature
10. To demonstrate positive and negative feedback mechanism.
11. Determination of tidal volume and vital capacity.
12. Study of digestive, respiratory, cardiovascular systems, urinary and reproductive systems with the help of models, charts and specimens.
13. Recording of basal mass index .
14. Study of family planning devices and pregnancy diagnosis test.
15. Demonstration of total blood count by cell analyser
16. Permanent slides of vital organs and gonads.

Recommended Books (Latest Editions)

1. Essentials of Medical Physiology by K. Sembulingam and P. Sembulingam. Jaypee brother's medical publishers, New Delhi.
2. Anatomy and Physiology in Health and Illness by Kathleen J.W. Wilson, Churchill Livingstone, New York
3. Physiological basis of Medical Practice-Best and Tailor. Williams & Wilkins Co, Riverview, MI USA
4. Text book of Medical Physiology- Arthur C, Guyton andJohn.E. Hall. Miamisburg, OH, U.S.A.
5. Principles of Anatomy and Physiology by Tortora Grabowski. Palmetto, GA, U.S.A.
6. Textbook of Human Histology by Inderbir Singh, Jaypee brother's medical publishers, New Delhi.
7. Textbook of Practical Physiology by C.L. Ghai, Jaypee brother's medical publishers, New Delhi.

8. Practical workbook of Human Physiology by K. Srinageswari and Rajeev Sharma, Jaypee brother's medical publishers, New Delhi.

Reference Books:

1. Physiological basis of Medical Practice-Best and Tailor. Williams & Wilkins Co, Riverview, MI USA
2. Text book of Medical Physiology- Arthur C, Guyton and John. E. Hall. Miamisburg, OH, U.S.A.
3. Human Physiology (vol 1 and 2) by Dr. C.C. Chatterrje, Academic Publishers Kolkata.

COURSE OUTCOMES-

By the end of this course, students will be able to:

CO	Statements
CO1	Understand the basic fundamentals structural features of neurons, mechanism ofneurotransmitters along with processes of neuroconduction andneurotransmission.
CO2	Demonstrate knowledge in human anatomy as in necessary for the study.
CO3	Clarify the anatomy and physiology of various sense organs involved in body homeostasis.
CO4	Understand the organs and mechanism involve in respiration along with disorders of respiratorysystem
CO5	Understand the essential organs ofurinary systems and process of urineformation.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Anatomy LAB
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Hospital visit

Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Learning Outcomes

Course Outcome	Bloom's level	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	,L2	H	M	H	L	-	-	L	M	L	-	L	-	H	L	L
CO2	L3	H	H	M	H	M	M	M	-	-	L	H	M	H	-	M
CO3	L4	M	H	L	M	M	M	M	-	H	L	M	M	M	H	L
CO4	L4	L	-	M	M	H	M	M	L	M	L	M	H	M	M	-
CO5	L3	M	-	H	L	L	-	-	L	-	L	L	L	L	L	M

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3
CD2	Anatomy LAB	CO2
CD3	Seminars	CO1, CO5
CD4	Self- learning advice using internets	CO1
CD5	Hospital visit & OPD	CO2,CO3,CO4

BP208P. PHARMACEUTICAL ORGANIC CHEMISTRY -I (Practical)

4 Hours / week

Scope/Objective:

This subject deals with classification and nomenclature of simple organiccompounds, structural isomerism, intermediates forming in reactions, important physical properties, reactions and methods of preparation of these compounds. The syllabus also emphasizes on mechanisms and orientation of reactions.

- Systematic qualitative analysis of unknown organic compounds like
  - i. Preliminary test: Color, odour, aliphatic/aromatic compounds, saturation and unsaturation, etc.
  - ii. Detection of elements like Nitrogen, Sulphur and Halogen by Lassaigne's test
  - iii. Solubility test
  - iv. Functional group test like Phenols, Amides/ Urea, Carbohydrates, Amines, Carboxylic acids, Aldehydes and Ketones, Alcohols, Esters, Aromatic and Halogenated Hydrocarbons, Nitro compounds and Anilides.
  - v. Melting point/Boiling point of organic compounds
  - vi. Identification of the unknown compound from the literature using melting point/ boiling point.
  - vii. Preparation of the derivatives and confirmation of the unknown compound by melting point/ boiling point.
  - viii. Minimum 5 unknown organic compounds to be analysed systematically.
- Preparation of suitable solid derivatives from organic compounds
- Construction of molecular models

Recommended Books (Latest Editions)

1. Organic Chemistry by Morrison and Boyd
2. Organic Chemistry by I.L. Finar, Volume-I
3. Textbook of Organic Chemistry by B.S. Bahl & Arun Bahl.
4. Organic Chemistry by P.L.Soni
5. Practical Organic Chemistry by Mann and Saunders.
6. Vogel's text book of Practical Organic Chemistry
7. Advanced Practical organic chemistry by N.K.Vishnoi.
8. Introduction to Organic Laboratory techniques by Pavia, Lampman and Kriz.
9. Reaction and reaction mechanism by Ahluwaliah/Chatwal.

COURSE OUTCOMES-

By the end of this course, students will be able to:

CO1	Gain knowledge about atomic structure and behavior, interactions between matter and energy at both the atomic and molecular level.
CO2	Understand about chemical bonding and molecular structure.
CO3	learn about Stereochemistry
CO4	Gain knowledge about fundamentals of organic chemistry.
CO5	Understand the physical and chemical properties of Aliphatic Hydrocarbons.

Course Delivery Methods (CD)	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Experiments, Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table: Mapping of Course Outcomes with Program Learning Outcomes

CO	Bloom Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L2	H	H	H	-	-	-	-	M	M	-	H	L	L	M	M
CO2	L2	H	M	H	L	L	-	-	M	L	-	H	L	H	-	M
CO3	L3	H	H	H	L	M	-	-	M	M	-	H	M	M	H	-
CO4	L3	H	M	H	L	M	-	-	M	M	-	H	H	L	-	L
CO5	L3	M	M	M	L	M	-	L	M	L	-	M	H	M	H	M

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD:

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1, CO2, CO3, CO4, CO5
CD3	Experiments, Seminars	CO3, CO4, CO5
CD4	Self- learning advice using internets	CO4, CO5
CD5	Industrial visit	CO5

BP 209 P. BIOCHEMISTRY (Practical)

4 Hours / Week

Scope/Objective:

Biochemistry deals with complete understanding of the molecular levels of thechemical process associated with living cells. The scope of the subject is providing biochemical facts and the principles to understand metabolism of nutrient molecules in physiological and pathological conditions. It is also emphasizing on genetic organization of mammalian genome and hetero & autocatalytic functions of DNA.

- Qualitative analysis of carbohydrates (Glucose, Fructose, Lactose, Maltose, Sucrose and starch)
- Identification tests for Proteins (albumin and Casein)
- Quantitative analysis of reducing sugars (DNSA method) and Proteins (Biuret method)
- Qualitative analysis of urine for abnormal constituents
- Determination of blood creatinine
- Determination of blood sugar
- Determination of serum total cholesterol
- Preparation of buffer solution and measurement of pH
- Study of enzymatic hydrolysis of starch
- Determination of Salivary amylase activity
- Study the effect of Temperature on Salivary amylase activity.
- Study the effect of substrate concentration on salivary amylase activity.

Recommended Books (Latest Editions)

1. Principles of Biochemistry by Lehninger.

2. Harper’s Biochemistry by Robert K. Murry, Daryl K. Granner and Victor W. Rodwell.

3. Biochemistry by Stryer.

4. Biochemistry by D. Satyanarayan and U.Chakrapani

5. Textbook of Biochemistry by Rama Rao.

6. Textbook of Biochemistry by Deb.

7. Outlines of Biochemistry by Conn and Stumpf

8. Practical Biochemistry by R.C. Gupta and S. Bhargavan.

9. Introduction of Practical Biochemistry by David T. Plummer. (3rd Edition)

10. Practical Biochemistry for Medical students by Rajagopal and Ramakrishna.

11. Practical Biochemistry by Harold Varley.

COURSE OUTCOMES-

By the end of this course, students will be able to:

CO	**Statements**
CO1	Understand the catalytic role of enzymes, importance of enzyme inhibitors in design of new drugs, therapeutic and diagnostic applications of enzymes.
CO2	Understand the metabolism of nutrient molecules in physiological and pathological conditions.
CO3	Understand the genetic organization of mammalian genome and functions of DNA in the synthesis of RNAs and proteins.
CO4	Understand basics like chemistry, function, classification, biological importance, qualitative tests & applications of various biomolecules. e.g. proteins, carbohydrates and lipids,etc
CO5	Clarify the fundamentals of metabolism, process, steps involved in metabolism of carbohydrates, lipids, protein and nucleicacid.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Lab visit

Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Learning Outcomes

Course Outcome	Bloom's Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L3	H	M	H	H	M	M	M	L	L	-	H	M	M	L	M
CO2	L1	M	M	H	L	L	L	-	L	-	L	L	L	H	-	M
CO3	L2	M	M	H	L	L	L	-	-	L	-	L	L	L	H	L
CO4	L3	M	H	H	H	H	H	H	M	M	M	H	H	M	M	L
CO5	L4	H	M	L	M	H	H	H	M	H	L	M	H	M	-	M

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1,CO2
CD2	Tutorials/Assignments	CO1,CO2.CO5,
CD3	Seminars	CO1,CO2,CO3
CD4	Self- learning advice using internets	CO1,CO2
CD5	Lab visit	CO4,CO5

BP210P. COMPUTER APPLICATIONS IN PHARMACY (Practical)

Scope/Objective:

This subject deals with the introduction Database, Database Management system, computer application in clinical studies and use of databases.

- Design a questionnaire using a word processing package to gather information about a particular disease.
- Create a HTML web page to show personal information.
- Retrieve the information of a drug and its adverse effects using online tools
- Creating mailing labels Using Label Wizard , generating label in MS WORD
- Create a database in MS Access to store the patient information with the required fields Using access
- Design a form in MS Access to view, add, delete and modify the patient record in the database
- Generating report and printing the report from patient database
- Creating invoice table using – MS Access
- Drug information storage and retrieval using MS Access
- Creating and working with queries in MS Access
- Exporting Tables, Queries, Forms and Reports to web pages
- Exporting Tables, Queries, Forms and Reports to XML pages

Recommended books (Latest edition):

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, INC., Publication, USA
3. Bioinformatics (Concept, Skills and Applications) – S.C.Rastogi-CBS Publishers and Distributors, 4596/1- A, 11 Darya Gani, New Delhi – 110 002(INDIA)
4. Microsoft office Access - 2003, Application Development Using VBA, SQL Server, DAP and Infopath – Cary N.Prague – Wiley Dreamtech India (P) Ltd., 4435/7, Ansari Road, Daryagani, New Delhi – 110002

COURSE OUTCOMES-

By the end of this course, students will be able to:

CO	Statements
CO1	Understand the various types of application of computers in pharmacy
CO2	Understand the various types of databases
CO3	Have the knowledge of MS-Access as a database tool to manage the organization information and know the various applications of databases in pharmacy
CO4	Understand the the Bioinformatics Databases
CO5	Understand the data analysis in preclinical developments

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Computer lab visit

Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcomes

Course out Come	Bloom level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L3	H	H	H	H	H	M	H	M	L	H	M	H	H	L	**M**
CO2	L4	M	H	M	M	H	M	H	H	M	M	M	H	M	-	H
CO3	L3	H	H	M	H	H	M	L	H	M	M	M	H	L	H	M
CO4	L4	M	M	H	H	M	M	L	M	M	M	L	M	M	M	L
CO5	L1	L	H	H	H	H	H	L	H	M	M	L	M	M	L	-

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1,CO2,CO3
CD2	Tutorials/Assignments	CO1,CO2,CO4
CD3	Seminars	CO3,CO5,
CD4	Self- learning advice using internets	CO1,CO3,CO5,
CD5	Computer lab visit	CO2,CO1,

BP 211: ANANDAM

Objectives:

- To instil the joy of giving in young people, turning them into responsible citizens to build up a better society.
- To inculcate the habit of service in students across the University.
- A compulsory course of 2 credits per semester to be included in each program of University.
- Students to be excepted to engage in individual and group acts of service and goodness.

Action Plan:

Students will be expected to

- Do at least one act of individual service each day
- Record this act of service in a dedicated Register / Personal Diary
- Share this Register / Personal Diary day in the Anandam Class scheduled per week. The class interaction will include Personal Diary check, Showing of Community based motivation videos, Community based presentations by students, Role playing etc.
- Undertake one group service project for 64 hours every semester (outside college hours)
- Upload the report on the group project on the Anandam platform
- Participate in a sharing and presentation on the group service in the discussion sessions held once in week
- there will be some suggested projects and organizations that students can work with. Students can also suggest their own projects which others can join

Each student will finish the year with a portfolio of giving. This will include their Register / Personal Diaries and their reports on group service projects.

Semester - III

Code No.	Paper	Type	Internal Marks	External Marks	Total Marks	L	T/P	Credit
BP301T	Pharmaceutical Organic Chemistry II – Theory	CORE	25	75	100	3	1	4
BP302T	Physical Pharmaceutics I – Theory	CORE	25	75	100	3	1	4
BP303T	Pharmaceutical Microbiology – Theory	CORE	25	75	100	3	1	4
BP304T	Pharmaceutical Engineering – Theory	CORE	25	75	100	3	1	4
BP305P	Pharmaceutical Organic Chemistry II–Practical	CORE	15	35	50	4	-	2
BP306P	Physical Pharmaceutics I– Practical	CORE	15	35	50	4	-	2
BP307P	Pharmaceutical Microbiology– Practical	CORE	15	35	50	4	-	2
BP308P	Pharmaceutical Engineering– Practical	CORE	15	35	50	4	-	2
BP309	Universal Human Values	AECC	30	70	100	2	-	2
BP310	Leadership & Management Skills	AECC	30	70	100	2	-	2
BP 311	ANANDAM	CEC	50	50	100	1	-	2
	Total		**270**	**630**	**900**			**30**

SEMESTER III

BP301T. PHARMACEUTICAL ORGANIC CHEMISTRY –II (Theory)

45 Hours

Scope/Objective:

This subject deals with general methods of preparation and reactions of someorganic compounds. Reactivity of organic compounds are also studied here. The syllabus emphasizes on mechanisms and orientation of reactions. Chemistry of fats and oils are also included in the syllabus.

Course Content:

General methods of preparation and reactions of compounds superscripted with asterisk (*) to be explainedo emphasize on definition, types, classification, principles/mechanisms, applications, examples and differences

Unit I **10 Hours**

Benzene and its derivatives

A. Analytical, synthetic and other evidences in the derivation of structure of benzene, Orbital picture, resonance in benzene, aromatic characters, Huckel's rule

B. Reactions of benzene - nitration, sulphonation, halogenation- Reactivity, Friedelcrafts alkylation- reactivity, limitations, Friedelcrafts acylation.

C. Substituents, effect of substituents on reactivity and orientation of mono substituted benzene compounds towards electrophilic substitution reaction

D. Structure and uses of DDT, Saccharin, BHC and Chloramine

Unit II **10 Hours**

Phenols* - Acidity of phenols, effect of substituents on acidity, qualitativetests, Structure and uses of phenol, cresols, resorcinol, naphthols

Aromatic Amines* - Basicity of amines, effect of substituents on basicity, and synthetic uses of aryl diazonium salts

Aromatic Acids* –Acidity, effect of substituents on acidity andimportant reactions of benzoic acid.

Unit III **10 Hours**

Fats and Oils

a. Fatty acids – reactions.Hydrolysis, Hydrogenation, Saponification and Rancidity of oils, Drying oils.

b. Analytical constants – Acid value, Saponification value, Ester value, Iodine value, Acetyl value, Reichert Meissl (RM) value – significance and principle involved in their determination.

Unit IV **08 Hours**

Polynuclear hydrocarbons:

a. Synthesis, reactions

b. Structure and medicinal uses of Naphthalene, Phenanthrene, Anthracene, Diphenylmethane, Triphenylmethane and their derivatives

Unit V **07 Hours**

Cyclo alkanes*

Stabilities – Baeyer's strain theory, limitation of Baeyer's strain theory, Coulson and Moffitt's modification, Sachse Mohr's theory (Theory of strainless rings), reactions of cyclopropane and cyclobutane only.

Recommended Books (Latest Editions)

1. Organic Chemistry by Morrison and Boyd
2. Organic Chemistry by I.L. Finar , Volume-I
3. Textbook of Organic Chemistry by B.S. Bahl & Arun Bahl.
4. Organic Chemistry by P.L.Soni
5. Practical Organic Chemistry by Mann and Saunders.
6. Vogel's text book of Practical Organic Chemistry
7. Advanced Practical organic chemistry by N.K.Vishnoi.
8. Introduction to Organic Laboratory techniques by Pavia, Lampman and Kriz.

COURSE OUTCOMES-

By the end of this course, students will be able to:

CO1	Know the structures with numbering of heterocyclic compounds, chemistry, methods of preparation and chemical reactions of five, six membered and fused heterocyclic rings.
CO2	Know schemes of synthesis and reactions of drugs containing heterocyclicrings.
CO3	Explain various techniques of combinatorial chemistry and understand applications ofcombinatorial chemistry in the speedy synthesis of organic compounds and peptides.
CO4	Know what polycyclic compounds are and the reactions and methods ofsynthesis.Understand general rules and guidelines involved in retro-synthesis and construct retrosynthesisof pharmaceutically importantcompounds.
CO5	Prepare organic compounds.Able to understand reactivity/stability of compounds.

Course Delivery Methods (CD)	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Experiments, Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table: Mapping of Course Outcomes with Program Learning Outcomes

CO	Bloom Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L2	H	H	H	-	-	-	-	M	M	-	H	L	M	H	M
CO2	L2	H	M	H	L	L	-	-	M	L	-	H	L	H	-	M
CO3	L3	H	H	H	L	M	-	-	M	M	-	H	M	H	H	H
CO4	L3	H	M	H	L	M	-	-	M	M	-	H	H	-	H	L
CO5	L3	M	M	M	L	M	-	L	M	L	-	M	H	H	L	M

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD:

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1, CO2, CO3, CO4, CO5
CD3	Experiments, Seminars	CO3, CO4, CO5
CD4	Self- learning advice using internets	CO4, CO5
CD5	Industrial visit	CO5

BP302T. PHYSICAL PHARMACEUTICS-I (Theory)

45Hours

Scope/Objective:

The course deals with the various physica and physicochemical properties, andprinciples involved in dosage forms/formulations. Theory and practical components of the subject help the student to get a better insight into various areas of formulation research and development, and stability studies of pharmaceutical dosage forms.

Course Content:

Unit-I **10 Hours**

Solubility of drugs: Solubility expressions, mechanisms of solute solvent interactions, ideal solubility parameters, solvation & association, quantitative approach to the factors influencing solubility of drugs, diffusion principles in biological systems. Solubility of gas in liquids, solubility of liquids in liquids, (Binary solutions, ideal solutions)

Raoult's law, real solutions. Partially miscible liquids, Critical solution temperature and applications. Distribution law, its limitations and applications

Unit-II **10 Hours**

States of Matter and properties of matter: State of matter, changes in the state of matter, latent heats, vapour pressure, sublimation critical point, eutectic mixtures, gases, aerosols ,Inhalers, relative humidity, liquid complexes, liquid crystals, glassy states, solid-crystalline, amorphous & polymorphism.

Physicochemical properties of drug molecules: Refractive index, optical rotation,dielectric constant, dipole moment, dissociation constant, determinations and applications

Unit-III **08 Hours**

Surface and interfacial phenomenon: Liquid interface, surface & interfacial tensions,surface free energy, measurement of surface & interfacial tensions, spreading coefficient, adsorption at liquid interfaces, surface active agents, HLB Scale, solubilisation, detergency, adsorption at solid interface.

Unit-IV **08Hours**

Complexation and protein binding: Introduction, Classification of Complexation,Applications, methods of analysis, protein binding, Complexation and drug action, crystalline structures of complexes and thermodynamic treatment of stability constants.

Unit-V **07 Hours**

pH, buffers and Isotonic solutions: Sorensen's pH scale, pH determination(electrometric and calorimetric), applications of buffers, buffer equation, buffer capacity, buffers in pharmaceutical and biological systems, buffered isotonic solutions.

Recommended Books: (Latest Editions)

1. Physical Pharmacy by Alfred Martin
2. Experimental Pharmaceutics by Eugene, Parott.
3. Tutorial Pharmacy by Cooper and Gunn.
4. Stocklosam J. Pharmaceutical Calculations, Lea &Febiger, Philadelphia.
5. Liberman H.A, Lachman C., Pharmaceutical Dosage forms, Tablets, Volume-1 to 3, MarcelDekkar Inc.
6. Liberman H.A, Lachman C, Pharmaceutical Dosage forms. Disperse systems, volume 1, 2, 3. Marcel Dekkar Inc.
7. Physical Pharmaceutics by Ramasamy C and ManavalanR.
8. Laboratory Manual of Physical Pharmaceutics, C.V.S. Subramanyam, J. Thimma settee
9. Physical Pharmaceutics by C.V.S. Subramanyam
10. Test book of Physical Phramacy, by Gaurav Jain & Roop K. Khar

COURSE OUTCOMES-

By the end of this course, students will be able to:

CO1	Understand various physicochemical properties of drug molecules in the designing the dosage forms
CO2	Know the principles of chemical kinetics & to use them for stability testing nad determination of expiry date of formulations
CO3	Demonstrate use of physicochemical properties in the formulationdevelopment and evaluation of dosage forms.
CO4	Learn about the black body radiations, Stefan- Boltzmann's law, Rayleigh-Jean's law and Planck's law and their significances.
CO5	Learn the quantum statistical distributions, viz., the Bose-Einstein statistics and the Fermi-Dirac statistics.

Course Delivery Methods (CD)	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Experiments, Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table: Mapping of Course Outcomes with Program Learning Outcomes

CO	Blooms Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L2	H	M	M	L	L	M	M	L	M	L	M	L	H	M	L
CO2	L2	M	M	H	H	L	L	H	L	L	L	H	M	M	-	M
CO3	L2	M	H	L	M	L	L	M	L	L	H	M	H	M	H	L
CO4	L2	H	L	M	L	H	H	L	L	L	H	H	M	-	M	L
CO5	L2	M	M	L	M	L	M	H	L	L	M	L	H	M	L	H

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1, CO2, CO3, CO4, CO5
CD3	Experiments, Seminars	CO1, CO4
CD4	Self- learning advice using internets	CO4, CO5
CD5	Industrial visit	CO1, CO4

BP 303 T. PHARMACEUTICAL MICROBIOLOGY (Theory)

45 Hours

Scope/Objective:

Study of all categories of microorganisims especially for the production of alchol antibiotics, vaccines, vitamins enzymes etc.

Course content:

Unit I **10 Hours**

Introduction, history of microbiology, its branches, scope and its importance. Introduction to Prokaryotes and Eukaryotes. Study of ultra-structure and morphological classification of bacteria, nutritional requirements, raw materials used for culture media and physical parameters for growth, growth curve, isolation and preservation methods for pure cultures, cultivation of anaerobes, quantitative measurement of bacterial growth (total & viable count). Study of different types of phase constrast microscopy, dark field microscopy and electron microscopy.

Unit II **10 Hours**

Identification of bacteria using staining techniques (simple, Gram's & Acid fast staining) and biochemical tests (IMViC). Study of principle, procedure, merits, demerits and applications of physical, Chemical gaseous, radiation and mechanical method of sterilization. Evaluation of the efficiency of sterilization methods.Equipments employed in large scale sterilization, Sterility indicators.

Unit III **10 Hours**

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 bacteriostatic and bactericidal actions. Evaluation of bactericidal & Bacteriostatic. Sterility testing of products (solids, liquids, ophthalmic and other sterile (products) according to IP, BP and USP.

Unit IV **08 Hours**

Designing of aseptic area, laminar flow equipments; study of different sources of contamination in an aseptic area and methods of prevention, Clean area classification. Principles and methods ofdifferent microbiological assay. Methods for Standardization of antibiotics, vitamins and amino acids. Assessment of a new antibiotic.

Unit V **07 Hours**

Types of spoilage, factors affecting the microbial spoilage of pharmaceutical products, sources and types of microbial contaminants, Assessment of microbial contamination and spoilage. Preservation of pharmaceutical products using antimicrobial agents, Evaluation of microbial stability of formulations. Growth of animal cells in culture, general procedure for cell culture, Primary established and transformed cell cultures.

Application of cell cultures in pharmaceutical industry and research.

Recommended Books (Latest edition):

1. W.B. Hugo and A.D. Russel: Pharmaceutical Microbiology, Blackwell Scientific publications, Oxford London.
2. Prescott and Dunn. Industrial Microbiology, 4th edition, CBS Publishers & Distributors, Delhi.
3. Pelczar, Chan Kreig, Microbiology, Tata McGraw Hill edn.
4. Malcolm Harris, Balliere Tindall and Cox: Pharmaceutical Microbiology.
5. Rose: Industrial Microbiology.
6. Probisher, Hinsdill et al: Fundamentals of Microbiology, 9th ed. Japan
7. Cooper and Gunn's: Tutorial Pharmacy, CBS Publisher and Distribution.
8. Peppler: Microbial Technology.
9. I.P., B.P., U.S.P.- latest editions.
10. Ananthnarayan : Text Book of Microbiology, Orient-Longman, Chennai
11. Edward: Fundamentals of Microbiology.
12. N.K.Jain: Pharmaceutical Microbiology, Vallabh Prakashan, Delhi
13. Bergeys manual of systematic bacteriology, Williams and Wilkins- A Waverly company

COURSE OUTCOMES-

By the end of this course, students will be able to:

CO	Statement
CO1	Understand methods of identification, cultivation and preservation of various microorganisms.
CO2	To understand the importance and implementation of sterlization in pharmaceutical processing and industry.
CO3	Understanding of core concepts of microbiology. Learn sterility testing of pharmaceutical products.
CO4	Know the methods used in study bacteria and can classify them. Carried out microbiological standardization of Pharmaceuticals.
CO5	Understand the cell culture technology and its applications in pharmaceutical industries.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Laboratory teaching

Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Learning Outcomes

CO	Blooms Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L2	H	M	M	L	L	M	M	L	M	L	M	L	L	H	M
CO2	L2	M	M	H	H	L	L	H	L	L	L	H	M	M	-	M
CO3	L2	M	H	L	M	L	L	M	L	L	H	M	H	M	M	-
CO4	L2	H	L	M	L	H	H	L	L	L	H	H	M	M	L	L
CO5	L2	M	M	L	M	L	M	H	L	L	M	L	H	M	L	M

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1,CO2,CO4
CD2	Tutorials/Assignments	CO1,CO3
CD3	Seminars	CO1,CO2,CO3
CD4	Self- learning advice using internets	CO1,CO2,CO3,CO4
CD5	Laboratory teaching	CO2,CO3,CO5

BP 304 T. PHARMACEUTICAL ENGINEERING (Theory)

45 Hours

Scope/Objective:

This course is designed to impart a fundamental knowledge on the art and scienceof various unit operations used in pharmaceutical industry.

Course content:

Unit-I **10 Hours**

Flow of fluids: Types of manometers, Reynolds number and its significance, Bernoulli's theorem and its applications, Energy losses, Orifice meter, Venturimeter, Pitot tube and Rotometer.

Size Reduction: Objectives, Mechanisms & Laws governing size reduction,factors affecting size reduction, principles, construction, working, uses, merits and demerits of Hammer mill, ball mill, fluid energy mill, Edge runner mill & end runner mill.

Size Separation: Objectives, applications & mechanism of size separation,

Official standards of powders, sieves, size separation Principles, construction,

Working, uses, merits and demerits of Sieve shaker, cyclone separator, Air separator, Bag filter & elutriation tank.

Unit-II **10 Hours**

Heat Transfer: Objectives, applications & Heat transfer mechanisms. Fourier'slaw, Heat transfer by conduction, convection & radiation. Heat interchangers & heat exchangers.

Evaporation: Objectives, applications and factors influencing evaporation, differences between evaporation and other heat process. principles, construction, working, uses, merits and demerits of Steam jacketed kettle, horizontal tube evaporator, climbing film evaporator, forced circulation evaporator, multiple effect evaporator& Economy of multiple effect evaporator.

Distillation: Basic Principles and methodology of simple distillation, flashdistillation, fractional distillation, distillation under reduced pressure, steam distillation & molecular distillation

Unit- III **08 Hours**

Drying: Objectives, applications & mechanism of drying process, measurements& applications of Equilibrium Moisture content, rate of drying curve. principles, construction, working, uses, merits and demerits of Tray dryer, drum dryer spray dryer, fluidized bed dryer, vacuum dryer, freeze dryer.

Mixing: Objectives, applications & factors affecting mixing, Difference betweensolid and liquid mixing, mechanism of solid mixing, liquids mixing and semisolids mixing. Principles, Construction, Working, uses, Merits and Demerits of Double cone blender, twin shell blender, ribbon blender, Sigma blade mixer, planetary mixers, Propellers, Turbines, Paddles & Silverson Emulsifier,

Unit-IV **08 Hours**

Filtration: Objectives, applications, Theories & Factors influencing filtration, filter aids, filter Medias. Principle, Construction, Working, Uses, Merits and demerits of plate & frame filter, filter leaf, rotary drum filter, Meta filter & Cartridge filter, membrane filters and Seidtz filter.

Centrifugation: Objectives, principle & applications of Centrifugation,principles, construction, working, uses, merits and demerits of Perforated basket centrifuge, Non-perforated basket centrifuge, semi continuous centrifuge & super centrifuge.

Unit- V **07 Hours**

Materials of pharmaceutical plant construction, Corrosion and its prevention: Factors affecting during materials selected for Pharmaceutical plantconstruction, Theories of corrosion, types of corrosion and there prevention. Ferrous and nonferrous metals, inorganic and organic non metals, basic of material handling systems.

Recommended Books: (Latest Editions)

1. Introduction to chemical engineering – Walter L Badger & Julius Banchero, Latest edition.
2. Solid phase extraction, Principles, techniques and applications by Nigel J.K. Simpson-Latest edition.
3. Unit operation of chemical engineering – Mcabe Smith, Latest edition.
4. Pharmaceutical engineering principles and practices – C.V.S Subrahmanyam et al., Latest edition.
5. Remington practice of pharmacy- Martin, Latest edition.
6. Theory and practice of industrial pharmacy by Lachmann. Latest edition.
7. Physical pharmaceutics- C.V.S Subrahmanyam et al., Latest edition.
8. Cooper and Gunn's Tutorial pharmacy, S.J. Carter, Latest edition.

COURSE OUTCOMES-

By the end of this course, students will be able to:

CO1	To know various unit operations used in Pharmaceutical industries.
CO2	Understand the basics of material handling techniques.
CO3	Students will learn about the professional way of various processes involved in pharmaceutical manufacturing process.
CO4	Students will gain knowledge about various test to prevent environmental pollution & the various preventive methods used for corrosion control in Pharmaceutical industries.
CO5	Understand the methods of preparation of plant lay out design for optimum use of resources.

Course Delivery Methods (CD)	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Experiments, Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table: Mapping of Course Outcomes with Program Learning Outcomes

CO	Bloom Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L2	H	H	H	-	-	-	-	M	M	-	H	L	H	M	L
CO2	L2	H	M	H	L	L	-	-	M	L	-	H	L	M	L	-
CO3	L3	H	H	H	L	M	-	-	M	M	-	H	M	M	L	M
CO4	L3	H	M	H	L	M	-	-	M	M	-	H	H	M	L	-
CO5	L3	M	M	M	L	M	-	L	M	L	-	M	H	M	M	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD:

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1, CO2, CO3, CO4, CO5
CD3	Experiments, Seminars	CO3, CO4, CO5
CD4	Self- learning advice using internets	CO4, CO5
CD5	Industrial visit	CO5

BP305P. PHARMACEUTICAL ORGANIC CHEMISTRY -II (Practical)

4 Hrs/week

Scope/Objective:

This subject deals with general methods of preparation and reactions of someorganic compounds. Reactivity of organic compounds are also studied here. The syllabus emphasizes on mechanisms and orientation of reactions. Chemistry of fats and oils are also included in the syllabus.

I Experiments involving laboratory techniques, Recrystallization, Steam distillation

II Determination of following oil values (including standardization of reagents) Acid value, Saponification value, Iodine value

III **Preparation of compounds**

Benzanilide/Phenyl benzoate/Acetanilide from Aniline/ Phenol /Aniline by acylation reaction. 2,4,6-Tribromo aniline/Para bromo acetanilide from Aniline/ Acetanilide by halogenation (Bromination) reaction. 5-Nitro salicylic acid/Meta di nitro benzene from Salicylic acid / Nitro benzene by nitration reaction. Benzoic acid from Benzyl chloride by oxidation reaction. Benzoic acid/ Salicylic acid from alkyl benzoate/ alkyl salicylate by hydrolysis reaction. 1-Phenyl azo-2-napthol from Aniline by diazotization and coupling reactions.

Benzil from Benzoin by oxidation reaction. Dibenzal acetone from Benzaldehyde by Claison Schmidt reaction Cinnammic acid from Benzaldehyde by Perkin reaction *P*-Iodo benzoic acid from *P*-amino benzoic acid

Recommended Books (Latest Editions)

1. Organic Chemistry by Morrison and Boyd
2. Organic Chemistry by I.L. Finar, Volume-I
3. Textbook of Organic Chemistry by B.S. Bahl & Arun Bahl.
4. Organic Chemistry by P.L.Soni
5. Practical Organic Chemistry by Mann and Saunders.
6. Vogel’s text book of Practical Organic Chemistry
7. Advanced Practical organic chemistry by N.K.Vishnoi.
8. Introduction to Organic Laboratory techniques by Pavia, Lampman and Kriz.

COURSE OUTCOMES-

By the end of this course, students will be able to:

CO1	Know the structures with numbering of heterocyclic compounds, chemistry, methods of preparation and chemical reactions of five, six membered and fused heterocyclic rings.
CO2	Know schemes of synthesis and reactions of drugs containing heterocyclicrings.
CO3	Explain various techniques of combinatorial chemistry and understand applications ofcombinatorial chemistry in the speedy synthesis of organic compounds and peptides.
CO4	Know what are polycyclic compounds and the reactions and methods ofsynthesis.Understand general rules and guidelines involved in retro-synthesis and construct retrosynthesisof pharmaceutically importantcompounds.
CO5	Prepare organic compounds.Able to understand reactivity/stability of compounds.

Course Delivery Methods (CD)	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Experiments, Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table: Mapping of Course Outcomes with Program Learning Outcomes

CO	Bloom Level	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L2	H	H	H	-	-	-	-	M	M	-	H	L	M	L	L
CO2	L2	H	M	H	L	L	-	-	M	L	-	H	L	L	-	L
CO3	L3	H	H	H	L	M	-	-	M	M	-	H	M	M	H	H
CO4	L3	H	M	H	L	M	-	-	M	M	-	H	H	H	M	-
CO5	L3	M	M	M	L	M	-	L	M	L	-	M	H	M	L	M

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD:

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1, CO2, CO3, CO4, CO5
CD3	Experiments, Seminars	CO3, CO4, CO5
CD4	Self- learning advice using internets	CO4, CO5
CD5	Industrial visit	CO5

306P. PHYSICAL PHARMACEUTICS – I (Practical)

4 Hrs/week

Scope/Objective:

The course deals with the various physica and physicochemical properties, andprinciples involved in dosage forms/formulations. Theory and practical components of the subject help the student to get a better insight into various areas of formulation research and development, and stability studies of pharmaceutical dosage forms.

1. Determination the solubility of drug at room temperature.
2. Determination of pKa value by Half Neutralization/ Henderson Hasselbalch equation.
3. Determination of Partition co- efficient of benzoic acid in benzene and water
4. Determination of Partition co- efficient of Iodine in CCl_4 and water
5. Determination of % composition of NaCl in a solution using phenol-water system by CST method
6. Determination of surface tension of given liquids by drop count and drop weight method
7. Determination of HLB number of a surfactant by saponification method
8. Determination of Freundlich and Langmuir constants using activated char coal
9. Determination of critical micellar concentration of surfactants
10. Determination of stability constant and donor acceptor ratio of PABA-Caffeine complex by solubility method
11. Determination of stability constant and donor acceptor ratio of Cupric-Glycine complex by pH titration method.

Recommended Books: (Latest Editions)

1. Physical Pharmacy by Alfred Martin
2. Experimental Pharmaceutics by Eugene, Parott.
3. Tutorial Pharmacy by Cooper and Gunn.
4. Stocklosam J. Pharmaceutical Calculations, Lea &Febiger, Philadelphia.
5. Liberman H.A, Lachman C., Pharmaceutical Dosage forms, Tablets, Volume-1 to 3, MarcelDekkar Inc.
6. Liberman H.A, Lachman C, Pharmaceutical Dosage forms. Disperse systems, volume 1, 2, 3. Marcel Dekkar Inc.
7. Physical Pharmaceutics by Ramasamy C and ManavalanR.
8. Laboratory Manual of Physical Pharmaceutics, C.V.S. Subramanyam, J. Thimma settee
9. Physical Pharmaceutics by C.V.S. Subramanyam
10. Test book of Physical Phramacy, by Gaurav Jain & Roop K. Khar

COURSE OUTCOMES-

By the end of this course, students will be able to:

CO1	Understand various physicochemical properties of drug molecules in the designing the dosage forms
CO2	Know the principles of chemical kinetics & to use them for stability testing nad determination of expiry date of formulations
CO3	Demonstrate use of physicochemical properties in the formulationdevelopment and evaluation of dosage forms.
CO4	Learn about the black body radiations, Stefan- Boltzmann's law, Rayleigh-Jean's law and Planck's law and their significances.
CO5	Learn the quantum statistical distributions, viz., the Bose-Einstein statistics and the Fermi-Dirac statistics.

Course Delivery Methods (CD)	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Experiments, Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table: Mapping of Course Outcomes with Program Learning Outcomes

CO	Blooms Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L2	H	M	M	L	L	M	M	L	M	L	M	L	H	M	L
CO2	L2	M	M	H	H	L	L	H	L	L	L	H	M	M	M	L
CO3	L2	M	H	L	M	L	L	M	L	L	H	M	H	M	H	M
CO4	L2	H	L	M	L	H	H	L	L	L	H	H	M	H	-	L
CO5	L2	M	M	L	M	L	M	H	L	L	M	L	H	M	L	M

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1, CO2, CO3, CO4, CO5
CD3	Experiments, Seminars	CO1, CO4, CO3,
CD4	Self- learning advice using internets	CO4, CO5
CD5	Industrial visit	CO1, CO4

BP 307P.PHARMACEUTICAL MICROBIOLOGY (Practical)

4 Hrs/week

Scope/Objective:

Study of all categories of microorganisims especially for the production of alchol antibiotics, vaccines, vitamins enzymes etc..

1. Introduction and study of different equipments and processing, e.g., B.O.D. incubator, laminar flow, aseptic hood, autoclave, hot air sterilizer, deep freezer, refrigerator, microscopes used in experimental microbiology.
2. Sterilization of glassware, preparation and sterilization of media.
3. Sub culturing of bacteria and fungus. Nutrient stabs and slants preparations.
4. Staining methods- Simple, Grams staining and acid fast staining (Demonstration with practical).
5. Isolation of pure culture of micro-organisms by multiple streak plate technique and other techniques.
6. Microbiological assay of antibiotics by cup plate method and other methods
7. Motility determination by Hanging drop method.
8. Sterility testing of pharmaceuticals.
9. Bacteriological analysis of water
10. Biochemical test.

Recommended Books (Latest edition)

1. W.B. Hugo and A.D. Russel: Pharmaceutical Microbiology, Blackwell Scientific publications, Oxford London.
2. Prescott and Dunn. Industrial Microbiology, 4th edition, CBS Publishers & Distributors, Delhi.
3. Pelczar, Chan Kreig, Microbiology, Tata McGraw Hill edn.
4. Malcolm Harris, Balliere Tindall and Cox: Pharmaceutical Microbiology.
5. Rose: Industrial Microbiology.
6. Probisher, Hinsdill et al: Fundamentals of Microbiology, 9th ed. Japan
7. Cooper and Gunn's: Tutorial Pharmacy, CBS Publisher and Distribution.
8. Peppler: Microbial Technology.
9. I.P., B.P., U.S.P.- latest editions.
10. Ananthnarayan: Text Book of Microbiology, Orient-Longman, Chennai
11. Edward: Fundamentals of Microbiology.
12. N.K.Jain: Pharmaceutical Microbiology, Vallabh Prakashan, Delhi
13. Bergeys manual of systematic bacteriology, Williams and Wilkins- A Waverly Company

COURSE OUTCOMES-

By the end of this course, students will be able to

CO	Statement
CO1	Understand methods of identification, cultivation and preservation of various microorganisms.
CO2	To understand the importance and implementation of sterlization in pharmaceutical processing and dustry.
CO3	Understanding of core concepts of microbiology. Learn sterility testing of pharmaceutical products.
CO4	Know the methods used in study bacteria and can classify them. Carried out microbiological standardization of Pharmaceuticals.
CO5	Understand the cell culture technology and its applications in pharmaceutical industries.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Laboratory teaching

Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Learning Outcomes

Course Outcome	Bloom's Level	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	P010	PO11	PO12	PSO1	PSO2	PSO3
CO1	L1	H	M	H	L	-	L	L	-	-	L	M	H	M	L	L
CO2	L2	H	L	M	L	-	-	-	L	-	L	L	M	M	H	L
CO3	L2	H	L	M	-	L	-	-	-	L	-	L	M	M	-	H
CO4	L2	H	M	M	L	L	L	-	-	-	L	M	M	H	M	L
CO5	L2	H	L	H	L	-	-	-	-	L	-	L	H	M	L	-

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1,CO2,CO4
CD2	Tutorials/Assignments	CO1,CO3
CD3	Seminars	CO1,CO2,CO3
CD4	Self- learning advice using internets	CO1,CO2,CO3,CO4
CD5	Laboratory teaching	CO2,CO3,CO5

P308P - PHARMACEUTICAL ENGINEERING (Practical)

4 Hours/week

Scope/Objective:

This course is designed to impart a fundamental knowledge on the art and scienceof various unit operations used in pharmaceutical industry.

I. Determination of radiation constant of brass, iron, unpainted and painted glass.

II. Steam distillation – To calculate the efficiency of steam distillation.

III. To determine the overall heat transfer coefficient by heat exchanger.

IV. Construction of drying curves (for calcium carbonate and starch).

V. Determination of moisture content and loss on drying.

VI. Determination of humidity of air – i) from wet and dry bulb temperatures –use of Dew point method.

VII. Description of Construction working and application of Pharmaceutical Machinery such as rotary tablet machine, fluidized bed coater, fluid energy mill, de humidifier.

VIII. Size analysis by sieving – To evaluate size distribution of tablet granulations – Construction of various size frequency curves including arithmetic andlogarithmic probability plots.

IX. Size reduction: To verify the laws of size reduction using ball mill and determining Kicks, Rittinger's, Bond's coefficients, power requirement and critical speed of Ball Mill.

X. Demonstration of colloid mill, planetary mixer, fluidized bed dryer, freeze dryer and such othermajor equipment.

XI. Factors affecting Rate of Filtration and Evaporation (Surface area, Concentration And Thickness/ viscosity

XII. To study the effect of time on the Rate of Crystallization.

XIII. To calculate the uniformity Index for given sample by using Double Cone Blender.

Recommended Books: (Latest Editions)

1. Introduction to chemical engineering – Walter L Badger & Julius Banchero, Latest edition.
2. Solid phase extraction, Principles, techniques and applications by Nigel J.K. Simpson-Latest edition.
3. Unit operation of chemical engineering – Mcabe Smith, Latest edition.
4. Pharmaceutical engineering principles and practices – C.V.S Subrahmanyam et al., Latest edition.
5. Remington practice of pharmacy- Martin, Latest edition.
6. Theory and practice of industrial pharmacy by Lachmann. Latest edition.
7. Physical pharmaceutics- C.V.S Subrahmanyam et al., Latest edition.
8. Cooper and Gunn's Tutorial pharmacy, S.J. Carter, Latest edition.

COURSE OUTCOMES-

By the end of this course, students will be able to:

CO1	To know various unit operations used in Pharmaceutical industries.
CO2	Understand the basics of material handling techniques.
CO3	Students will learn about the professional way of various processes involved in pharmaceutical manufacturing process.
CO4	Students will gain knowledge about various test to prevent environmental pollution & the various preventive methods used for corrosion control in Pharmaceutical industries.
CO5	Understand the methods of preparation of plant lay out design for optimum use of resources.

Course Delivery Methods (CD)	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Experiments, Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table: Mapping of Course Outcomes with Program Learning Outcomes

CO	Bloom Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L2	H	H	H	-	-	-	-	M	M	-	H	L	M	L	L
CO2	L2	H	M	H	L	L	-	-	M	L	-	H	L	M	-	L
CO3	L3	H	H	H	L	M	-	-	M	M	-	H	M	H	L	H
CO4	L3	H	M	H	L	M	-	-	M	M	-	H	H	H	M	L
CO5	L3	M	M	M	L	M	-	L	M	L	-	M	H	M	L	-

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD:

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1, CO2, CO3, CO4, CO5
CD3	Experiments, Seminars	CO3, CO4, CO5
CD4	Self- learning advice using internets	CO4, CO5
CD5	Industrial visit	CO5

BP309: UNIVERSAL HUMAN VALUES

Objectives :

The present course deals with meaning, purpose, and relevance of universal human values and how to inculcate and practice them consciously to be a good human being and realize one's potentials.

Course contents

Unit I: Love & Compassion

Introduction: What is love? Forms of love—for self, parents, family, friend, spouse, community, nation, humanity and other beings, both for living and non-living, Love and compassion and inter-relatedness, Love, compassion, empathy, sympathy and non-violence, Individuals who are remembered in history for practicing compassion and love. Narratives and anecdotes from history, literature including local folklore , Practicing love and compassion: What will learners learn gain if they practice love and compassion? What will learners lose if they don't practice love and compassion?, Sharing learner's individual and/or group experience(s)
Simulated Situations
Case studies

Unit II: Truth

Introduction: What is truth? Universal truth, truth as value, truth as fact (veracity, sincerity, honesty among others), Individuals who are remembered in history for practicing this value, Narratives and anecdotes from history, literature including local folklore, Practicing Truth: What will learners learn/gain if they practice truth? What will learners lose if they don't practice it?, Learners' individual and/or group experience(s)
Simulated situations
Case studies

Unit III: Non-Violence

Introduction: What is non-violence? Its need. Love, compassion, empathy sympathy for others as pre-requisites for non-violence, Ahimsa as non-violence and non-killing, Individuals and organisations that are known for their commitment to nonviolence, Narratives and anecdotes about non-violence from history, and literature including local folklore, Practicing non-violence: What will learners learn/gain if they practice nonviolence? What will learners lose if they don't practice it? , Sharing learner's individual and/or group experience(s) about non-violence,
Simulated situations
Case studies

Unit IV: Righteousness & Peace

Introduction: What is righteousness? ,Righteousness and *dharma*, Righteousness and Propriety, Individuals who are remembered in history for practicing righteousness, Narratives and anecdotes from history, literature including local folklore ,racticing righteousness: What will learners learn/gain if they practice righteousness? What will learners lose if they don't practice it?, Sharing learners' individual and/or group experience(s), Simulated situations, Case studies ,Introduction: What is peace? Its need, relation with harmony and balance ,Individuals and organisations that are known for their commitment to peace, Narratives and Anecdotes about peace from history, and literature including local folklore, Practicing peace: What will learners learn/gain if they practice peace? What will learners lose if they don't practice it? ,Sharing learner's individual and/or group experience(s) about peace ,Simulated situations,Case studies,

Unit V: Service & Renunciation (Sacrifice)

Introduction: What is service? Forms of service, for self, parents, family, friend, spouse, community, nation, humanity and other beings—living and non-living, persons in distress or disaster. Individuals who are remembered in history for practicing this value.Narratives and anecdotes dealing with instances of service from history, literature including local folklore.

Practicing service: What will learners learn/gain gain if they practice service? What will learners lose if they don't practice it? Sharing learners' individual and/or group experience(s) regarding service.Simulated situations.Case studies Introduction: What is renunciation? Renunciation and sacrifice. Self-restrain and Ways of overcoming greed. Renunciation with action as true renunciation

Individuals who are remembered in history for practicing this value., Narratives and anecdotes from history and literature, including local folklore about individuals who are remembered for their sacrifice and renunciation., Practicing renunciation and sacrifice: What will learners learn/gain if they practice Renunciation and sacrifice? What will learners lose if they don't practice it? , Sharing learners' individual and/or group experience(s),

Simulated situations

Case studies

Text Books:

1. Mookerji Radha Kumud, Ancient Indian Education,
2. Motilal Banarasidass Saraswati Swami Satyananda,
3. Asana Pranayama Mudra Bandha, Bihar School of yoga Joshi Kireet, Education for Character Development, Dharma Hinduja Center of Indic Studies Joshi Rokeach (1973).
4. The Nature of Human Values. New York: The Free Press Ghosh, Sri Aurobindo. 1998. The Foundations of Indian Culture. Pondicherry: Sri Aurobindo

Course Outcomes:

CO	Statement
	After the completion of this course, students will be able to:
CO1	Know about universal human values and understand the importance of values in individual, social circles, career path, and national life
CO2	Understand from case studies of lives of great and successful people who followed and practised human values
CO3	Adapt self-actualisation
CO4	Become conscious practitioners of human values.
CO5	Apply their potential as human beings and conduct themselves properly in the ways of the world.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Bloom's Levels	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO3
CO1	L2	L	L	-	M	L	H	H	M	-	H	-	-	L	-	-
CO2	L2	L	L	-	M	L	H	H	M	-	H	-	-	L	-	-
CO3	L3	L	L	-	M	L	H	H	M	-	H	-	-	L	-	-
CO4	L2	L	L	-	M	L	H	H	M	-	H	-	-	L	-	-
CO5	L3	L	L	-	M	L	H	H	M	-	H	-	-	L	-	-

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1,CO2,CO3
CD2	Tutorials/Assignments	CO1,CO2,CO3, CO5
CD3	Seminars	CO3
CD4	Self- learning advice using internets	CO4
CD5	Industrial visit	-

BP310: LEADERSHIP & MANAGEMENT SKILLS

Course Objectives:

1. To help students to develop essential skills to influence and motivate others
2. To inculcate emotional and social intelligence and integrative thinking for effective leadership
3. To create and maintain an effective and motivated team to work for the society
4. To nurture a creative and entrepreneurial mindset
5. To make students understand the personal values and apply ethical principles in professional and social contexts.

Course Contents

Unit I - Leadership Skills

Understanding Leadership and its Importance: What is leadership? Why Leadership required? Whom do you consider as an ideal leader? Traits and Models of Leadership: Are leaders born or made? Key characteristics of an effective leader, Leadership styles, Perspectives of different leaders. Basic Leadership Skills: Motivation, Team work, Negotiation, Networking. Innovative Leadership. Concept of emotional and social intelligence, Synthesis of human and artificial intelligence, Why does culture matter for today's global leaders.

Unit II Managerial Skills

Basic Managerial Skills, Planning for effective management, How to organise teams? Recruiting and retaining talent, Delegation of tasks, Learn to coordinate, Conflict management, Self Management Skills, Understanding self concept, Developing self-awareness, Self-examination, Self-regulation.

Unit III Entrepreneurial Skills

Basics of Entrepreneurship: Meaning of entrepreneurship, Classification and types of entrepreneurship, Traits and competencies of entrepreneur, Creating Business Plan, Problem identification and idea generation, Idea validation, Pitch making.

Unit IV Design Thinking

Design Thinking: What is design thinking? Key elements of design thinking: Discovery, Interpretation, Ideation- Experimentation – Evolution, How to transform challenges into pportunities? How to develop human-centric solutions for creating social good?

Unit V Ethics and Integrity

Learning through Biographies: What makes an individual great? Understanding the persona of a leader for deriving holistic inspiration, Drawing insights for leadership, How leaders sail through difficult situations? Ethics and Conduct, Importance of ethics, Ethical decision making, Personal and professional moral codes of conduct, Creating a harmonious life

Text Books:

1. Ashokan, M. S. (2015). *Karmayogi: A Bbiography of E. Sreedharan*. Penguin, UK.
2. Brown, T. (2012). *Change by Design.* Harper Business
3. Kalam A. A. (2003). *Ignited Minds: Unleashing the Power within India*. Penguin Books India
4. Kelly T., Kelly D. (2014). *Creative Confidence: Unleashing the Creative Potential Within Us All.* William Collins
5. McCormack M. H. (1986).*What They Don't Teach You at Harvard Business School: Notes From A Street-Smart Executive*. RHUS

Suggested Readings:

- Sternberg R. J., Sternberg R. J., & Baltes P. B. (Eds.). (2004). *International Handbook of Intelligence*. Cambridge University Press.

E-Resources

- India's Hidden Hot Beds of Invention Ted Talk by Anil Gupta - https://www.ted.com/ talks/anil_gupta_india_s_hidden_hotbeds_of_invention
- Knowledge@Wharton Interviews Former Indian President APJ Abdul Kalam - . "A Leader Should Know How to Manage Failure" https://www.youtube.com/ watch?v=laGZaS4sdeU

NPTEL Course on Leadership - https://nptel.ac.in/courses/122105021/9

Course Outcome:

CO	Statement
	After completion of this course, students will be able to:
CO1	Examine various leadership models and understand/assess their skills, strengths abilities that affect their own leadership style and can create their leadership vision
CO2	Learn and demonstrate a set of practical skills such as time management, self managem handling conflicts, team leadership, etc.
CO3	Understand the basics of entrepreneurship and develop business plans
CO4	Apply the design thinking approach for leadership
CO5	Discuss the importance of ethics and moral values for making of a balanced personality

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Bloom's Levels	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO3
CO1	L4	M	M	-	-	M	M	M	H	-	L	L	-	M	-	-
CO2	L3	M	M	M	M	M	M	L	M	-	M	M	-	M	-	-
CO3	L2	M	M	M	H	M	M	M	M	-	L	L	-	M	-	-
CO4	L3	M	M	M	M	M	M	M	H	-	L	L	-	M	-	-
CO5	L1`	-	M	L	H	H	H	M	M	-	L	L	-	M	-	-

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1,CO2,CO3, CO4,CO5
CD2	Tutorials/Assignments	CO1,CO2,CO3, CO4,CO5
CD3	Seminars	CO1,CO2,CO3, CO4,CO5
CD4	Self- learning advice using internets	CO1, CO2,CO3, CO4
CD5	Industrial visit	CO5

BP 311: ANANDAM

Objectives:

- To instil the joy of giving in young people, turning them into responsible citizens to build up a better society.
- To inculcate the habit of service in students across the University.
- A compulsory course of 2 credits per semester to be included in each program of University.
- Students to be excepted to engage in individual and group acts of service and goodness.

Action Plan:

Students will be expected to

- Do at least one act of individual service each day
- Record this act of service in a dedicated Register / Personal Diary
- Share this Register / Personal Diary day in the Anandam Class scheduled per week. The class interaction will include Personal Diary check, Showing of Community based motivation videos, Community based presentations by students, Role playing etc.
- Undertake one group service project for 64 hours every semester (outside college hours)
- Upload the report on the group project on the Anandam platform
- Participate in a sharing and presentation on the group service in the discussion sessions held once in week
- there will be some suggested projects and organizations that students can work with. Students can also suggest their own projects which others can join

Each student will finish the year with a portfolio of giving. This will include their Register / Personal Diaries and their reports on group service projects.

Semester - IV

Code No.	Paper	Type	Internal Marks	External Marks	Total Marks	L	T/P	Credit
BP401T	Pharmaceutical Organic Chemistry III– Theory	CORE	25	75	100	3	1	4
BP402T	Medicinal Chemistry I – Theory	CORE	25	75	100	3	1	4
BP403T	Physical Pharmaceutics II – Theory	CORE	25	75	100	3	1	4
BP404T	Pharmacology I – Theory	CORE	25	75	100	3	1	4
BP405T	Pharmacognosy and Phytochemistry I– Theory	CORE	25	75	100	3	1	4
BP406P	Medicinal Chemistry I– Practical	CORE	15	35	50	4	-	2
BP407P	Physical Pharmaceutics II– Practical	CORE	15	35	50	4	-	2
BP408P	PharmacologyI–Practical	CORE	15	35	50	4	-	2
BP409P	Pharmacognosy I– Practical	CORE	15	35	50	4	-	2
BP 410	ANANDAM	CEC	50	50	100	1	-	2
BP 411	Research Methodology & Biostatics	CORE	50	50	100	1	-	2
	TOTAL		**285**	**615**	**900**			**32**

SEMESTER IV

BP401T. PHARMACEUTICAL ORGANIC CHEMISTRY –III (Theory)

45 Hours

Scope/Objective: This subject imparts knowledge on stereo-chemical aspects of organic compoundsand organic reactions, important named reactions, chemistry of important hetero cyclic compounds. It also emphasizes on medicinal and other uses of organic compounds.

Course Content:

Note: To emphasize on definition, types, mechanisms, examples, uses/applications

Unit-I **10 Hours**

Stereo isomerism

Optical isomerism – Optical activity, enantiomerism, diastereoisomerism, meso compounds Elements of symmetry, chiral and achiral molecules DL system of nomenclature of optical isomers, sequence rules, RS system of nomenclature of optical isomers Reactions of chiral molecules Racemic modification and resolution of racemic mixture. Asymmetric synthesis: partial and absolute

Unit-II **10 Hours**

Geometrical isomerism Nomenclature of geometrical isomers (Cis Trans, EZ, Syn Anti systems) Methods of determination of configuration of geometrical isomers. Conformational isomerism in Ethane, n-Butane and Cyclohexane. Stereo isomerism in biphenyl compounds (Atropisomerism) and conditions for optical activity. Stereospecific and stereoselective reactions

Unit-III **10 Hours**

Heterocyclic compounds:

Nomenclature and classificationSynthesis, reactions and medicinal uses of following

Compounds/derivatives Pyrrole, Furan, and Thiophene

Relative aromaticity and reactivity of Pyrrole, Furan and Thiophene

Unit-IV **8 Hours**

Synthesis, reactions and medicinal uses of following compounds/derivatives

Pyrazole, Imidazole, Oxazole and Thiazole.

Pyridine, Quinoline, Isoquinoline, Acridine and Indole. Basicity of pyridine Synthesis and medicinal uses of Pyrimidine, Purine, azepines and their derivatives

Unit-V **07 Hours**

Reactions of synthetic importance

Metal hydride reduction ($NaBH_4$ and $LiAlH_4$), Clemmensen reduction, Birch reduction, Wolff Kishner reduction. Oppenauer-oxidation and Dakin reaction. Beckmann's rearrangement and Schmidt rearrangement. Claisen-Schmidt condensation

Recommended Books (Latest Editions)

1. Organic chemistry by I.L. Finar, Volume-I & II.
2. A text book of organic chemistry – Arun Bahl, B.S. Bahl.
3. Heterocyclic Chemistry by Raj K. Bansal
4. Organic Chemistry by Morrison and Boyd
5. Heterocyclic Chemistry by T.L. Gilchrist
6. Know schemes of synthesis and reactions of drugs containing heterocyclicrings.

COURSE OUTCOMES-

By the end of this course, students will be able to:

CO1	Know the structures with numbering of heterocyclic compounds, chemistry, methods of preparation and chemical reactions of five, six membered and fused heterocyclic rings.
CO2	Know what are polycyclic compounds and the reactions and methods ofsynthesis.
CO3	Explain various techniques of combinatorial chemistry and understand applications ofcombinatorial chemistry in the speedy synthesis of organic compounds and peptides.
CO4	Understand general rules and guidelines involved in retro-synthesis and construct retrosynthesisof pharmaceutically importantcompounds.
CO5	Comprehend the techniques of microwave assisted synthesis and explain applications ofmicrowave assisted synthesis in pharmaceuticalresearch.

Course Delivery Methods (CD)	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Experiments, Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table: Mapping of Course Outcomes with Program Learning Outcomes

CO	Bloom Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L2	H	H	H	-	-	-	-	M	M	-	H	H	H	M	L
CO2	L2	H	M	H	L	L	-	-	M	L	-	H	M	M	M	L
CO3	L3	H	H	H	L	M	-	-	M	M	-	H	L	M	L	-
CO4	L3	H	M	H	L	M	-	-	M	M	-	H	-	L	-	M
CO5	L3	M	M	M	L	M	-	L	M	L	-	M	M	M	L	M

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD:

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1, CO2, CO3, CO4, CO5
CD3	Experiments, Seminars	CO3, CO4, CO5
CD4	Self- learning advice using internets	CO4, CO5
CD5	Industrial visit	CO5

BP402T. MEDICINAL CHEMISTRY – I (Theory)

45 Hours

Scope/Objective:

This subject is designed to impart fundamental knowledge on the structure,chemistry and therapeutic value of drugs. The subject emphasizes on structure activity relationships of drugs, importance of physicochemical properties and metabolism of drugs. The syllabus also emphasizes on chemical synthesis of important drugs under each class.

Course Content:

Study of the development of the following classes of drugs, Classification, mechanism of action, uses of drugs mentioned in the course, Structure activity relationship of selective class of drugs as specified in the course and synthesis of drugs superscripted (*)

Unit- I **10 Hours**

Introduction to Medicinal Chemistry

History and development of medicinal chemistry

Physicochemical properties in relation to biological action

Ionization, Solubility, Partition Coefficient, Hydrogen bonding, Protein binding, Chelation, Bioisosterism, Optical and Geometrical isomerism.

Drug metabolism

Drug metabolism principles- Phase I and Phase II.

Factors affecting drug metabolism including stereo chemical aspects.

Unit- II **10 Hours**

Drugs acting on Autonomic Nervous System

Adrenergic Neurotransmitters:

Biosynthesis and catabolism of catecholamine. Adrenergic receptors (Alpha & Beta) and their distribution.

Sympathomimetic agents: SAR of Sympathomimetic agents

Direct acting: Nor-epinephrine, Epinephrine, Phenylephrine*, Dopamine, Methyldopa, Clonidine, Dobutamine, Isoproterenol, Terbutaline, Salbutamol*, Bitolterol, Naphazoline, Oxymetazoline and Xylometazoline. Indirect acting agents: Hydroxyamphetamine, Pseudoephedrine, Propylhexedrine. Agents with mixed mechanism: Ephedrine, Metaraminol.

Adrenergic Antagonists:

Alpha adrenergic blockers: Tolazoline*, Phentolamine,Phenoxybenzamine, Prazosin, Dihydroergotamine, Methysergide.

Beta adrenergic blockers: SAR of beta blockers, Propranolol*, Metibranolol, Atenolol, Betazolol, Bisoprolol, Esmolol, Metoprolol, Labetolol, Carvedilol.

Unit-III **10 Hours**

Cholinergic neurotransmitters:

Biosynthesis and catabolism of acetylcholine.

Cholinergic receptors (Muscarinic & Nicotinic) and their distribution.

Parasympathomimetic agents: SAR of Parasympathomimetic agents

Direct acting agents: Acetylcholine, Carbachol*, Bethanechol, Methacholine, Pilocarpine.

Indirect acting/ Cholinesterase inhibitors (Reversible & Irreversible): Physostigmine, Neostigmine*, Pyridostigmine, Edrophonium chloride, Tacrine hydrochloride, Ambenonium chloride, Isofluorphate, Echothiophate iodide, Parathione, Malathion.

Cholinesterase reactivator: Pralidoxime chloride.

Cholinergic Blocking agents: SAR of cholinolytic agents

Solanaceous alkaloids and analogues: Atropine sulphate, Hyoscyaminesulphate, Scopolamine hydrobromide, Homatropine hydrobromide, Ipratropium bromide*.

Synthetic cholinergic blocking agents: Tropicamide, Cyclopentolate, Hydrochloride, Clidinium bromide, Dicyclomine hydrochloride*, Glycopyrrolate, Methantheline bromide, Propantheline bromide, Benztropine mesylate, Orphenadrine citrate, Biperidine hydrochloride, Procyclidine hydrochloride*, Tridihexethyl chloride, Isopropamide iodide, Ethopropazine hydrochloride.

Unit- IV **08 Hours**

Drugs acting on Central Nervous System

A. Sedatives and Hypnotics:

Benzodiazepines: SAR of Benzodiazepines, Chlordiazepoxide, Diazepam*, Oxazepam, Chlorazepate, Lorazepam, Alprazolam, Zolpidem

Barbiturtes: SAR of barbiturates, Barbital*, Phenobarbital, Mephobarbital, Amobarbital, Butabarbital, Pentobarbital, Secobarbital

Miscelleneous: Amides & imides: Glutethmide. Alcohol & their carbamate derivatives: Meprobomate, Ethchlorvynol. Aldehyde & their derivatives: Triclofos sodium, Paraldehyde.

B. Antipsychotics

Phenothiazeines: SAR of Phenothiazeines – Promazine hydrochloride, Chlorpromazine hydrochloride*, Triflupromazine, Thioridazine hydrochloride, Piperacetazine hydrochloride, Prochlorperazine maleate, Trifluoperazine hydrochloride.

Ring Analogues of Phenothiazeines: Chlorprothixene, Thiothixene, Loxapine succinate, Clozapine.

Fluro buterophenones: Haloperidol, Droperidol, Risperidone.

Beta amino ketones: Molindone hydrochloride.

Benzamides: Sulpieride.

C. Anticonvulsants: SAR of Anticonvulsants**,** mechanism of anticonvulsantaction

Barbiturates: Phenobarbitone, Methabarbital. **Hydantoins:** Phenytoin*, Mephenytoin, Ethotoin **Oxazolidine diones:** Trimethadione, Paramethadione **Succinimides:** Phensuximide, Methsuximide, Ethosuximide* **Urea and monoacylureas**: Phenacemide, Carbamazepine*

Benzodiazepines: Clonazepam **Miscellaneous:** Primidone, Valproic acid, Gabapentin, Felbamate

Unit – V **07 Hours**

Drugs acting on Central Nervous System

General anesthetics:

Inhalation anesthetics: Halothane*, Methoxyflurane, Enflurane, Sevoflurane, Isoflurane, Desflurane.

Ultra short acting barbitutrates: Methohexital sodium*, Thiamylalsodium, Thiopental sodium.

Dissociative anesthetics: Ketamine hydrochloride.*

Narcotic and non-narcotic analgesics

Morphine and related drugs: SAR of Morphine analogues, Morphinesulphate, Codeine, Meperidine hydrochloride, Anilerdine hydrochloride, Diphenoxylate hydrochloride, Loperamide hydrochloride, Fentanyl citrate*, Methadone hydrochloride*, Propoxyphene hydrochloride, Pentazocine, Levorphanol tartarate.

Narcotic antagonists: Nalorphine hydrochloride, Levallorphan tartarate, Naloxone hydrochloride.

Anti-inflammatory agents: Sodium salicylate, Aspirin, Mefenamic acid*, Meclofenamate, Indomethacin, Sulindac, Tolmetin, Zomepriac, Diclofenac, Ketorolac, Ibuprofen*, Naproxen, Piroxicam, Phenacetin, Acetaminophen, Antipyrine, Phenylbutazone.

Recommended Books (Latest Editions)

1. Wilson and Giswold's Organic medicinal and Pharmaceutical Chemistry.
2. Foye's Principles of Medicinal Chemistry.
3. Burger's Medicinal Chemistry, Vol I to IV.
4. Introduction to principles of drug design- Smith and Williams.
5. Remington's Pharmaceutical Sciences.
6. Martindale's extra pharmacopoeia.
7. Organic Chemistry by I.L. Finar, Vol. II.
8. The Organic Chemistry of Drug Synthesis by Lednicer, Vol. 1-5.
9. Indian Pharmacopoeia.
10. Text book of practical organic chemistry- A.I.Vogel.

COURSE OUTCOMES-

By the end of this course, students will be able to:

CO1	Know general aspects of the design & development of drugs including history, classification, nomenclature, structure activity relationship(SAR).
CO2	Understand the mechanism of action, adverse effects, therapeutic uses and recent developments inNSAIDs,
CO3	Understand the mechanism of action, adverse effects, therapeutic uses and recent developments in steroidal anti-inflammatory drugs, narcotic & non-narcotic analgesics.
CO4	Understand the mechanism of action, adverse effects, therapeutic uses and recent developments in antipyretics and autacoidsdrugs.
CO5	Understand the mechanism of action, adverse effects, therapeutic uses and recent developments in drugs acting on respiratory &gastrointestinaltract.

Course Delivery Methods (CD)	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Experiments, Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table: Mapping of Course Outcomes with Program Learning Outcomes

CO	Blooms Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L3	M	L	L	-	-	-	-	M	L	-	M	-	M	M	M
CO2	L3	M	M	M	-	-	M	-	M	L	-	M	-	M	L	L
CO3	L5	M	M	M	L	M	-	L	M	L	L	M	M	H	L	-
CO4	L5	M	M	M	L	M	-	L	M	L	L	M	M	H	M	**L**
CO5	L5	M	M	M	L	M	-	L	M	L	L	M	M	H	L	-

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1, CO2, CO3, CO4, CO5
CD3	Experiments, Seminars	CO1, CO2, CO3, CO4, CO5
CD4	Self- learning advice using internets	CO4, CO5
CD5	Industrial visit	CO5

BP 403 T. PHYSICAL PHARMACEUTICS-II (Theory)

45Hours

Scope/Objective:

The course deals with the various physica and physicochemical properties, andprinciples involved in dosage forms/formulations. Theory and practical components of the subject help the student to get a better insight into various areas of formulation research and development, and stability studies of pharmaceutical dosage forms.

Course Content:

Unit-I **07 Hours**

Colloidal dispersions: Classification of dispersed systems & their generalcharacteristics, size & shapes of colloidal particles, classification of colloids & comparative account of their general properties. Optical, kinetic & electrical properties. Effect of electrolytes, coacervation, peptization & protective action.

Unit-II **10 Hours**

Rheology: Newtonian systems, law of flow, kinematic viscosity, effect of temperature,non-Newtonian systems, pseudoplastic, dilatant, plastic, thixotropy, thixotropy in formulation, determination of viscosity, capillary, falling Sphere, rotational viscometers

Deformation of solids: Plastic and elastic deformation, Heckel equation, Stress, Strain, Elastic Modulus

Unit-III **10 Hours**

Coarse dispersion: Suspension, interfacial properties of suspended particles, settling insuspensions, formulation of flocculated and deflocculated suspensions. Emulsions and theories of emulsification, microemulsion and multiple emulsions; Stability of emulsions, preservation of emulsions, rheological properties of emulsions and emulsion formulation by HLB method.

Unit-IV **10 Hours**

Micromeretics: Particle size and distribution, mean particle size, number and weightdistribution, particle number, methods for determining particle size by different methods, counting and separation method, particle shape, specific surface, methods for determining surface area, permeability, adsorption, derived properties of powders, porosity, packing arrangement, densities, bulkiness & flow properties.

Unit-V **10 Hours**

Drug stability: Reaction kinetics: zero, pseudo-zero, first & second order, units of basicrate constants, determination of reaction order. Physical and chemical factors influencing the chemical degradation of pharmaceutical product: temperature, solvent, ionic strength, dielectric constant, specific & general acid base catalysis, Simple numerical problems. Stabilization of medicinal agents against common reactions like hydrolysis & oxidation. Accelerated stability testing in expiration dating of pharmaceutical dosage forms. Photolytic degradation and its prevention.

Recommended Books: (Latest Editions)

1. Physical Pharmacy by Alfred Martin, Sixth edition
2. Experimental pharmaceutics by Eugene, Parott.
3. Tutorial pharmacy by Cooper and Gunn.
4. Stocklosam J. Pharmaceutical calculations, Lea & Febiger, Philadelphia.
5. Liberman H.A, Lachman C., Pharmaceutical Dosage forms, Tablets, Volume-1 to 3, Marcel Dekkar Inc.
6. Liberman H.A, Lachman C, Pharmaceutical dosage forms. Disperse systems, volume 1, 2, 3. Marcel Dekkar Inc.
7. Physical Pharmaceutics by Ramasamy C and Manavalan R.

COURSE OUTCOMES-

By the end of this course, students will be able to:

CO1	Understand various physicochemical properties of drug molecules in the designing the dosage forms
CO2	Know the principles of chemical kinetics & to use them for stability testing nad determination of expiry date of formulations
CO3	Demonstrate use of physicochemical properties in the formulation development and evaluation of dosage forms.
CO4	Recognize the Pharmacokinetics of drug. Understand the process of drug discovery and development of new API.
CO5	Describe the fundamental molecular mechanism of drug, receptor and their intracellular signaling mechanism

Course Delivery Methods (CD)	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Experiments, Seminars
CD4	Self- learning advice using Internets
CD5	Industrial visit

Table: Mapping of Course Outcomes with Program Learning Outcomes

CO	Blooms Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L2	H	M	M	L	L	M	M	L	M	L	M	L	M	L	L
CO2	L2	M	M	H	H	L	L	H	L	L	L	H	M	M	-	L
CO3	L2	M	H	L	M	L	L	M	L	L	H	M	H	H	L	H
CO4	L2	H	L	M	L	H	H	L	L	L	H	H	M	H	M	**L**
CO5	L2	M	M	L	M	L	M	H	L	L	M	L	H	M	L	-

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1, CO2, CO3, CO4, CO5
CD3	Experiments, Seminars	CO1, CO4
CD4	Self- learning advice using internets	CO4, CO5
CD5	Industrial visit	CO1, CO4

BP 404 T. PHARMACOLOGY-I (Theory)

45 Hrs

Scope/Objective:

The main purpose of the subject is to understand what drugs do to the livingorganisms and how their effects can be applied to therapeutics. The subject covers the information about the drugs like, mechanism of action, physiological and biochemical effects (pharmacodynamics) as well as absorption, distribution, metabolism and excretion (pharmacokinetics) along with the adverse effects, clinical uses, interactions, doses, contraindications and routes of administration of different classes of drugs.

Course Content:

Unit-I **08 hours**

1. General Pharmacology

a. Introduction to Pharmacology- Definition, historical landmarks and scope of pharmacology, nature and source of drugs, essential drugs concept and routes of drug administration, Agonists, antagonists(competitive and non competitive), spare receptors, addiction, tolerance, dependence, tachyphylaxis, idiosyncrasy, allergy.

b. Pharmacokinetics- Membrane transport, absorption, distribution, metabolism and excretion of drugs .Enzyme induction, enzyme inhibition, kinetics of elimination

Unit-II **12 Hours**

General Pharmacology

a. Pharmacodynamics- Principles and mechanisms of drug action. Receptor theories and classification of receptors, regulation of receptors. drug receptors interactions signal transduction mechanisms, G-protein–coupled receptors, ion channel receptor, transmembrane enzyme linked receptors, transmembrane JAK-STAT binding receptor and receptors that regulate transcription factors, dose response relationship, therapeutic index, combined effects of drugs and factors modifying drug action.

b. Adverse drug reactions.

c. Drug interactions (pharmacokinetic and pharmacodynamic)

d. Drug discovery and clinical evaluation of new drugs -Drug discovery phase, preclinical evaluation phase, clinical trial phase, phases of clinical trials and pharmacovigilance.

Unit-III **10 Hours**

2. Pharmacology of drugs acting on peripheral nervous system

a. Organization and function of ANS.

b. Neurohumoral transmission,co-transmission and classification of neurotransmitters.

c. Parasympathomimetics, Parasympatholytics, Sympathomimetics, sympatholytics.

d. Neuromuscular blocking agents and skeletal muscle relaxants (peripheral).

e. Local anesthetic agents.

f. Drugs used in myasthenia gravis and glaucoma

Unit-IV **08 Hours**

3. Pharmacology of drugs acting on central nervous system

a. Neurohumoral transmission in the C.N.S.special emphasis on importance of various neurotransmitters like with GABA, Glutamate, Glycine, serotonin, dopamine.

b. General anesthetics and pre-anesthetics**.**

c. Sedatives, hypnotics and centrally acting muscle relaxants.

d. Anti-epileptics

e. Alcohols and disulfiram

Unit-V **07 Hours**

3. Pharmacology of drugs acting on central nervous system

a. Psychopharmacological agents: Antipsychotics, antidepressants, anti-anxiety agents, anti-manics and hallucinogens.
b. Drugs used in Parkinsons disease and Alzheimer's disease.
c. CNS stimulants and nootropics.
d. Opioid analgesics and antagonists
e. Drug addiction, drug abuse, tolerance and dependence.

Recommended Books (Latest Editions)

1. Rang H. P., Dale M. M., Ritter J. M., Flower R. J., Rang and Dale's Pharmacology,.Churchil Livingstone Elsevier
2. Katzung B. G., Masters S. B., Trevor A. J., Basic and clinical pharmacology, Tata Mc Graw-Hill
3. Goodman and Gilman's, The Pharmacological Basis of Therapeutics
4. Marry Anne K. K., Lloyd Yee Y., Brian K. A., Robbin L.C., Joseph G. B., Wayne A. K., Bradley R.W., Applied Therapeutics, The Clinical use of Drugs, The Point Lippincott Williams & Wilkins
5. Mycek M.J, Gelnet S.B and Perper M.M. Lippincott's Illustrated Reviews-Pharmacology
6. K.D.Tripathi. Essentials of Medical Pharmacology, JAYPEE Brothers Medical Publishers (P) Ltd, New Delhi.
7. Sharma H. L., Sharma K. K., Principles of Pharmacology, Paras medical publisher
8. Modern Pharmacology with clinical Applications, by Charles R.Craig& Robert,
9. Ghosh MN. Fundamentals of Experimental Pharmacology. Hilton & Company, Kolkata.
10. Kulkarni SK. Handbook of experimental pharmacology. VallabhPrakashan.

COURSE OUTCOMES-

By the end of this course, students will be able to:

CO	Statements
CO1	Possess a relevant knowledge in basic principles of pharmacology and its recent advances. Understand the pharmacological actions of different categories of drugs
CO2	Explain the mechanism of drug action at organ system/sub cellular/ macromolecular levels.
CO3	Apply the basic pharmacological knowledge in the prevention and treatment of various diseases.
CO4	Understand the general principles of various antibiotics and the handling of drugs by thebody.
CO5	Appreciate correlation of pharmacology with other bio medical sciences

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets

Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Learning Outcomes

Course Outcome	Bloom's Level	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L1	M	M	H	-	L	-	L	-	L	-	H	-	H	M	L
CO2	L2	H	M	H	L	H	L	L	L	L	L	H	L	M	-	L
CO3	L2	L	M	H	M	L	L	L	L	M	L	H	M	M	L	H
CO4	L2	H	M	H	L	M	L	L	L	H	L	H	H	H	M	L
CO5	L4	M	M	M	H	H	H	H	M	M	M	M	H	M	L	-

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1,CO2,CO3,CO3,CO5
CD2	Tutorials/Assignments	CO1,CO2
CD3	Seminars	CO1
CD4	Self- learning advice using internets	CO1,CO2,CO3,CO4

BP405T.PHARMACOGNOSY AND PHYTOCHEMISTRY I (Theory)

45 Hours

Scope/Objective:

The subject involves the fundamentals of Pharmacognosy like scope, classification ofcrude drugs, their identification and evaluation, phytochemicals present in them and their medicinal properties.

Course Content:

Unit-I **10 Hours**

Introduction to Pharmacognosy:

(a) Definition, history, scope and development of Pharmacognosy

(b) Sources of Drugs – Plants, Animals, Marine & Tissue culture

(c) Organized drugs, unorganized drugs (dried latex, dried juices, dried extracts, gums and mucilages, oleoresins and oleo- gum -resins).

Classification of drugs:

Alphabetical, morphological, taxonomical, chemical, pharmacological, chemo and sero taxonomical classification of drugs

Quality control of Drugs of Natural Origin:

Adulteration of drugs of natural origin. Evaluation by organoleptic, microscopic, physical, chemical and biological methods and properties.

Quantitative microscopy of crude drugs including lycopodium spore method, leafconstants, camera lucida and diagrams of microscopic objects to scale with camera lucida.

Unit-II **10 Hours**

Cultivation, Collection, Processing and storage of drugs of natural origin:

Cultivation and Collection of drugs of natural origin

Factors influencing cultivation of medicinal plants.

Plant hormones and their applications.

Polyploidy, mutation and hybridization with reference to medicinal plants

Conservation of medicinal plants

Unit-III **07 Hours**

Plant tissue culture:

Historical development of plant tissue culture, types of cultures, Nutritional requirements, growth and their maintenance.

Applications of plant tissue culture in pharmacognosy.

Edible vaccines

Unit IV **10 Hours**

Pharmacognosy in various systems of medicine:

Role of Pharmacognosy in allopathy and traditional systems of medicine namely, Ayurveda, Unani, Siddha, Homeopathy and Chinese systems of medicine.

Introduction to secondary metabolites:

Definition, classification, properties and test for identification of Alkaloids, Glycosides, Flavonoids, Tannins, Volatile oil and Resins

Unit V **08 Hours**

Study of biological source, chemical nature and uses of drugs of natural origin containing following drugs

Plant Products:

Fibers - Cotton, Jute, Hemp

Hallucinogens, Teratogens, Natural allergens

Primary metabolites:

General introduction, detailed study with respect to chemistry, sources, preparation, evaluation, preservation, storage, therapeutic used and commercial utility as Pharmaceutical Aids and/or Medicines for the following Primary metabolites: **Carbohydrates:** Acacia, Agar, Tragacanth, Honey

Proteins and Enzymes: Gelatin, casein, proteolytic enzymes (Papain, bromelain, serratiopeptidase, urokinase, streptokinase, pepsin).

Lipids (Waxes, fats, fixed oils) : Castor oil, Chaulmoogra oil, Wool Fat, Bees Wax **Marine Drugs:**

Novel medicinal agents from marine sources.

Recommended Books: (Latest Editions)

1. W.C.Evans, Trease and Evans Pharmacognosy, 16th edition, W.B. Sounders & Co., London, 2009.
2. Tyler, V.E., Brady, L.R. and Robbers, J.E., Pharmacognosy, 9th Edn., Lea and Febiger, Philadelphia, 1988.
3. Text Book of Pharmacognosy by T.E. Wallis
4. Mohammad Ali. Pharmacognosy and Phytochemistry, CBS Publishers & Distribution, New Delhi.
5. Text book of Pharmacognosy by C.K. Kokate, Purohit, Gokhlae (2007), 37th Edition, Nirali Prakashan, New Delhi.
6. Herbal drug industry by R.D. Choudhary (1996), Ist Edn, Eastern Publisher, New Delhi.
7. Essentials of Pharmacognosy, Dr.SH.Ansari, IInd edition, Birla publications, New Delhi, 2007
8. Practical Pharmacognosy: C.K. Kokate, Purohit, Gokhlae
9. Anatomy of Crude Drugs by M.A. Iyengar.

COURSE OUTCOMES-

By the end of this course, students will be able to:

CO1	Learners will able to acquire the knowledge of plant, animals and minerals source.
CO2	Understand the techniques in the cultivation and production of crude drugs.
CO3	Learners will competent to understand the know the crude drugs, their uses and chemical nature.
CO4	Become skilled at the synthesis, physical and chemical properties of different chemicals which derived from plants.
CO5	Students will capable to learn the microscopic and morphological evaluation of crude drugs.

Course Delivery Methods (CD)	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Experiments, Seminars
CD4	Self- learning advice using internets
CD5	Herbal garden visit

Table: Mapping of Course Outcomes with Program Learning Outcomes

CO	Blooms Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L3	M	L	L	-	-	-	-	M	L	-	M	-	M	M	L
CO2	L3	M	M	M	-	-	M	-	M	L	-	M	-	H	M	M
CO3	L5	M	M	M	L	M	-	L	M	L	L	M	M	H	L	H
CO4	L5	M	M	M	L	M	-	L	M	L	L	M	M	H	-	M
CO5	L5	M	M	M	L	M	-	L	M	L	L	M	M	M	L	-

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1, CO2, CO3, CO4, CO5
CD3	Experiments, Seminars	CO1, CO2, CO3, CO4, CO5
CD4	Self- learning advice using internets	CO4, CO5
CD5	Herbal garden visit	CO5

BP406P. MEDICINAL CHEMISTRY – I (Practical)

4 Hours/Week

Scope/Objective:

This subject is designed to impart fundamental knowledge on the structure, chemistry and therapeutic value of drugs. The subject emphasizes on structure activity relationships of drugs, importance of physicochemical properties and metabolism of drugs. The syllabus also emphasizes on chemical synthesis of important drugs under each class.

I Preparation of drugs/ intermediates

1 1,3-pyrazole
2 1,3-oxazole
3 Benzimidazole
4 Benztriazole
5 2,3- diphenyl quinoxaline
6 Benzocaine
7 Phenytoin
8 Phenothiazine
9 Barbiturate

II Assay of drugs

1 Chlorpromazine
2 Phenobarbitone
3 Atropine
4 Ibuprofen
5 Aspirin
6 Furosemide

III Determination of Partition coefficient for any two drugs

Recommended Books (Latest Editions)

1. Wilson and Giswold's Organic medicinal and Pharmaceutical Chemistry.
2. Foye's Principles of Medicinal Chemistry.
3. Burger's Medicinal Chemistry, Vol I to IV.
4. Introduction to principles of drug design- Smith and Williams.
5. Remington's Pharmaceutical Sciences.
6. Martindale's extra pharmacopoeia.
7. Organic Chemistry by I.L. Finar, Vol. II.
8. The Organic Chemistry of Drug Synthesis by Lednicer, Vol. 1-5.
9. Indian Pharmacopoeia.
10. Text book of practical organic chemistry- A.I.Vogel.

COURSE OUTCOMES-

By the end of this course, students will be able to:

CO1	Know general aspects of the design & development of drugs including history, classification, nomenclature, structure activity relationship(SAR).
CO2	Understand the mechanism of action, adverse effects, therapeutic uses and recent developments inNSAIDs,
CO3	Understand the mechanism of action, adverse effects, therapeutic uses and recent developments in steroidal anti-inflammatory drugs, narcotic & non-narcotic analgesics.
CO4	Understand the mechanism of action, adverse effects, therapeutic uses and recent developments in antipyretics and autacoidsdrugs.
CO5	Understand the mechanism of action, adverse effects, therapeutic uses and recent developments in drugs acting on respiratory &gastrointestinaltract.

Course Delivery Methods (CD)	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Experiments, Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table: Mapping of Course Outcomes with Program Learning Outcomes

CO	BLOOMS LEVEL	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L3	M	L	L	-	-	-	-	M	L	-	M	-	H	L	L
CO2	L3	M	M	M	-	-	M	-	M	L	-	M	-	M	M	L
CO3	L5	M	M	M	L	M	-	L	M	L	L	M	M	L	L	H
CO4	L5	M	M	M	L	M	-	L	M	L	L	M	M	H	M	L
CO5	L5	M	M	M	L	M	-	L	M	L	L	M	M	M	L	-

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1, CO2, CO3, CO4, CO5
CD3	Experiments, Seminars	CO1, CO2, CO3, CO4, CO5
CD4	Self- learning advice using internets	CO4, CO5
CD5	Industrial visit	CO5

BP 407P. PHYSICAL PHARMACEUTICS- II (Practical)

2Hrs/week

Scope/Objective:

The course deals with the various physica and physicochemical properties, andprinciples involved in dosage forms/formulations. Theory and practical components of the subject help the student to get a better insight into various areas of formulation research and development, and stability studies of pharmaceutical dosage forms.

1. Determination of particle size, particle size distribution using sieving method
2. Determination of particle size, particle size distribution using Microscopic method
3. Determination of bulk density, true density and porosity
4. Determine the angle of repose and influence of lubricant on angle of repose
5. Determination of viscosity of liquid using Ostwald's viscometer
6. Determination sedimentation volume with effect of different suspending agent
7. Determination sedimentation volume with effect of different concentration of single suspending agent
8. Determination of viscosity of semisolid by using Brookfield viscometer
9. Determination of reaction rate constant first order.
10. Determination of reaction rate constant second order
11. Accelerated stability studies

Recommended Books: (Latest Editions)

1. Physical Pharmacy by Alfred Martin, Sixth edition
2. Experimental pharmaceutics by Eugene, Parott.
3. Tutorial pharmacy by Cooper and Gunn.
4. Stocklosam J. Pharmaceutical calculations, Lea & Febiger, Philadelphia.
5. Liberman H.A, Lachman C., Pharmaceutical Dosage forms, Tablets, Volume-1 to 3, Marcel Dekkar Inc.
6. Libermn H.A, Lachman C, Pharmaceutical dosage forms. Disperse systems, volume 1, 2, 3. Marcel Dekkar Inc.
7. Physical Pharmaceutics by Ramasamy C, and Manavalan R.

COURSE OUTCOMES-

By the end of this course, students will be able to:

CO1	Understand various physicochemical properties of drug molecules in the designing the dosage forms
CO2	Know the principles of chemical kinetics & to use them for stability testing nad determination of expiry date of formulations
CO3	Demonstrate use of physicochemical properties in the formulation development and evaluation of dosage forms.
CO4	Recognize the Pharmacokinetics of drug. Understand the process of drug discovery and development of new API.
CO5	Describe the fundamental molecular mechanism of drug, receptor and their intracellular signaling mechanism

Course Delivery Methods (CD)	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Experiments, Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table: Mapping of Course Outcomes with Program Learning Outcomes

CO	BLOOMS LEVEL	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L2	H	M	M	L	L	M	M	L	M	L	M	L	H	L	L
CO2	L2	M	M	H	H	L	L	H	L	L	L	H	M	M	M	L
CO3	L2	M	H	L	M	L	L	M	L	L	H	M	H	H	L	H
CO4	L2	H	L	M	L	H	H	L	L	L	H	H	M	H	M	M
CO5	L2	M	M	L	M	L	M	H	L	L	M	L	H	M	L	-

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1, CO2, CO3, CO4, CO5
CD3	Experiments, Seminars	CO1, CO4
CD4	Self- learning advice using internets	CO4, CO5
CD5	Industrial visit	CO1, CO4

BP 408P.PHARMACOLOGY-I (Practical)

4Hrs/Week

Scope/Objective:

The main purpose of the subject is to understand what drugs do to the livingorganisms and how their effects can be applied to therapeutics. The subject covers the information about the drugs like, mechanism of action, physiological and biochemical effects (pharmacodynamics) as well as absorption, distribution, metabolism and excretion (pharmacokinetics) along with the adverse effects, clinical uses, interactions, doses, contraindications and routes of administration of different classes of drugs.

1. Introduction to experimental pharmacology.
2. Commonly used instruments in experimental pharmacology.
3. Study of common laboratory animals.
4. Maintenance of laboratory animals as per CPCSEA guidelines.
5. Common laboratory techniques. Blood withdrawal, serum and plasma separation, anesthetics and euthanasia used for animal studies.
6. Study of different routes of drugs administration in mice/rats.
7. Study of effect of hepatic microsomal enzyme inducers on the phenobarbitone sleeping time in mice.
8. Effect of drugs on ciliary motility of frog oesophagus
9. Effect of drugs on rabbit eye.
10. Effects of skeletal muscle relaxants using rota-rod apparatus.
11. Effect of drugs on locomotor activity using actophotometer.
12. Anticonvulsant effect of drugs by MES and PTZ method.
13. Study of stereotype and anti-catatonic activity of drugs on rats/mice.
14. Study of anxiolytic activity of drugs using rats/mice.
15. Study of local anesthetics by different methods

Note: All laboratory techniques and animal experiments are demonstrated by simulated experiments by softwares and videos

Recommended Books (Latest Editions)

1. Rang H. P., Dale M. M., Ritter J. M., Flower R. J., Rang and Dale's Pharmacology,.Churchil Livingstone Elsevier
2. Katzung B. G., Masters S. B., Trevor A. J., Basic and clinical pharmacology, Tata Mc Graw-Hill
3. Goodman and Gilman's, The Pharmacological Basis of Therapeutics
4. Marry Anne K. K., Lloyd Yee Y., Brian K. A., Robbin L.C., Joseph G. B., Wayne A. K., Bradley R.W., Applied Therapeutics, The Clinical use of Drugs, The Point Lippincott Williams & Wilkins
5. Mycek M.J, Gelnet S.B and Perper M.M. Lippincott's Illustrated Reviews-Pharmacology
6. K.D.Tripathi. Essentials of Medical Pharmacology, JAYPEE Brothers Medical Publishers (P) Ltd, New Delhi.
7. Sharma H. L., Sharma K. K., Principles of Pharmacology, Paras medical publisher
8. Modern Pharmacology with clinical Applications, by Charles R.Craig& Robert,
9. Ghosh MN. Fundamentals of Experimental Pharmacology. Hilton & Company, Kolkata.
10. Kulkarni SK. Handbook of experimental pharmacology. VallabhPrakashan,

COURSE OUTCOMES-

By the end of this course, students will be able to:

CO	Statements
CO1	Possess a relevant knowledge in basic principles of pharmacology and its recent advances. Understand the pharmacological actions of different categories of drugs
CO2	Explain the mechanism of drug action at organ system/sub cellular/ macromolecular levels.
CO3	Apply the basic pharmacological knowledge in the prevention and treatment of various diseases.
CO4	Understand the general principles of various antibiotics and the handling of drugs by thebody.
CO5	Appreciate correlation of pharmacology with other bio medical sciences

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets

Mapping of Course Outcomes onto Program Learning Outcomes

Course Outcome	Bloom's Level	PO 1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L1	M	M	H	-	L	-	L	-	L	-	H	-	M	L	L
CO2	L2	H	M	H	L	H	L	L	L	L	L	H	L	H	H	L
CO3	L2	L	M	H	M	L	L	L	L	M	L	H	M	H	L	H
CO4	L2	H	M	H	L	M	L	L	L	H	L	H	L	M	-	L
CO5	L4	M	M	M	H	H	H	H	M	M	M	M	H	M	L	-

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1,CO2,CO3,CO3,CO5
CD2	Tutorials/Assignments	CO1,CO2
CD3	Seminars	CO1
CD4	Self- learning advice using internets	CO1,CO2,CO3,CO4

BP409 P. PHARMACOGNOSY AND PHYTOCHEMISTRY I (Practical)

4 Hours/Week

Scope/Objective:

The subject involves the fundamentals of Pharmacognosy like scope, classification ofcrude drugs, their identification and evaluation, phytochemicals present in them and their medicinal properties.

1. Analysis of crude drugs by chemical tests: **(**i)Tragaccanth (ii) Acacia (iii)Agar (iv) Gelatin (v) starch (vi) Honey (vii) Castor oil
2. Determination of stomatal number and index
3. Determination of vein islet number, vein islet termination and paliside ratio.
4. Determination of size of starch grains, calcium oxalate crystals by eye piece micrometer
5. Determination of Fiber length and width
6. Determination of number of starch grains by Lycopodium spore method
7. Determination of Ash value
8. Determination of Extractive values of crude drugs
9. Determination of moisture content of crude drugs
10. Determination of swelling index and foaming

Recommended Books: (Latest Editions)

1. W.C.Evans, Trease and Evans Pharmacognosy, 16th edition, W.B. Sounders & Co., London, 2009.
2. Tyler, V.E., Brady, L.R. and Robbers, J.E., Pharmacognosy, 9th Edn., Lea and Febiger, Philadelphia, 1988.
3. Text Book of Pharmacognosy by T.E. Wallis
4. Mohammad Ali. Pharmacognosy and Phytochemistry, CBS Publishers & Distribution, New Delhi.
5. Text book of Pharmacognosy by C.K. Kokate, Purohit, Gokhlae (2007), 37th Edition, Nirali Prakashan, New Delhi.
6. Herbal drug industry by R.D. Choudhary (1996), Ist Edn, Eastern Publisher, New Delhi.
7. Essentials of Pharmacognosy, Dr.SH.Ansari, IInd edition, Birla publications, New Delhi, 2007
8. Practical Pharmacognosy: C.K. Kokate, Purohit, Gokhlae
9. Anatomy of Crude Drugs by M.A. Iyengar.

COURSE OUTCOMES-

By the end of this course, students will be able to:

CO1	Learners will able to acquire the knowledge of plant, animals and minerals source.
CO2	Understand the techniques in the cultivation and production of crude drugs.
CO3	Learners will competent to understand know the crude drugs, their uses and chemical nature.
CO4	Become skilled at the synthesis, physical and chemical properties of different chemicals which derived from plants.
CO5	Students will capable to learn the microscopic and morphological evaluation of crude drugs.

Course Delivery Methods (CD)	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Experiments, Seminars
CD4	Self- learning advice using internets
CD5	Herbal garden visit

Table: Mapping of Course Outcomes with Program Learning Outcomes

CO	Blooms Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L3	M	L	L	-	-	-	-	M	L	-	M	-	H	L	L
CO2	L3	M	M	M	-	-	M	-	M	L	-	M	-	H	H	L
CO3	L5	M	M	M	L	M	-	L	M	L	L	M	M	M	L	H
CO4	L5	M	M	M	L	M	-	L	M	L	L	M	M	M	-	L
CO5	L5	M	M	M	L	M	-	L	M	L	L	M	M	M	L	-

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1, CO2, CO3, CO4, CO5
CD3	Experiments, Seminars	CO1, CO2, CO3, CO4, CO5
CD4	Self- learning advice using internets	CO4, CO5
CD5	Herbal garden visit	CO5

BP 410: ANANDAM

Objectives:

- To instil the joy of giving in young people, turning them into responsible citizens to build up a better society.
- To inculcate the habit of service in students across the University.
- A compulsory course of 2 credits per semester to be included in each program of University.
- Students to be excepted to engage in individual and group acts of service and goodness.

Action Plan:

Students will be expected to

- Do at least one act of individual service each day
- Record this act of service in a dedicated Register / Personal Diary
- Share this Register / Personal Diary day in the Anandam Class scheduled per week. The class interaction will include Personal Diary check, Showing of Community based motivation videos, Community based presentations by students, Role playing etc.
- Undertake one group service project for 64 hours every semester (outside college hours)
- Upload the report on the group project on the Anandam platform
- Participate in a sharing and presentation on the group service in the discussion sessions held once in week
- there will be some suggested projects and organizations that students can work with. Students can also suggest their own projects which others can join

Each student will finish the year with a portfolio of giving. This will include their Register / Personal Diaries and their reports on group service projects.

BP411 RESEARCH METHODOLOGY AND BIOSTATISTICS

COURSEOBJECTIVES:

- To understand the significance of various research methodology.
- To understand the principles of biostatistics and its significances.
- To understand the applied methodology for research.

Unit-I

1. Objective and types of research.
2. Study design.
3. Research process
4. Sample size.
5. Structure of a research proposal.
6. Protocol writing.
7. Ethical aspects

Unit-II

8. Research Proposal
9. Data collection analysis, interpretation and presentation.
10. Common statistical terms.
11. Measures of location, average & percentiles.
12. Normal distribution & normal curve.
13. Demography & vital statistics.
14. Correlation of measures of population & vital statistics
15. Use of micro Computers in Research.

Unit-III

16. Probability.
17. Variability & its measures.
18. Significance of difference in mean.
19. Chi- square test.
20. Correlation & regression.
21. Hypothesis

Unit-IV

22. **Questionnaires**
23. **Surveys**
24. Sampling variability & significance
25. Review of literature
26. Pilot study
27. Schedule

Unit-V

28. **ANOVA, basic principle of ANOVA,ANOVA technique**
29. **ANCOVA**
30. **Reading 2 published research paper**
31. **Synopsis writing**
32. **Difference between thesis and dissertation**

BooksRecommended:

1. Methods in Biostatistics-Mahajan-J.P.
2. Statistics in Medicine-Colton-Little Brown,Boston.
3. Research for Physiotherapist:Project Design and Analysis-Hicks–Churchill Livingstone
4. Biostatistics:The manual for Statistical methods for in health and nutition-K.V.Rao.J.P.
5. Research methods in behavioural Sciences-Mohsin-OrientPublication.

COURSE OUTCOMES-

By the end of this course, students will be able to:

CO1	Rememberingvariousmethodologyofresearchandbiostaticsinphysiotherapy
CO2	Demonstrate understanding of the concepts of research methodology andbiostatistics that are required in the profession and community at alllevelsof research process.
CO3	Applytheknowledgeandconceptsofresearchmethodologyandbiostatisticsinphysiotherapy
CO4	Analyzetheprincipleconceptsofbiostatisticsandresearchinphysiotherapy
CO5	Interpret the data collected while practicing the techniques on subjects

Course Delivery Methods (CD)	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Experiments, Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table: Mapping of Course Outcomes with ProgramLearning Outcomes

CO	Bloom Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L4	M	M	M	M	M	L	M	M	L	M	M	H	M	L	L
CO2	L4	M	M	M	M	M	L	M	M	L	M	L	H	H	H	L
CO3	L3	M	M	M	M	M	L	M	M	L	M	M	H	H	L	H
CO4	L4	M	M	M	M	M	L	M	M	L	M	M	M	M	L	**L**
CO5	L4	M	M	M	M	M	L	M	M	L	M	H	H	H	L	-

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1, CO2, CO3, CO4, CO5
CD3	Experiments, Seminars	CO2,CO3, CO4, CO5
CD4	Self- learning advice using internets	CO4, CO5
CD5	Industrial visit	CO4

Semester - V

Code No.	Paper	Type	Internal Marks	External Marks	Total Marks	L	T/P	Credit
BP501T	Medicinal Chemistry II – Theory	CORE	25	75	100	3	1	4
BP502T	Industrial PharmacyI– Theory	CORE	25	75	100	3	1	4
BP503T	Pharmacology II – Theory	CORE	25	75	100	3	1	4
BP504T	Pharmacognosy and Phytochemistry II– Theory	CORE	25	75	100	3	1	4
BP505T	Pharmaceutical Jurisprudence – Theory	CORE	25	75	100	3	1	4
BP506P	Industrial Pharmacy I– Practical	CORE	15	35	50	4	-	2
BP507P	Pharmacology II– Practical	CORE	15	35	50	4	-	2
BP508P	Pharmacognosy and Phytochemistry-II– Practical	CORE	15	35	50	4	-	2
BP509	Professional Skills	AECC	30	70	100	2	-	2
BP 510	ANANDAM	CEC	50	50	100	1	-	2
	Total		**250**	**600**	**850**			**30**

SEMESTER V

BP501T. MEDICINAL CHEMISTRY – II (Theory)

45 Hours

Scope/Objective:

This subject is designed to impart fundamental knowledge on the structure, chemistry and therapeutic value of drugs. The subject emphasizes on structure activity relationships of drugs, importance of physicochemical properties and metabolism of drugs. The syllabus also emphasizes on chemical synthesis of important drugs under each class.

Course Content:

Study of the development of the following classes of drugs, Classification, mechanism of action, uses of drugs mentioned in the course, Structure activity relationship of selective class of drugs as specified in the course and synthesis of drugs superscripted (*)

Unit- I **10 Hours**

Antihistaminic agents: Histamine, receptors and their distribution in thehumanbody

H_1–antagonists: Diphenhydramine hydrochloride*,Dimenhydrinate, Doxylamines cuccinate, Clemastine fumarate, Diphenylphyraline hydrochloride, Tripelenamine hydrochloride, Chlorcyclizine hydrochloride, Meclizine hydrochloride, Buclizine hydrochloride, Chlorpheniramine maleate, Triprolidine, Hydrochloride*, Phenidamine tartarate, Promethazine hydrochloride*, Trimeprazine tartrate, Cyproheptadine hydrochloride, Azatidine maleate, Astemizole, Loratadine, Cetirizine, Levocetrazine Cromolyn sodium

H_2-antagonists: Cimetidine*, Famotidine, Ranitidin.

Gastric Proton pump inhibitors: Omeprazole, Lansoprazole, Rabeprazole, Pantoprazole

Anti-neoplastic agents:

Alkylatingagents: Meclorethamine*,Cyclophosphamide, Melphalan, Chlorambucil, Busulfan, Thiotepa

Antimetabolites: Mercaptopurine*, Thioguanine, Fluorouracil, Floxuridine, Cytarabine, Methotrexate*, Azathioprine

Antibiotics: Dactinomycin, Daunorubicin, Doxorubicin, Bleomycin

Plant products: Etoposide, Vinblastin sulphate, Vincristin sulphate

Miscellaneous: Cisplatin, Mitotane.

Unit – II **10 Hours**

Anti-anginal:

Vasodilators: Amyl nitrite, Nitroglycerin*, Pentaerythritol tetranitrate, Isosorbidedinitrite*, Dipyridamole.

Calcium channel blockers: Verapamil, Bepridil hydrochloride, Diltiazemhydrochloride, Nifedipine, Amlodipine, Felodipine, Nicardipine, Nimodipine.

Diuretics:

Carbonic anhydrase inhibitors: Acetazolamide*, Methazolamide, Dichlorphenamide. Thiazides: Chlorthiazide*, Hydrochlorothiazide, Hydroflumethiazide, Cyclothiazide,

Loop diuretics: Furosemide*, Bumetanide, Ethacrynic acid.

Potassium sparing Diuretics: Spironolactone, Triamterene, Amiloride.

Osmotic Diuretics: Mannitol

Anti-hypertensive Agents: Timolol, Captopril, Lisinopril, Enalapril, Benazeprilhydrochloride, Quinapril hydrochloride, Methyldopate hydrochloride,* Clonidine hydrochloride, Guanethidine monosulphate, Guanabenz acetate, Sodium nitroprusside, Diazoxide, Minoxidil, Reserpine, Hydralazine hydrochloride.

Unit- III **10 Hours**

Anti-arrhythmic Drugs: Quinidine sulphate, Procainamide hydrochloride, Disopyramide phosphate*, Phenytoin sodium, Lidocaine hydrochloride, Tocainide hydrochloride, Mexiletine hydrochloride, Lorcainide hydrochloride, Amiodarone, Sotalol.

Anti-hyperlipidemic agents: Clofibrate, Lovastatin, Cholesteramine andCholestipol

Coagulant & Anticoagulants: Menadione, Acetomenadione, Warfarin*, Anisindione, clopidogrel

Drugs used in Congestive Heart Failure: Digoxin, Digitoxin, Nesiritide, Bosentan, Tezosentan.

Unit- IV **08 Hours**

Drugs acting on Endocrine system

Nomenclature, Stereochemistry and metabolism of steroids

Sex hormones: Testosterone, Nandralone, Progestrones, Oestriol, Oestradiol, Oestrione, Diethyl stilbestrol.

Drugs for erectile dysfunction: Sildenafil, Tadalafil.

Oral contraceptives: Mifepristone, Norgestril, Levonorgestrol

Corticosteroids: Cortisone, Hydrocortisone, Prednisolone, Betamethasone, Dexamethasone

Thyroid and antithyroid drugs: L-Thyroxine, L-Thyronine, Propylthiouracil, Methimazole.

Unit – V **07 Hours**

Antidiabetic agents:

Insulin and its preparations

Sulfonyl ureas: Tolbutamide*, Chlorpropamide, Glipizide, Glimepiride.

Biguanides: Metformin.

Thiazolidinediones: Pioglitazone, Rosiglitazone.

Meglitinides: Repaglinide, Nateglinide.

Glucosidase inhibitors: Acrabose, Voglibose.

Local Anesthetics: SAR of Local anesthetics

Benzoic Acid derivatives; Cocaine, Hexylcaine, Meprylcaine, Cyclomethycaine,Piperocaine.

Amino Benzoic acid derivatives: Benzocaine*, Butamben, Procaine*, Butacaine,Propoxycaine, Tetracaine, Benoxinate.

Lidocaine/Anilide derivatives: Lignocaine, Mepivacaine, Prilocaine, Etidocaine.

Miscellaneous: Phenacaine, Diperodon, and Dibucaine.*

Recommended Books (Latest Editions)

1. Wilson and Giswold's Organic medicinal and Pharmaceutical Chemistry.
2. Foye's Principles of Medicinal Chemistry.
3. Burger's Medicinal Chemistry, Vol I to IV.
4. Introduction to principles of drug design- Smith and Williams.
5. Remington's Pharmaceutical Sciences.
6. Martindale's extra pharmacopoeia.
7. Organic Chemistry by I.L. Finar, Vol. II.
8. The Organic Chemistry of Drug Synthesis by Lednicer, Vol. 1to 5.
9. Indian Pharmacopoeia.
10. Text book of practical organic chemistry- A.I.Vogel.

COURSE OUTCOMES-

By the end of this course, students will be able to:

CO1	Students will learn the basic concepts of drugs & pharmaceuticals and synthesis of analgesics, antipyretic and anti-inflammatory agents
CO2	Understand the drug metabolic pathways, adverse effect and therapeutic value of drugs.Learner will competent to synthesis of antibiotics, antibacterial, antifungal and antiviral agents.
CO3	Knowledge of synthesis of central nervous system, cardiovascular, antilaprosy, HIV-AIDS related drugs.
CO4	Understand the chemistry of drugs with respect to their pharmacological activity
CO5	Know the Structural Activity Relationship of different class of drugs. Study the chemical synthesis of selected drugs

Course Delivery Methods (CD)	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Experiments, Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

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CO1	L4	M	M	M	M	M	L	M	M	L	M	M	H	M	L	L
CO2	L4	M	M	M	M	M	L	M	M	L	M	L	H	H	H	L
CO3	L3	M	M	M	M	M	L	M	M	L	M	M	H	H	L	H
CO4	L4	M	M	M	M	M	L	M	M	L	M	M	M	M	L	L
CO5	L4	M	M	M	M	M	L	M	M	L	M	H	H	H	L	-

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1, CO2, CO3, CO4, CO5
CD3	Experiments, Seminars	CO2,CO3, CO4, CO5
CD4	Self- learning advice using internets	CO4, CO5
CD5	Industrial visit	CO4

BP 502 T. Industrial PharmacyI (Theory)

45 Hours

Scope/Objective:

Course enables the student to understand and appreciate the influence ofpharmaceutical additives and various pharmaceutical dosage forms on the performance of the drug product.

Course content:

Unit-I **07 Hours**

Preformulation Studies: Introduction to preformulation, goals and objectives, study ofphysicochemical characteristics of drug substances.

a. Physical properties: Physical form (crystal & amorphous), particle size, shape, flowproperties, solubility profile (pKa, pH, partition coefficient), polymorphism

b. Chemical Properties: Hydrolysis, oxidation, reduction, racemisation, polymerizationBCS classification of drugs & its significant

Application of preformulation considerations in the development of solid, liquid oral and parenteral dosage forms and its impact on stability of dosage forms.

Unit-II **10 Hours**

Tablets:

a. Introduction, ideal characteristics of tablets, classification of tablets. Excipients, Formulation of tablets, granulation methods, compression and processing problems. Equipments and tablet tooling.
b. Tablet coating: Types of coating, coating materials, formulation of coating composition, methods of coating, equipment employed and defects in coating.
c. Quality control tests: In process and finished product tests

Liquid orals: Formulation and manufacturing consideration of syrups and elixirssuspensions and emulsions; Filling and packaging; evaluation of liquid orals official in pharmacopoeia

Unit-III **08 Hours**

Capsules:

a. ***Hard gelatin capsules:*** Introduction, Production of hard gelatin capsule shells. sizeof capsules, Filling, finishing and special techniques of formulation of hard gelatin capsules, manufacturing defects. In process and final product quality control tests for capsules.
b. ***Soft gelatin capsules:*** Nature of shell and capsule content, size ofcapsules,importance of base adsorption and minim/gram factors, production, in process and final product quality control tests. Packing, storage and stability testing of soft gelatin capsules and their applications.

Pellets: Introduction, formulation requirements, pelletization process, equipments formanufacture of pellets

Unit-IV **10 Hours**

Parenteral Products:

a. Definition, types, advantages and limitations. Preformulation factors and essential requirements, vehicles, additives, importance of isotonicity
b. Production procedure, production facilities and controls, aseptic processing
c. Formulation of injections, sterile powders, large volume parenterals and lyophilized products.

d. Containers and closures selection, filling and sealing of ampoules, vials and infusion fluids. Quality control tests of parenteral products.

Ophthalic Preparations: Introduction, formulation considerations; formulation of eyedrops, eye ointments and eye lotions; methods of preparation; labeling, containers; evaluation of ophthalmic preparations

Unit-V **10 Hours**

Cosmetics: Formulation and preparation of the following cosmetic preparations:lipsticks, shampoos, cold cream and vanishing cream, tooth pastes, hair dyes and sunscreens.

Pharmaceutical Aerosols: Definition, propellants, containers, valves, types of aerosolsystems; formulation and manufacture of aerosols; Evaluation of aerosols; Quality control and stability studies.

Packaging Materials Science: Materials used for packaging of pharmaceutical products,factors influencing choice of containers, legal and official requirements for containers, stability aspects of packaging materials, quality control tests.

Recommended Books: (Latest Editions)

1. Pharmaceutical dosage forms - Tablets, volume 1 -3 by H.A. Liberman, Leon Lachman &J.B.Schwartz
2. Pharmaceutical dosage form - Parenteral medication vol- 1&2 by Liberman & Lachman
3. Pharmaceutical dosage form disperse system VOL-1 by Liberman & Lachman
4. Modern Pharmaceutics by Gilbert S. Banker & C.T. Rhodes, 3rd Edition
5. Remington: The Science and Practice of Pharmacy, 20th edition Pharmaceutical Science (RPS)
6. Theory and Practice of Industrial Pharmacy by Liberman & Lachman
7. Pharmaceutics- The science of dosage form design by M.E.Aulton, Churchill livingstone, Latest edition
8. Introduction to Pharmaceutical Dosage Forms by H. C.Ansel, Lea &Febiger, Philadelphia, 5thedition, 2005
9. Drug stability - Principles and practice by Cartensen & C.J. Rhodes, 3rd Edition, Marcel Dekker Series, Vol 107.

COURSE OUTCOMES-

By the end of this course, students will be able to:

CO1	Students will learn the basic concepts of Industry & manufacturing.
CO2	Know the various pharmaceutical dosage forms and their manufacturing techniques.
CO3	Know various considerations in development of pharmaceutical dosage forms and their manufacturing techniques.
CO4	Able to understand the industrial process. Know various considerations in development of pharmaceutical dosage forms.
CO5	Able to understand the production of different dosage form. Formulate solid, liquid and semisolid dosage forms and evaluate them for their quality

Course Delivery Methods (CD)	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Experiments, Seminars
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CD5	Industrial visit

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CO1	L4	M	M	M	M	M	-	L	M	M	L	M	H	M	L	L
CO2	L4	M	M	M	M	M	-	L	M	M	L	M	H	H	H	L
CO3	L3	M	H	M	L	M	H	L	M	M	L	M	H	M	L	-
CO4	L4	M	M	M	H	M	-	L	H	M	L	M	M	M	L	L
CO5	L4	M	M	M	M	M	-	L	M	M	L	M	H	M	L	-

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1, CO2, CO3, CO4, CO5
CD3	Experiments, Seminars	CO2,CO3, CO4, CO5
CD4	Self- learning advice using internets	CO4, CO5
CD5	Industrial visit	CO4

BP503.T. PHARMACOLOGY-II (Theory)

45 Hours

Scope/Objective:

This subject is intended to impart the fundamental knowledge on various aspects(classification, mechanism of action, therapeutic effects, clinical uses, side effects and contraindications) of drugs acting on different systems of body and in addition,emphasis on the basic concepts of bioassay.

Course Content:

Unit-I **10 hours**

1. Pharmacology of drugs acting on cardio vascular system

a. Introduction to hemodynamic and electrophysiology of heart.
b. Drugs used in congestive heart failure
c. Anti-hypertensive drugs.
d. Anti-anginal drugs.
e. Anti-arrhythmic drugs.
f. Anti-hyperlipidemic drugs.

Unit-II **10 hours**

1. Pharmacology of drugs acting on cardio vascular system

a. Drug used in the therapy of shock.
b. Hematinics, coagulants and anticoagulants.
c. Fibrinolytics and anti-platelet drugs
d. Plasma volume expanders

2. Pharmacology of drugs acting on urinary system

a. Diuretics
b. Anti-diuretics.

Unit-III **10 hours**

3. Autocoids and related drugs

a. Introduction to autacoids and classification
b. Histamine, 5-HT and their antagonists.
c. Prostaglandins, Thromboxanes and Leukotrienes.
d. Angiotensin, Bradykinin and Substance P.
e. Non-steroidal anti-inflammatory agents
f. Anti-gout drugs
g. Antirheumatic drugs

Unit-IV **08 hours**

5. Pharmacology of drugs acting on endocrine system

a. Basic concepts in endocrine pharmacology.
b. Anterior Pituitary hormones- analogues and their inhibitors.
c. Thyroid hormones- analogues and their inhibitors.
d. Hormones regulating plasma calcium level- Parathormone, Calcitonin and Vitamin-D.
d. Insulin, Oral Hypoglycemic agents and glucagon.
e. ACTH and corticosteroids.

Unit-V **07hours**

5. Pharmacology of drugs acting on endocrine system

a. Androgens and Anabolic steroids.

b. Estrogens, progesterone and oral contraceptives.

c. Drugs acting on the uterus.

6. **Bioassay**

a. Principles and applications of bioassay.

b. Types of bioassay

c. Bioassay of insulin, oxytocin, vasopressin, ACTH,d-tubocurarine,digitalis, histamine and 5-HT.

Recommended Books (Latest Editions)

1. Rang H. P., Dale M. M., Ritter J. M., Flower R. J., Rang and Dale's Pharmacology, Churchil Livingstone Elsevier
2. Katzung B. G., Masters S. B., Trevor A. J., Basic and clinical pharmacology, Tata Mc Graw-Hill.
3. Goodman and Gilman's, The Pharmacological Basis of Therapeutics
4. Marry Anne K. K., Lloyd Yee Y., Brian K. A., Robbin L.C., Joseph G. B., Wayne A. K., Bradley R.W., Applied Therapeutics, The Clinical use of Drugs, The Point Lippincott Williams & Wilkins.
5. Mycek M.J, Gelnet S.B and Perper M.M. Lippincott's Illustrated Reviews-Pharmacology.
6. K.D.Tripathi. Essentials of Medical Pharmacology, , JAYPEE Brothers Medical Publishers (P) Ltd, New Delhi.
7. Sharma H. L., Sharma K. K., Principles of Pharmacology, Paras medical publisher
8. Modern Pharmacology with clinical Applications, by Charles R.Craig& Robert.
9. Ghosh MN. Fundamentals of Experimental Pharmacology. Hilton & Company, Kolkata.
10. Kulkarni SK. Handbook of experimental pharmacology. Vallabh Prakashan.

COURSE OUTCOMES-

By the end of this course, students will be able to:

CO	Statements
CO1	Possess a relevant knowledge in basic principles of pharmacology and its recent advances.
CO2	Understand the mechanism of drug action and its relevance in the treatment of different diseases.
CO3	Demonstrate isolation of different organs/tissues from the laboratory animals by simulated experiments.
CO4	Demonstrate the various receptor actions using isolated tissue preparation.
CO5	Appreciate correlation of pharmacology with related medical sciences.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets

Mapping between Objectives and Outcomes

Mapping of Course **Outcomes onto Program Learning Outcomes**

CO	Bloom Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L4	M	M	M	M	M	-	L	M	M	L	M	H	M	L	L
CO2	L4	M	M	M	M	M	-	L	M	M	L	M	H	H	H	L
CO3	L3	M	M	M	M	M	-	L	M	M	L	M	H	M	L	-
CO4	L4	M	M	M	M	M	-	L	M	M	L	M	M	M	L	L
CO5	L4	M	M	M	M	M	-	L	M	M	L	M	H	M	L	-

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1,CO2,CO3,CO3,CO5
CD2	Tutorials/Assignments	CO1,CO2
CD3	Seminars	CO1
CD4	Self- learning advice using internets	CO1,CO2,CO3,CO4

BP504 T. PHARMACOGNOSY AND PHYTOCHEMISTRY II (Theory)

45Hours

Scope/Objective:

The main purpose of subject is to impart the students the knowledge of how thesecondary metabolites are produced in the crude drugs, how to isolate and identify and produce them industrially. Also this subject involves the study of producing the plants and phytochemicals through plant tissue culture, drug interactions and basic principles of traditional system of medicine.

Course Content:

Unit-I **7 Hours**

Metabolic pathways in higher plants and their determination

a) Brief study of basic metabolic pathways and formation of different secondary metabolites through these pathways- Shikimic acid pathway, Acetate pathways and Amino acid pathway.
b) Study of utilization of radioactive isotopes in the investigation of Biogenetic studies.

Unit-II **14 Hours**

General introduction, composition, chemistry & chemical classes, biosources, therapeutic uses and commercial applications of followingsecondary metabolites:

Alkaloids: Vinca, Rauwolfia, Belladonna, Opium,

Phenylpropanoids and Flavonoids: Lignans, Tea, Ruta

Steroids, Cardiac Glycosides & Triterpenoids: Liquorice, Dioscorea, Digitalis

Volatile oils: Mentha, Clove, Cinnamon, Fennel, Coriander,

Tannins: Catechu, Pterocarpus

Resins: Benzoin, Guggul, Ginger, Asafoetida, Myrrh, Colophony

Glycosides: Senna, Aloes, Bitter Almond

Iridoids, Other terpenoids & Naphthaquinones: Gentian, Artemisia, taxus, carotenoids

Unit-III **06 Hours**

Isolation, Identification and Analysis of Phytoconstituents

a) Terpenoids: Menthol, Citral, Artemisin
b) Glycosides: Glycyrhetinic acid & Rutin
c) Alkaloids: Atropine,Quinine,Reserpine,Caffeine
d) Resins: Podophyllotoxin, Curcumin

Unit-IV **10 Hours**

Industrial production, estimation and utilization of the following phytoconstituents:

Forskolin, Sennoside, Artemisinin, Diosgenin, Digoxin, Atropine, Podophyllotoxin, Caffeine, Taxol, Vincristine and Vinblastine

Unit V **8 Hours**

Basics of Phytochemistry

Modern methods of extraction, application of latest techniques like Spectroscopy, chromatography and electrophoresis in the isolation, purification and identification of crude drugs.

Recommended Books: (Latest Editions)

1. W.C.Evans, Trease and Evans Pharmacognosy, 16th edition, W.B. Sounders & Co., London, 2009.
2. Mohammad Ali. Pharmacognosy and Phytochemistry, CBS Publishers & Distribution, New Delhi.
3. Text book of Pharmacognosy by C.K. Kokate, Purohit, Gokhlae (2007), 37th Edition, Nirali Prakashan, New Delhi.
4. Herbal drug industry by R.D. Choudhary (1996), Ist Edn, Eastern Publisher, New Delhi.
5. Essentials of Pharmacognosy, Dr.SH.Ansari, IInd edition, Birla publications, New Delhi, 2007
6. Herbal Cosmetics by H.Pande, Asia Pacific Business press, Inc, New Delhi.
7. A.N. Kalia, Textbook of Industrial Pharmacognosy, CBS Publishers, New Delhi, 2005.
8. R Endress, Plant cell Biotechnology, Springer-Verlag, Berlin, 1994.
9. Pharmacognosy & Pharmacobiotechnology. James Bobbers, Marilyn KS, VE Tylor.
10. The formulation and preparation of cosmetic, fragrances and flavours.
11. Remington's Pharmaceutical sciences.
12. Text Book of Biotechnology by Vyas and Dixit.
13. Text Book of Biotechnology by R.C. Dubey.

COURSE OUTCOMES-

By the end of this course, students will be able to:

CO1	To know the modern extraction techniques, characterization and identification of the herbal drugs and phytoconstituents.
CO2	To understand the preparation and development of herbal formulation.
CO3	Obtain the knowledge of analysis of water and food products. To understand the herbal drug interactions
CO4	Learners will understand the chromatography techniques.
CO5	To carryout isolation and identification of phytoconstituents

Course Delivery Methods (CD)	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Experiments, Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit ,Herbal garden Visit

Table: Mapping of Course Outcomes with Program Learning Outcomes

CO	Bloom Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L2	M	L	L	L	L	-	-	M	L	-	M	-	H	M	L
CO2	L2	M	M	M	L	L	L	-	M	-	-	M	-	H	H	L
CO3	L3	M	M	M	M	M	L	M	M	L	L	M	M	H	L	H
CO4	L2	L	M	L	L	L	M	M	L	-	-	M	L	M	-	L
CO5	L4	M	M	M	M	M	L	M	M	L	L	M	H	M	L	-

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1, CO2, CO3, CO4, CO5
CD3	Experiments, Seminars	CO3, CO4, CO5
CD4	Self- learning advice using internets	CO4, CO5
CD5	Industrial visit ,Herbal garden visit	CO4,CO5

BP 505 T. PHARMACEUTICAL JURISPRUDENCE (Theory)

45 Hours

Scope/Objective:

This course is designed to impart basic knowledge on importantlegislations related to the profession of pharmacy in India.

Course Content:

Unit-I **10 Hours**

Drugs and Cosmetics Act, 1940 and its rules 1945:

Objectives, Definitions, Legal definitions of schedules to the Act and Rules

Import of drugs – Classes of drugs and cosmetics prohibited from import, Import under license or permit. Offences and penalties**.**

Manufacture of drugs – Prohibition of manufacture and sale of certain drugs,

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.

Unit-II **10 Hours**

Drugs and Cosmetics Act, 1940 and its rules 1945.

Detailed study of Schedule G, H, M, N, P,T,U, V, X, Y, Part XII B, Sch F & DMR (OA) Sale of Drugs – Wholesale, Retail sale and Restricted license. Offences and penalties

Labeling & Packing of drugs- General labeling requirements and specimen labels for drugs and cosmetics, List of permitted colors. Offences and penalties.

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

Unit-III **10 Hours**

Pharmacy Act –1948: Objectives, Definitions, Pharmacy Council of India; itsconstitution and functions, Education Regulations, State and Joint state pharmacy councils; constitution and functions, Registration of Pharmacists, Offences andpenalties

Medicinal and Toilet Preparation Act –1955: Objectives, Definitions, Licensing,Manufacture In bond and Outside bond, Export of alcoholic preparations, Manufacture of Ayurvedic, Homeopathic, Patent & Proprietary Preparations. Offences and Penalties.

Narcotic Drugs and Psychotropic substances Act-1985 and Rules: Objectives,Definitions, Authorities and Officers, Constitution and Functions of narcotic & Psychotropic Consultative Committee, 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

Unit-IV **08 Hours**

Study of Salient Features of Drugs and Magic Remedies Act and its rules: Objectives, Definitions, Prohibition of certain advertisements, Classes ofExempted advertisements, Offences and Penalties

Prevention of Cruelty to animals Act-1960: Objectives, Definitions, InstitutionalAnimal Ethics Committee, CPCSEA guidelines for Breeding and Stocking of Animals, Performance of

Experiments, Transfer and acquisition of animals for experiment, Records, Power to suspend or revoke registration, Offences and Penalties

National Pharmaceutical Pricing Authority: Drugs Price Control Order (DPCO)-2013. Objectives, Definitions, Sale prices of bulk drugs, Retail price of formulations, Retail price and ceiling price of scheduled formulations, National List of Essential Medicines (NLEM)

Unit-V **07 Hours**

Pharmaceutical Legislations –A brief review, Introduction, Study of drugs enquirycommittee, Health survey and development committee, Hathi committee and Mudaliar committee

Code of Pharmaceutical ethics D efinition, Pharmacist in relation to his job, trade,medical profession and his profession, Pharmacist's oath

Medical Termination of Pregnancy Act

Right to Information Act

Introduction to Intellectual Property Rights (IPR)

Recommended books: (Latest Edition)

1. Forensic Pharmacy by B. Suresh
2. Text book of Forensic Pharmacy by B.M. Mithal
3. Hand book of drug law-by M.L. Mehra
4. A text book of Forensic Pharmacy by N.K. Jain
5. Drugs and Cosmetics Act/Rules by Govt. of India publications.
6. Medicinal and Toilet preparations act 1955 by Govt. of India publications.
7. Narcotic drugs and psychotropic substances act by Govt. of India publications
8. Drugs and Magic Remedies act by Govt. of India publication
9. Bare Acts of the said laws published by Government. Reference books (Theory)

COURSE OUTCOMES-

By the end of this course, students will be able to:

Course Outcome	CO'S
CO1	The Pharmaceutical legislations and their implications in the development and marketing of pharmaceuticals.
CO2	The regulatory authorities and agencies governing the manufacture and sale of pharmaceuticals
CO3	Various Indian pharmaceutical Acts and Laws
CO4	Social, historical, philosophical, and economic context of law.
CO5	The code of ethics during the pharmaceutical practice

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Interaction with drug inspectors

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Bloom Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L5	H	M	L	-	M	H	M	H	H	M	H	M	M	L	M
CO2	L4	L	L	H	H	L	L	M	M	L	H	L	M	H	H	L
CO3	L2	M	H	M	H	H	M	H	L	M	-	M	H	H	L	L
CO4	L1	H	M	L	-	M	H	M	H	H	M	H	M	M	-	L
CO5	L3	L	L	H	H	L	L	M	M	L	H	L	M	M	L	-

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3
CD2	Tutorials/Assignments	CO1,CO2, CO3
CD3	Seminars	CO2,CO4
CD4	Self- learning advice using internets	CO1,CO2,CO5
CD5	Interaction with Drug inspectors	CO1, CO2, CO3

BP 506 P. Industrial Pharmacy-I (Practical)

4 Hours/week

Scope/Objectives:

Course enables the student to understand and appreciate the influence ofpharmaceutical additives and various pharmaceutical dosage forms on the performance of the drug product.

1. Preformulation studies on paracetamol/aspain/or any other drug
2. Preparation and evaluation of Paracetamol tablets
3. Preparation and evaluation of Aspirin tablets
4. Coating of tablets- film coating of tables/granules
5. Preparation and evaluation of Tetracycline capsules
6. Preparation of Calcium Gluconate injection
7. Preparation of Ascorbic Acid injection
8. Qulaity control test of (as per IP) marketed tablets and capsules
9. Preparation of Eye drops/ and Eye ointments
10. Preparation of Creams (cold / vanishing cream)
11. Evaluation of Glass containers (as per IP)

Recommended Books: (Latest Editions)

1. Pharmaceutical dosage forms - Tablets, volume 1 -3 by H.A. Liberman, Leon Lachman &J.B.Schwartz
2. Pharmaceutical dosage form - Parenteral medication vol- 1&2 by Liberman & Lachman
3. Pharmaceutical dosage form disperse system VOL-1 by Liberman & Lachman
4. Modern Pharmaceutics by Gilbert S. Banker & C.T. Rhodes, 3rd Edition
5. Remington: The Science and Practice of Pharmacy, 20th edition Pharmaceutical Science (RPS)
6. Theory and Practice of Industrial Pharmacy by Liberman & Lachman
7. Pharmaceutics- The science of dosage form design by M.E.Aulton, Churchill livingstone, Latest edition
8. Introduction to Pharmaceutical Dosage Forms by H. C.Ansel, Lea &Febiger, Philadelphia, 5thedition, 2005
9. Drug stability - Principles and practice by Cartensen & C.J. Rhodes, 3rd Edition, Marcel Dekker Series, Vol 107.

COURSE OUTCOMES-

By the end of this course, students will be able to:

CO1	Students will learn the basic concepts of Industry & manufacturing.
CO2	Know the various pharmaceutical dosage forms and their manufacturing techniques.
CO3	Know various considerations in development of pharmaceutical dosage forms and their manufacturing techniques.
CO4	Able to understand the industrial process. Know various considerations in development of pharmaceutical dosage forms.
CO5	Able to understand the production of different dosage form. Formulate solid, liquid and semisolid dosage forms and evaluate them for their quality

Course Delivery Methods (CD)	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Experiments, Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table: Mapping of Course Outcomes with ProgramLearning Outcomes

CO	Bloom Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L4	M	M	M	M	M	-	L	M	M	L	M	H	M	L	L
CO2	L4	M	M	M	M	M	-	L	M	M	L	M	H	H	H	L
CO3	L3	M	M	M	M	M	-	L	M	M	L	M	H	H	L	H
CO4	L4	M	M	M	M	M	-	L	M	M	L	M	M	L	L	**L**
CO5	L4	M	M	M	M	M	-	L	M	M	L	M	H	M	L	-

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1, CO2, CO3, CO4, CO5
CD3	Experiments, Seminars	CO2,CO3, CO4, CO5
CD4	Self- learning advice using internets	CO4, CO5
CD5	Industrial visit	CO4

BP 507 P. PHARMACOLOGY-II (Practical)

4Hrs/Week

Scope/Objective:

This subject is intended to impart the fundamental knowledge on various aspects(classification, mechanism of action, therapeutic effects, clinical uses, side effects and contraindications) of drugs acting on different systems of body and in addition,emphasis on the basic concepts of bioassay.

1. Introduction to *in-vitro* pharmacology and physiological salt solutions.
2. Effect of drugs on isolated frog heart.
3. Effect of drugs on blood pressure and heart rate of dog.
4. Study of diuretic activity of drugs using rats/mice.
5. DRC of acetylcholine using frog rectus abdominis muscle.
6. Effect of physostigmine and atropine on DRC of acetylcholine using frog rectus abdominis muscle and rat ileum respectively.
7. Bioassay of histamine using guinea pig ileum by matching method.
8. Bioassay of oxytocin using rat uterine horn by interpolation method.
9. Bioassay of serotonin using rat fundus strip by three point bioassay.
10. Bioassay of acetylcholine using rat ileum/colon by four point bioassay.
11. Determination of PA_2 value of prazosin using rat anococcygeus muscle (by Schilds plot method).
12. Determination of PD_2 value using guinea pig ileum.
13. Effect of spasmogens and spasmolytics using rabbit jejunum.
14. Anti-inflammatory activity of drugs using carrageenan induced paw-edema model.
15. Analgesic activity of drug using central and peripheral methods

Note: All laboratory techniques and animal experiments are demonstrated by simulated experiments by softwares and videos

Recommended Books (Latest Editions)

1. Rang H. P., Dale M. M., Ritter J. M., Flower R. J., Rang and Dale's Pharmacology, Churchil Livingstone Elsevier
2. Katzung B. G., Masters S. B., Trevor A. J., Basic and clinical pharmacology, Tata Mc Graw-Hill.
3. Goodman and Gilman's, The Pharmacological Basis of Therapeutics
4. Marry Anne K. K., Lloyd Yee Y., Brian K. A., Robbin L.C., Joseph G. B., Wayne A. K., Bradley R.W., Applied Therapeutics, The Clinical use of Drugs, The Point Lippincott Williams & Wilkins.
5. Mycek M.J, Gelnet S.B and Perper M.M. Lippincott's Illustrated Reviews-Pharmacology.
6. K.D.Tripathi. Essentials of Medical Pharmacology, , JAYPEE Brothers Medical Publishers (P) Ltd, New Delhi.
7. Sharma H. L., Sharma K. K., Principles of Pharmacology, Paras medical publisher
8. Modern Pharmacology with clinical Applications, by Charles R.Craig& Robert.
9. Ghosh MN. Fundamentals of Experimental Pharmacology. Hilton & Company, Kolkata.
10. Kulkarni SK. Handbook of experimental pharmacology. Vallabh Prakashan.

COURSE OUTCOMES-

By the end of this course, students will be able to:

CO	Statements
CO1	Possess a relevant knowledge in basic principles of pharmacology and its recent advances.
CO2	Understand the mechanism of drug action and its relevance in the treatment of different diseases.
CO3	Demonstrate isolation of different organs/tissues from the laboratory animals by simulated experiments.
CO4	Demonstrate the various receptor actions using isolated tissue preparation.
CO5	Appreciate correlation of pharmacology with related medical sciences.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets

Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Learning Outcomes

Course Outcome	Bloom's Level	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L1	M	M	H	-	L	-	L	-	L	-	H	-	H	L	L
CO2	L2	H	M	H	L	H	L	L	L	L	L	H	L	H	H	-
CO3	L2	L	M	H	M	L	L	L	L	M	L	H	M	H	-	H
CO4	L2	H	M	H	L	M	L	L	L	H	L	H	L	L	L	L
CO5	L4	M	M	M	H	H	H	H	M	M	M	M	H	M	L	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1,CO2,CO3,CO3,CO5
CD2	Tutorials/Assignments	CO1,CO2
CD3	Seminars	CO1
CD4	Self- learning advice using internets	CO1,CO2,CO3,CO4

BP 508 P. PHARMACOGNOSY AND PHYTOCHEMISTRY-II (Practical)

4 Hours/Week

Scope/Objective:

The main purpose of subject is to impart the students the knowledge of how thesecondary metabolites are produced in the crude drugs, how to isolate and identify and produce them industrially. Also this subject involves the study of producing the plants and phytochemicals through plant tissue culture, drug interactions and basic principles of traditional system of medicine.

1. Morphology, histology and powder characteristics & extraction & detection of: Cinchona, Cinnamon, Senna, Clove, Ephedra, Fennel and Coriander.
2. Exercise involving isolation & detection of active principles
   a. Caffeine - from tea dust.
   b. Diosgenin from Dioscorea
   c. Atropine from Belladonna
   d. Sennosides from Senna
3. Separation of sugars by Paper chromatography.
4. TLC of herbal extract.
5. Distillation of volatile oils and detection of phytoconstitutents by TLC
6. Analysis of crude drugs by chemical tests: **(**i) Asafoetida (ii) Benzoin (iii) Colophony (iv) Aloes (v) Myrrh

Recommended Books: (Latest Editions)

1. W.C.Evans, Trease and Evans Pharmacognosy, 16th edition, W.B. Sounders & Co., London, 2009.
2. Mohammad Ali. Pharmacognosy and Phytochemistry, CBS Publishers & Distribution, New Delhi.
3. Text book of Pharmacognosy by C.K. Kokate, Purohit, Gokhlae (2007), 37th Edition, Nirali Prakashan, New Delhi.
4. Herbal drug industry by R.D. Choudhary (1996), Ist Edn, Eastern Publisher, New Delhi.
5. Essentials of Pharmacognosy, Dr.SH.Ansari, IInd edition, Birla publications, New Delhi, 2007
6. Herbal Cosmetics by H.Pande, Asia Pacific Business press, Inc, New Delhi.
7. A.N. Kalia, Textbook of Industrial Pharmacognosy, CBS Publishers, New Delhi, 2005.
8. R Endress, Plant cell Biotechnology, Springer-Verlag, Berlin, 1994.
9. Pharmacognosy& Pharmacobiotechnology. James Bobbers, Marilyn KS, VE Tylor.
10. The formulation and preparation of cosmetic, fragrances and flavours.
11. Remington’s Pharmaceutical sciences.
12. Text Book of Biotechnology by Vyas and Dixit.
13. Text Book of Biotechnology by R.C. Dubey.

COURSE OUTCOMES-

By the end of this course, students will be able to:

CO1	To know the modern extraction techniques, characterization and identification of the herbal drugs and phytoconstituents.
CO2	To understand the preparation and development of herbal formulation.
CO3	Obtain the knowledge of analysis of water and food products. To understand the herbal drug interactions.
CO4	Learners will understand the chromatography techniques.
CO5	To carryout isolation and identification of phytoconstituents

Course Delivery Methods (CD)	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Experiments, Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit ,Herbal garden Visit

Table: Mapping of Course Outcomes with Program Learning Outcomes

CO	Bloom Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L2	M	L	L	L	L	-	-	M	L	-	M	-	M	L	L
CO2	L2	M	M	M	L	L	L	-	M	-	-	M	-	M	H	L
CO3	L3	M	M	M	M	M	L	M	M	L	L	M	M	M	-	H
CO4	L2	L	M	L	L	L	M	M	L	-	-	M	L	L	L	**L**
CO5	L4	M	M	M	M	M	L	M	M	L	L	M	H	M	L	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1, CO2, CO3, CO4, CO5
CD3	Experiments, Seminars	CO3, CO4, CO5
CD4	Self- learning advice using internets	CO4, CO5
CD5	Industrial visit ,Herbal garden visit	CO4,CO5

BP509: Professional Skills

Objectives:

1. To acquire career skills and fully pursue to partake in a successful career path
2. To prepare good resume, prepare for interviews and group discussions
3. To explore desired career opportunities in the employment market in consideration of an individual SWOT.
4. Understand the significance of Team Skills and help them in acquiring them
5. To help them design, develop and adapt to situations as an individual and as a team.

Course Contents

Unit I: Resume Skills & Interview Skills

Resume Skills : Preparation and Presentation, Introduction of resume and its importance, Difference between a CV, Resume and Bio data, Essential components of a good resume, Resume skills : common errors, Common errors people generally make in preparing their resume, Prepare a good resume of her/his considering all essential components

Interview Skills : Preparation and Presentation, Meaning and types of interview (F2F, telephonic, video, etc.), Dress Code, Background Research, Do's and Don'ts, Situation, Task, Approach and Response (STAR Approach) for facing an interview, Interview procedure (opening, listening skills, closure, etc.), Important questions generally asked in a job interview (open and closed ended questions), Interview Skills : Simulation, Observation of exemplary interviews, Comment critically on simulated interviews, Interview Skills : Common Errors, Discuss the common errors generally candidates make in interview, Demonstrate an ideal interview

Unit II: Group Discussion Skills & Exploring career opportunities

Meaning and methods of Group Discussion, Procedure of Group Discussion, Group Discussion-Simulation, Group Discussion - Common Errors, Knowing yourself – personal characteristics

Knowledge about the world of work, requirements of jobs including self-employment, Sources of career information, Preparing for a career based on their potentials and availability of opportunities

Unit III: Presentation Skills, Trust and Collaboration

Types of presentations, Internal and external presentation, Knowing the purpose, Knowing the audience, Opening and closing a presentation, Using presentation tools, Handling questions, Presentation to heterogenic group, Ways to improve presentation skills over time, Explain the importance of trust in creating a collaborative team, Agree to Disagree and Disagree to Agree – Spirit of Team work, Understanding fear of being judged and strategies to overcome fear

Unit IV: Listening as a Team Skill & Brainstorming

Advantages of Effective Listening, Listening as a team member and team leader. Use of active listening strategies to encourage sharing of ideas (full and undivided attention, no interruptions, no prethink, use empathy, listen to tone and voice modulation, recapitulate points, etc.)., Use of group and individual brainstorming techniques to promote idea generation., Learning and showcasing the principles of documentation of team session outcomes

Unit V: Social and Cultural Etiquette & Internal Communication 4 Hours

Need for etiquette (impression, image, earn respect, appreciation, etc), Aspects of social and cultural/corporate etiquette in promoting teamwork, Importance of time, place, propriety and adaptability to diverse cultures, Use of various channels of transmitting information including digital and physical, to team members.

Course Outcomes:

CO	Statement
	After the completion of this course, students will be able to:
CO1	Prepare their resume in an appropriate template without grammatical and other errors and using proper syntax and Participate in a simulated interview
CO2	Actively participate in group discussions towards gainful employment, Capture a self - interview simulation video regarding the job role concerned and Enlist the common errors generally made by candidates in an interview.
CO3	Perform appropriately and effectively in group discussions and Explore sources (online/offline) of career opportunities
CO4	Use common technology messaging tools that are used in enterprises for flow of information and transition from command and control to informal communication during an online/offline team session & Actively use and operate online team communication tools: Webinar, Skype, Zoom, Google hangout etc
CO5	Appreciate and demonstrate Team Skills & Generate, share and maximise new ideas with the concept of brainstorming and the documentation of key critical ideas/thoughts articulated and action points to be implemented with timelines in a team discussion (as MOM) in identified applicable templates

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Mapping between Objectives and Outcomes
Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Bloom's Levels	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO3
CO1	L6	L	H	L	M	L	H	H	M	-	H	M	-	L	-	-
CO2	L3	L	H	L	M	L	H	H	M	-	H	M	-	L	-	-
CO3	L3	L	H	L	M	L	H	H	M	-	H	M	-	L	-	-
CO4	L3	L	H	L	M	L	H	H	M	-	H	M	-	L	-	-
CO5	L3	L	H	L	M	L	H	H	M	-	H	M	-	L	-	-

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1, CO2, CO3, CO4, CO5
CD3	Seminars	CO3, CO4
CD4	Self- learning advice using internets	CO1, CO2, CO3, CO4, CO5
CD5	Industrial visit	CO3, CO4, CO5

BP 510: ANANDAM

Objectives:

- To instil the joy of giving in young people, turning them into responsible citizens to build up a better society.
- To inculcate the habit of service in students across the University.
- A compulsory course of 2 credits per semester to be included in each program of University.
- Students to be excepted to engage in individual and group acts of service and goodness.

Action Plan:

Students will be expected to

- Do at least one act of individual service each day
- Record this act of service in a dedicated Register / Personal Diary
- Share this Register / Personal Diary day in the Anandam Class scheduled per week. The class interaction will include Personal Diary check, Showing of Community based motivation videos, Community based presentations by students, Role playing etc.
- Undertake one group service project for 64 hours every semester (outside college hours)
- Upload the report on the group project on the Anandam platform
- Participate in a sharing and presentation on the group service in the discussion sessions held once in week
- there will be some suggested projects and organizations that students can work with. Students can also suggest their own projects which others can join

Each student will finish the year with a portfolio of giving. This will include their Register / Personal Diaries and their reports on group service projects.

Semester - VI

Code No.	Paper	Type	Internal Marks	External Marks	Total Marks	L	T/P	Credit
BP601T	Medicinal Chemistry III – Theory	CORE	25	75	100	3	1	4
BP602T	Pharmacology III – Theory	CORE	25	75	100	3	1	4
BP603T	Herbal Drug Technology – Theory	CORE	25	75	100	3	1	4
BP604T	Bio-pharmaceutics and Pharmacokinetics –Theory	CORE	25	75	100	3	1	4
BP605T	Pharmaceutical Biotechnology – Theory	CORE	25	75	100	3	1	4
BP606T	Quality Assurance –Theory	CORE	25	75	100	3	1	4
BP607P	Medicinal chemistry III– Practical	CORE	15	35	50	4	-	2
BP608P	Pharmacology III–Practical	CORE	15	35	50	4	-	2
BP609P	Herbal Drug Technology– Practical	CORE	15	35	50	4	-	2
BP 610	ANANDAM	CEC	50	50	100	1	-	2
	TOTAL		**245**	**605**	**850**			**32**

SEMESTER VI

BP601T. MEDICINAL CHEMISTRY – III (Theory)

45 Hours

Scope/Objective:

This subject is designed to impart fundamental knowledge on the structure, chemistry and therapeutic value of drugs. The subject emphasis on modern techniques of rational drug design like quantitative structure activity relationship (QSAR), Prodrug concept, combinatorial chemistry and Computer aided drug design (CADD). The subject also emphasizes on the chemistry, mechanism of action, metabolism, adverse effects, Structure Activity Relationships (SAR), therapeutic uses and synthesis of important drugs.

Course Content:

Study of the development of the following classes of drugs, Classification, mechanism of action, uses of drugs mentioned in the course, Structure activity relationship of selective class of drugs as specified in the course and synthesis of drugs superscripted by (*)

Unit – I **10 Hours**

Antibiotics

Historical background, Nomenclature, Stereochemistry, Structure activity relationship, Chemical degradation classification and important products of the following classes.

B-Lactamantibiotics: Penicillin, Cepholosporins, β-Lactamase inhibitors, Monobactams

Aminoglycosides: Streptomycin, Neomycin, Kanamycin

Tetracyclines: Tetracycline, Oxytetracycline, Chlortetracycline, Minocycline, Doxycycline

Unit – II **10 Hours**

Antibiotics

Historical background, Nomenclature, Stereochemistry, Structure activity relationship, Chemical degradation classification and important products of the following classes.

Macrolide: Erythromycin Clarithromycin, Azithromycin.

Miscellaneous: Chloramphenicol*, Clindamycin.

Prodrugs: Basic concepts and application of prodrugs design.

Antimalarials: Etiology of malaria.

Quinolines: SAR, Quinine sulphate, Chloroquine*, Amodiaquine, Primaquine phosphate, Pamaquine*, Quinacrine hydrochloride, Mefloquine.

Biguanides and dihydro triazines: Cycloguanil pamoate, Proguanil.

Miscellaneous: Pyrimethamine, Artesunete, Artemether and Atovoquone.

Unit – III **10 Hours**

Anti-tubercular Agents

Synthetic anti tubercular agents: Isoniozid*, Ethionamide, Ethambutol, Pyrazinamide, Para amino salicylic acid.*

Anti tubercular antibiotics: Rifampicin, Rifabutin, CycloserineStreptomycine, Capreomycin sulphate.

Urinary tract anti-infective agents

Quinolones:SAR of quinolones, Nalidixic Acid, Norfloxacin, Enoxacin, Ciprofloxacin*, Ofloxacin, Lomefloxacin, Sparfloxacin, Gatifloxacin, Moxifloxacin

Miscellaneous: Furazolidine, Nitrofurantoin*, Methanamine.

Antiviral agents:

Amantadine hydrochloride, Rimantadine hydrochloride, Idoxuridine trifluoride, Acyclovir*, Gancyclovir, Zidovudine, Didanosine, Zalcitabine, Lamivudine, Loviride, Delavirding, Ribavirin, Saquinavir, Indinavir, Ritonavir.

Unit – IV **08 Hours**

Antifungal agents:

Antifungal antibiotics: Amphotericin-B, Nystatin, Natamycin, Griseofulvin.

Synthetic Antifungal agents: Clotrimazole, Econazole, Butoconazole, Oxiconazole Tioconozole, Miconazole*, Ketoconazole, Terconazole, Itraconazole, Fluconazole, Naftifine hydrochloride, Tolnaftate*.

Anti-protozoal Agents: Metronidazole*, Tinidazole, Ornidazole, Diloxanide, Iodoquinol, Pentamidine Isethionate, Atovaquone, Eflornithine.

Anthelmintics: Diethylcarbamazine citrate*, Thiabendazole, Mebendazole*, Albendazole, Niclosamide, Oxamniquine, Praziquantal, Ivermectin.

Sulphonamides and Sulfones

Historical development, chemistry, classification and SAR of Sulfonamides:

Sulphamethizole, Sulfisoxazole, Sulphamethizine, Sulfacetamide*, Sulphapyridine, Sulfamethoxaole*, Sulphadiazine, Mefenide acetate, Sulfasalazine.

Folate reductase inhibitors: Trimethoprim*, Cotrimoxazole.

Sulfones: Dapsone*.

Unit – V **07 Hours**

Introduction to Drug Design

Various approaches used in drug design.

Physicochemical parameters used in quantitative structure activity relationship (QSAR) such as partition coefficient, Hammet's electronic parameter, Tafts steric parameter and Hansch analysis.

Pharmacophore modeling and docking techniques.

Combinatorial Chemistry: Concept and applications of combinatorial Chemistry: solid phase and solution phase synthesis.

Recommended Books (Latest Editions)

1. Wilson and Giswold's Organic medicinal and Pharmaceutical Chemistry.
2. Foye's Principles of Medicinal Chemistry.
3. Burger's Medicinal Chemistry, Vol I to IV.
4. Introduction to principles of drug design- Smith and Williams.
5. Remington's Pharmaceutical Sciences.
6. Martindale's extra pharmacopoeia.
7. Organic Chemistry by I.L. Finar, Vol. II.
8. The Organic Chemistry of Drug Synthesis by Lednicer, Vol. 1-5.
9. Indian Pharmacopoeia.
10. Text book of practical organic chemistry- A.I.Vogel.

COURSE OUTCOMES-

By the end of this course, students will be able to:

CO1	Understand the importance of drug design and different techniques of drug design.
CO2	Understand the chemistry of drugs with respect to their biological activity.
CO3	Students will learn about medicinalchemistry&Know the metabolism, adverse effects and therapeutic value of drugs.
CO4	Students will gain knowledge about fundamentals of medicinal chemistry chemistry.
CO5	Understand the importance of SAR of drugs.

Course Delivery Methods (CD)	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Experiments, Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit ,Lab visit

Table: Mapping of Course Outcomes with Program Learning Outcomes

CO	Bloom Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L2	H	H	H	-	-	-	-	M	M	-	H	L	H	M	L
CO2	L2	H	M	H	L	L	-	-	M	L	-	H	L	H	M	L
CO3	L3	H	H	H	L	M	-	-	M	M	-	H	M	M	M	H
CO4	L3	H	M	H	L	M	-	-	M	M	-	H	H	L	L	-
CO5	L3	M	M	M	L	M	-	L	M	L	-	M	H	M	L	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD:

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1, CO2, CO3, CO4, CO5
CD3	Experiments, Seminars	CO3, CO4, CO5
CD4	Self- learning advice using internets	CO4, CO5
CD5	Industrial visit ,lab visit	CO5

BP602 T. PHARMACOLOGY-III (Theory)

45 Hours

Scope/Objective:

This subject is intended to impart the fundamental knowledge on various aspects(classification, mechanism of action, therapeutic effects, clinical uses, side effects and contraindications) of drugs acting on respiratory and gastrointestinal system, infectiousdiseases, immuno-pharmacology and in addition,emphasis on the principles of toxicology and chronopharmacology.

Course Content:

Unit-I10 hours

1. Pharmacology of drugs acting on Respiratory system

a. Anti -asthmatic drugs
b. Drugs used in the management of COPD
c. Expectorants and antitussives
d. Nasal decongestants
e. Respiratory stimulants

2. Pharmacology of drugs acting on the Gastrointestinal Tract

a. Antiulcer agents.
b. Drugs for constipation and diarrhoea.
c. Appetite stimulants and suppressants.
d. Digestants and carminatives.
e. Emetics and anti-emetics

Unit-II **10 hours**

3. Chemotherapy

a. General principles of chemotherapy.
b. Sulfonamides and cotrimoxazole.
c. Antibiotics- Penicillins, cephalosporins, chloramphenicol, macrolides, quinolones and fluoroquinolins, tetracycline and aminoglycosides

Unit-II **10 hours**

3. Chemotherapy

a. Antitubercular agents
b. Antileprotic agents
c. Antifungal agents
d. Antiviral drugs
e. Anthelmintics
f. Antimalarial drugs
g. Antiamoebic agents

Unit-IV **08 hours**

3. Chemotherapy

a. Urinary tract infections and sexually transmitted diseases.

b. Chemotherapy of malignancy.

4. Immunopharmacology

a. Immunostimulants

b. Immunosuppressant

Protein drugs, monoclonal antibodies, target drugs to antigen, biosimilars

Unit-V **07 hours**

5. Principles of toxicology

a. Definition and basic knowledge of acute, subacute and chronic toxicity.

b. Definition and basic knowledge of genotoxicity, carcinogenicity, teratogenicity and mutagenicity

c. General principles of treatment of poisoning

d. Clinical symptoms and management of barbiturates, morphine, and organophosphosphorus compound and lead, mercury and arsenic poisoning.

6. Chronopharmacology

a. Definition of rhythm and cycles.

b. Biological clock and their significance leading to chronotherapy.

Recommended Books (Latest Editions)

1. Rang H. P., Dale M. M., Ritter J. M., Flower R. J., Rang and Dale's Pharmacology, Churchil Livingstone Elsevier
2. Katzung B. G., Masters S. B., Trevor A. J., Basic and clinical pharmacology, Tata Mc Graw-Hill
3. Goodman and Gilman's, The Pharmacological Basis of Therapeutics
4. Marry Anne K. K., Lloyd Yee Y., Brian K. A., Robbin L.C., Joseph G. B., Wayne A. K., Bradley R.W., Applied Therapeutics, The Clinical use of Drugs. The Point Lippincott Williams & Wilkins
5. Mycek M.J, Gelnet S.B and Perper M.M. Lippincott's Illustrated Reviews-Pharmacology
6. K.D.Tripathi. Essentials of Medical Pharmacology, , JAYPEE Brothers Medical Publishers (P) Ltd, New Delhi.
7. Sharma H. L., Sharma K. K., Principles of Pharmacology, Paras medical publisher Modern Pharmacology with clinical Applications, by Charles R.Craig& Robert,
8. Ghosh MN. Fundamentals of Experimental Pharmacology. Hilton & Company, Kolkata,
9. Kulkarni SK. Handbook of experimental pharmacology. VallabhPrakashan,
10. N.Udupa and P.D. Gupta, Concepts in Chronopharmacology.

COURSE OUTCOMES-

By the end of this course, students will be able to:

CO	Statements
CO1	Possess a relevant knowledge in basic principles of pharmacology and its recent advances.
CO2	Understand the mechanism of drug action and its relevance in the treatment of different infectious diseases
CO3	Comprehend the principles of toxicology and treatment of various poisoningsand
CO4	Understand the general principles of various drugs and the handling of drugs by the body.
CO5	Appreciate correlation of pharmacology with related medical sciences.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets

Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Learning Outcomes

Course Outcome	Bloom's Level	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L1	M	M	H	-	L	-	L	-	L	-	H	-	M	M	L
CO2	L2	H	M	H	L	H	L	L	L	L	L	H	L	H	M	L
CO3	L3	L	M	H	M	L	L	L	L	M	L	H	M	M	L	M
CO4	L2	H	M	H	L	M	L	L	L	H	L	H	L	L	-	L
CO5	L4	M	M	M	H	H	H	H	M	M	M	M	H	M	L	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1,CO2,CO3,CO3,CO5
CD2	Tutorials/Assignments	CO1,CO2
CD3	Seminars	CO1
CD4	Self- learning advice using internets	CO1,CO2,CO3,CO4

BP 603 T. HERBAL DRUG TECHNOLOGY (Theory)

45 hours

Scope/Objective:

This subject gives the student the knowledge of basic understanding of herbal drugindustry, 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

Course content:

Unit-I **11 Hours**

Herbs as raw materials

Definition of herb, herbal medicine, herbal medicinal product, herbal drug preparation Source of Herbs

Selection, identification and authentication of herbal materials processing of herbal raw material

Biodynamic Agriculture

Good agricultural practices in cultivation of medicinal plants including Organic farming.

Pest and Pest management in medicinal plants: Biopesticides/Bioinsecticides.

Indian Systems of Medicine

a) Basic principles involved in Ayurveda, Siddha, Unani and Homeopathy

b) Preparation and standardization of Ayurvedic formulations viz Aristas and Asawas, Ghutika, Churna, Lehya and Bhasma.

Unit-II **7 Hours**

Nutraceuticals

General aspects, Market, growth, scope and types of products available in the market. Health benefits and role of Nutraceuticals in ailments like Diabetes, CVS diseases, Cancer, Irritable bowel syndrome and various Gastro intestinal diseases.

Study of following herbs as health food: Alfaalfa, Chicory, Ginger, Fenugreek, Garlic, Honey, Amla, Ginseng, Ashwagandha, Spirulina

Herbal-Drug and Herb-Food Interactions: General introduction to interaction andclassification. Study of following drugs and their possible side effects and interactions: Hypercium, kava-kava, Ginkobiloba, Ginseng, Garlic, Pepper & Ephedra.

Unit-III **10 Hours**

Herbal Cosmetics

Sources and description of raw materials of herbal origin used via, fixed oils, waxes, gums colours, perfumes, protective agents, bleaching agents, antioxidants in products such as skin care, hair care and oral hygiene products.

Herbal excipients:

Herbal Excipients – Significance of substances of natural origin as excipients – colorants, sweeteners, binders, diluents, viscosity builders, disintegrants, flavors & perfumes.

Herbal formulations:

Conventional herbal formulations like syrups, mixtures and tablets and Novel dosage forms like phytosomes

Unit- IV **10 Hours**

Evaluation of Drugs WHO & ICH guidelines for the assessment of herbal drugsStability testing of herbal drugs.

Patenting and Regulatory requirements of natural products:

a) Definition of the terms: Patent, IPR, Farmers right, Breeder's right, Bioprospecting and Biopiracy

b) Patenting aspects of Traditional Knowledge and Natural Products. Case study of Curcuma & Neem.

Regulatory Issues - Regulations in India (ASU DTAB, ASU DCC), Regulation ofmanufacture of ASU drugs - Schedule Z of Drugs & Cosmetics Act for ASU drugs.

Unit-V **07 Hours**

General Introduction to Herbal Industry

Herbal drugs industry: Present scope and future prospects.

A brief account of plant based industries and institutions involved in work on medicinal and aromatic plants in India.

S**chedule T–Good Manufacturing Practice of Indian systems of medicine** Components of GMP (Schedule – T) and its objectives

Infrastructural requirements, working space, storage area, machinery and equipments, standard operating procedures, health and hygiene, documentation and records.

Recommended Books: (Latest Editions)

1. Textbook of Pharmacognosy by Trease & Evans.
2. Textbook of Pharmacognosy by Tyler, Brady & Robber.
3. Pharmacognosy by Kokate, Purohit and Gokhale
4. Essential of Pharmacognosy by Dr.S.H.Ansari
5. Pharmacognosy & Phytochemistry by V.D.Rangari
6. Pharmacopoeal standards for Ayurvedic Formulation (Council of Research in Indian Medicine & Homeopathy)
7. Mukherjee, P.W. Quality Control of Herbal Drugs: An Approach to Evaluation of Botanicals. Business Horizons Publishers, New Delhi, India, 2002.

COURSE OUTCOMES-

By the end of this course, students will be able to:

CO	Statements
CO1	To understand the raw material as source of herbal drugs from cultivation to herbal drug product.
CO2	To understand the guidelines provided by the WHO and ICH for the evaluation of the herbal drugs.
CO3	Understand the principle & applications of chromatographic & non-chromatographic separationmethods of herbal drugs.
CO4	Explain need of analysis of natural products & explain theirsignificance.
CO5	Generate micrometric data & identify the herbaldrugs

Course Delivery Methods (CD)	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets

Table: Mapping of Course Outcomes with Program Learning Outcomes

Course Outcomes	Blooms Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2	PSO3
CO1	L1	H	M	M	-	H	-	H	H	-	H	H	-	H	M	L
CO2	L1	H	H	_	L	M	-	M	H	-	H	H	-	H	M	L
CO3	L6	H	M	_	-	M	-	L	H	-	M	H	-	M	M	-
CO4	L6	M	M	H	M	M	H	M	H	M	M	M	M	M	L	M
CO5	L4	L	M	M	-	-	-	L	L	M	L	L	L	M	L	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD:

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1, CO2, CO3, CO4,
CD3	Seminars	CO2,CO3,CO5,
CD4	Self- learning advice using internets	CO1,CO2,CO3,CO4,CO5,

BP 604 T. BIOPHARMACEUTICS AND PHARMACOKINETICS (Theory)

45 Hours

Scope/Objective:

This subject is designed to impart knowledge and skills of Biopharmaceuticsand pharmacokinetics and their applications in pharmaceutical development, design of dose and dosage regimen and in solving the problems arised therein

CourseContent:

Unit-I **10 Hours**

IntroductiontoBiopharmaceutics

Absorption; Mechanisms of drug absorption through GIT, factors influencing drugabsorption though GIT, absorption of drug from Non per oral extra-vascular routes, **Distribution** Tissue permeability of drugs, binding of drugs, apparent, volume of drug distribution, plasma and tissue protein binding of drugs, factors affecting protein-drug binding. Kinetics of protein binding, Clinical significance of protein binding of drugs

Unit- II **10 Hours**

Elimination: Drug metabolism and basic understanding metabolic pathways renalexcretion of drugs, factors affecting renal excretion of drugs, renal clearance, Non renal routes of drug excretion of drugs

Bioavailability and Bioequivalence: Definition and Objectives of bioavailability,absolute and relative bioavailability, measurement of bioavailability, *in-vitro* drug dissolution models, *in-vitro-in-vivo* correlations, bioequivalence studies, methods to enhance the dissolution rates and bioavailability of poorly soluble drugs.

Unit- III **10 Hours**

Pharmacokinetics: Definition and introduction to Pharmacokinetics, Compartmentmodels, Non compartment models, physiological models and one compartment open model. (a). Intravenous Injection (Bolus) (b). Intravenous infusion and (c) Extra vascular administrations. Pharmacokinetics parameters - K_E, t1/2, Vd, AUC, Ka, Clt and CL_R- definitions methods of eliminations, understanding of their significance and application

Unit- IV **08 Hours**

Multicompartment models: Two compartment open model. IV bolus

Kinetics of multiple dosing, steady state drug levels, calculation of loading and mainetnance doses and their significance in clinical settins.

Unit- V **07 Hours**

Nonlinear Pharmacokinetics:

a. Introduction.
b. Factors causing Non-linearity.
c. Michaelis-menton method of estimating parameters, Explanation with example of drugs.

Recommended Books: (Latest Editions)

1. Biopharmaceutics and Clinical Pharmacokinetics by, Milo Gibaldi.
2. Biopharmaceutics and Pharmacokinetics; By Robert F Notari
3. Applied biopharmaceutics and pharmacokinetics, Leon Shargel and Andrew B.C.YU 4th edition,Prentice-Hall Inernational edition.USA
4. Bio pharmaceutics and Pharmacokinetics-A Treatise, By D. M. Brahmankar and Sunil B.Jaiswal,Vallabh Prakashan Pitampura, Delhi
5. Pharmacokinetics: By Milo Glbaldi Donald, R. Mercel Dekker Inc.
6. Hand Book of Clinical Pharmacokinetics, By Milo Gibaldi and Laurie Prescott by ADIS Health Science Press.
7. Biopharmaceutics; By Swarbrick
8. Clinical Pharmacokinetics, Concepts and Applications: By Malcolm Rowland and
9. Thomas, N. Tozen, Lea and Febrger, Philadelphia, 1995.
10. Dissolution, Bioavailability and Bioequivalence, By Abdou H.M, Mack, Publishing Company, Pennsylvania 1989.
11. Biopharmaceutics and Clinical Pharmacokinetics-An introduction 4th edition Revised and expanded by Rebort F Notari Marcel Dekker Inn, New York and Basel, 1987.
12. Remington's Pharmaceutical Sciences, By Mack Publishing Company, Pennsylvnia

COURSE OUTCOMES-

By the end of this course, students will be able to:

CO	Statements
CO1	Understand the basic concepts in biopharmaceutics and pharmacokinetics and their significance.
CO2	Use of plasma drug concentration-time data to calculate the pharmacokinetic parameters to describe the kinetics of drug absorption, distribution, metabolism, excretion, elimination.
CO3	To understand the concepts of bioavailability and bioequivalence of drug products and their significance.
CO4	Understand various pharmacokinetic parameters, their significance & applications.
CO5	Understand the concept and mechanisms of dissolution and IVIVCcorrelation.

Course Delivery Methods (CD)	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets

Table: Mapping of Course Outcomes with Program Learning Outcomes

Course Outcomes	Blooms Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P010	PO11	PO12	PSO1	PSO2	PSO3
CO1	L1	H	M	M	-	H	-	H	H	H	H	-	L	H	-	L
CO2	L6	H	H	M	-	M	-	M	H	H	H	-	L	M	M	L
CO3	L1	H	H	_	L	M	-	M	H	H	H	-	L	M	-	-
CO4	L6	H	M	_	-	M	-	L	H	M	H	-	L	M	L	M
CO5	L6	M	M	H	M	M	H	M	H	M	M	M	M	M	L	-

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD:

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4,
CD2	Tutorials/Assignments	CO1, CO2, CO3, CO4,
CD3	Seminars	CO2,CO3,CO5,
CD4	Self- learning advice using internets	CO1,CO2,CO3,CO4,CO5,

BP 605 T. PHARMACEUTICAL BIOTECHNOLOGY (Theory)

45 Hours

Scope/Objective:

Biotechnology has a long promise to revolutionize the biological sciences and technology.Scientific application of biotechnology in the field of genetic engineering, medicine and fermentation technology makes the subject interesting.Biotechnology is leading to new biological revolutions in diagnosis, prevention and cure of diseases, new and cheaper pharmaceutical drugs.Biotechnology has already produced transgenic crops and animals and the future promises lot more.It is basically a research-based subject.

Course Contents:

Unit I **10 Hours**

a) Brief introduction to Biotechnology with reference to Pharmaceutical Sciences.
b) Enzyme Biotechnology- Methods of enzyme immobilization and applications.
c) Biosensors- Working and applications of biosensors in Pharmaceutical Industries.
d) Brief introduction to Protein Engineering.
e) Use of microbes in industry. Production of Enzymes- General consideration - Amylase, Catalase, Peroxidase, Lipase, Protease, Penicillinase.
f) Basic principles of genetic engineering.

Unit II **10 Hours**

a) Study of cloning vectors, restriction endonucleases and DNA ligase.
b) Recombinant DNA technology. Application of genetic engineering in medicine.
c) Application of r DNA technology and genetic engineering in the production of:
i) Interferon ii) Vaccines- hepatitis- B iii) Hormones-Insulin.
d) Brief introduction to PCR

Unit III **10 Hours**

Types of immunity- humoral immunity, cellular immunity

a) Structure of Immunoglobulins
b) Structure and Function of MHC
c) Hypersensitivity reactions, Immune stimulation and Immune suppressions.
d) General method of the preparation of bacterial vaccines, toxoids, viral vaccine, antitoxins, serum-immune blood derivatives and other products relative to immunity.
e) Storage conditions and stability of official vaccines
f) Hybridoma technology- Production, Purification and Applications
g) Blood products and Plasma Substituties.

Unit IV **08 Hours**

a) Immuno blotting techniques- ELISA, Western blotting, Southern blotting.
b) Genetic organization of Eukaryotes and Prokaryotes
c) Microbial genetics including transformation, transduction, conjugation, plasmids and transposons.
d) Introduction to Microbial biotransformation and applications.
e) Mutation: Types of mutation/mutants.

Unit V **07 Hours**

a) Fermentation methods and general requirements, study of media, equipments, sterilization methods, aeration process, stirring.

b) Large scale production fermenter design and its various controls.

c) Study of the production of - penicillins, citric acid, Vitamin B12, Glutamic acid, Griseofulvin,

d) Blood Products: Collection, Processing and Storage of whole human blood, dried human plasma, plasma Substituties.

Recommended Books (Latest edition):

1. B.R. Glick and J.J. Pasternak: Molecular Biotechnology: Principles and Applications of RecombinantDNA: ASM Press Washington D.C.
2. RA Goldshy et. al., : Kuby Immunology.
3. J.W. Goding: Monoclonal Antibodies.
4. J.M. Walker and E.B. Gingold: Molecular Biology and Biotechnology by Royal Society of Chemistry.
5. Zaborsky: Immobilized Enzymes, CRC Press, Degraland, Ohio.
6. S.B. Primrose: Molecular Biotechnology (Second Edition) Blackwell Scientific Publication.
7. Stanbury F., P., Whitakar A., and Hall J., S., Principles of fermentation technology, 2nd edition, Aditya books Ltd., New Delhi

COURSE OUTCOMES-

By the end of this course, students will be able to:

CO1	Know the structure and functions of cell organelles . Classify biomolecules with structure and functions
CO2	Understanding the importance of Immobilized enzymes in Pharmaceutical Industries
CO3	Discuss the pathways of biomolecules and regulations. Identify the biomolecules in given sample
CO4	Genetic engineering applications in relation to production of pharmaceuticals
CO5	Importance of Monoclonal antibodies in Industries.Appreciate the use of microorganisms in fermentation technology

Course Delivery Methods (CD)	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit / Field visit

Mapping between Programme Outcomes (POs) and Course Outcomes (COs):

POs/COs	Blooms Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L3	H	-	-	-	M	M	-	-	-	-	-	-	H	-	L
CO2	L4	H	-	M	-	-	-	-	-	-	-	-	-	M	M	L
CO3	L2	H	-	-	H	H	-	-	-	-	-	-	-	M	-	-
CO4	L3	-	L	H	-	-	-	-	L	-	-	-	-	-	L	M
CO5	L6	-	L		H	-	M	-	L	L	-	L	H	M	-	-

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CD and CO

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO5
CD2	Tutorials/Assignments	CO1, CO2, CO3, CO5
CD3	Seminars	CO2, CO3, CO5
CD4	Self- learning advice using internets	CO1, CO2, CO4, CO5
CD5	Industrial visit / Field visit	CO4,CO5

BP606T PHARMACEUTICAL QUALITY ASSURANCE (Theory)

45 Hours

Scope/Objective:
This course deals with the various aspects of quality control and qualityassurance aspects of pharmaceutical industries. It deals with the important aspects like cGMP, QC tests, documentation, quality certifications and regulatory affairs.

Course content:

Unit – I **10 Hours**

Quality Assurance and Quality Management concepts: Definition and concept of Qualitycontrol, Quality assurance and GMP

Total Quality Management (TQM): Definition, elements, philosophies

ICH Guidelines: purpose, participants, process of harmonization, Brief overview of QSEM, with special emphasis on Q-series guidelines, ICH stability testing guidelines

Quality by design (QbD): Definition, overview, elements of QbD program, tools

ISO 9000 & ISO14000: Overview, Benefits, Elements, steps for registration

NABL accreditation: Principles and procedures

Unit – II **10 Hours**

Organization and personnel: Personnel responsibilities, training, hygiene and personal records.

Premises: Design, construction and plant layout, maintenance, sanitation, environmentalcontrol, utilities and maintenance of sterile areas, control of contamination.

Equipments and raw materials: Equipment selection, purchase specifications, maintenance, purchase specifications and maintenance of stores for raw materials.

Unit – III **10 Hours**

Quality Control: Quality control test for containers, rubber closures and secondary packing materials.

Good Laboratory Practices: General Provisions, Organization and Personnel, Facilities,Equipment, Testing Facilities Operation, Test and Control Articles, Protocol for Conduct of a Nonclinical Laboratory Study, Records and Reports, Disqualification of Testing Facilities

Unit – IV **08 Hours**

Complaints: Complaints and evaluation of complaints, Handling of return good, recalling andwaste disposal.

Document maintenance in pharmaceutical industry: Batch Formula Record, Master FormulaRecord, SOP, Quality audit, Quality Review and Quality documentation, Reports and documents, distribution records.

Unit – V **07 Hours**

Calibration and Validation: Introduction, definition and general principles of calibration, qualification and validation, importance and scope of validation, types of validation, validation master plan. Calibration of pH meter, Qualification of UV-Visible spectrophotometer, General principles of Analytical method Validation.

Warehousing: Good warehousing practice, materials management

Recommended Books: (Latest Edition)

1. Quality Assurance Guide by organization of Pharmaceutical Products of India.
2. Good Laboratory Practice Regulations, 2nd Edition, Sandy Weinberg Vol. 69.
3. Quality Assurance of Pharmaceuticals- A compendium of Guide lines and Related materials Vol I WHO Publications.
4. A guide to Total Quality Management- Kushik Maitra and Sedhan K Ghosh
5. How to Practice GMP's – P P Sharma.
6. ISO 9000 and Total Quality Management – Sadhank G Ghosh
7. The International Pharmacopoeia – Vol I, II, III, IV- General Methods of Analysis and Quality specification for Pharmaceutical Substances, Excipients and Dosage forms
8. Good laboratory Practices – Marcel Deckker Series
9. ICH guidelines, ISO 9000 and 14000 guidelines.

COURSE OUTCOMES-

By the end of this course, students will be able to:

CO	**Statements**
CO1	Understand the cGMP aspects in a pharmaceutical industry
CO2	Appreciate the importance of documentation
CO3	Understand the scope of quality certifications applicable to pharmaceutical industries. Understand the responsibilities of QA & QC departments.
CO4	Able to describe various packaging materials used, types, choice of containers, official quality control tests and methods ofevaluation
CO5	Able to describe the GMP and design and layout of Parenteral Production Facility, environmental control zones, heating ventilation air conditioning (HVAC), HEPA filter and laminar area flowsystems.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Learning Outcomes

Course Outcome	Bloom's Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO 8	PO9	PO1 0	PO 11	PO1 2	PS O1	PS O2	PS O3
CO1	L3	H	M	H	H	M	M	M	L	L	-	H	M	H	-	L
CO2	L1	M	M	H	L	L	L	-	L	-	L	L	L	M	M	L
CO3	L2	M	M	H	L	L	L	-	-	L	-	L	L	M	-	-
CO4	L3	M	H	H	H	H	H	H	M	M	M	H	H	-	L	M
CO5	L4	H	M	L	M	H	H	H	M	H	L	M	H	M	-	-

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1,CO2
CD2	Tutorials/Assignments	CO1,CO2
CD3	Seminars	CO1,CO2,CO3
CD4	Self- learning advice using internets	CO1,CO2
CD5	Industrial visit	CO4,CO5

BP607P. MEDICINAL CHEMISTRY- III (Practical)

4 Hours / week

Scope/Objective:

This subject is designed to impart fundamental knowledge on the structure, chemistry and therapeutic value of drugs. The subject emphasis on modern techniques of rational drug design like quantitative structure activity relationship (QSAR), Prodrug concept, combinatorial chemistry and Computer aided drug design (CADD). The subject also emphasizes on the chemistry, mechanism of action, metabolism, adverse effects, Structure Activity Relationships (SAR), therapeutic uses and synthesis of important drugs.

I Preparation of drugs and intermediates

1 Sulphanilamide
2 7-Hydroxy, 4-methyl coumarin
3 Chlorobutanol
4 Triphenyl imidazole
5 Tolbutamide
6 Hexamine

II Assay of drugs

1 Isonicotinic acid hydrazide
2 Chloroquine
3 Metronidazole
4 Dapsone
5 Chlorpheniramine maleate
6 Benzyl penicillin

III Preparation of medicinally important compounds or intermediates by Microwave irradiation technique

IV Drawing structures and reactions using chem draw®

V Determination of physicochemical properties such as logP, clogP, MR, Molecular weight, Hydrogen bond donors and acceptors for class of drugs course content using drug design software Drug likeliness screening (Lipinskies RO5)

Recommended Books (Latest Editions)

1. Wilson and Giswold's Organic medicinal and Pharmaceutical Chemistry.
2. Foye's Principles of Medicinal Chemistry.
3. Burger's Medicinal Chemistry, Vol I to IV.
4. Introduction to principles of drug design- Smith and Williams.
5. Remington's Pharmaceutical Sciences.
6. Martindale's extra pharmacopoeia.
7. Organic Chemistry by I.L. Finar, Vol. II.
8. The Organic Chemistry of Drug Synthesis by Lednicer, Vol. 1-5.
9. Indian Pharmacopoeia.
10. Text book of practical organic chemistry- A.I.Vogel.

COURSE OUTCOMES-

By the end of this course, students will be able to:

CO1	Understand the importance of drug design and different techniques of drug design.
CO2	Understand the chemistry of drugs with respect to their biological activity.
CO3	Students will learn about medicinalchemistry&Know the metabolism, adverse effects and therapeutic value of drugs.
CO4	Students will gain knowledge about fundamentals of medicinal chemistry chemistry.
CO5	Understand the importance of SAR of drugs.

Course Delivery Methods (CD)	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Experiments, Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit ,Lab visit

Table: Mapping of Course Outcomes with Program Learning Outcomes

Course Outcome	Bloom Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L2	H	H	H	-	-	-	-	M	M	-	H	L	M	M	L
CO2	L2	H	M	H	L	L	-	-	M	L	-	H	L	M	M	L
CO3	L3	H	H	H	L	M	-	-	M	M	-	H	M	M	-	-
CO4	L3	H	M	H	L	M	-	-	M	M	-	H	H	-	L	M
CO5	L3	M	M	M	L	M	-	L	M	L	-	M	H	M	L	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD:

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1, CO2, CO3, CO4, CO5
CD3	Experiments, Seminars	CO3, CO4, CO5
CD4	Self- learning advice using internets	CO4, CO5
CD5	Industrial visit,lab visit	CO5

BP 608 P. PHARMACOLOGY-III (Practical)

4Hrs/Week

Scope/Objective:

This subject is intended to impart the fundamental knowledge on various aspects(classification, mechanism of action, therapeutic effects, clinical uses, side effects and contraindications) of drugs acting on respiratory and gastrointestinal system, infectiousdiseases, immuno-pharmacology and in addition,emphasis on the principles of toxicology and chronopharmacology

1. Dose calculation in pharmacological experiments
2. Antiallergic activity by mast cell stabilization assay
3. Study of anti-ulcer activity of a drug using pylorus ligand (SHAY) rat model and NSAIDS induced ulcer model.
4. Study of effect of drugs on gastrointestinal motility
5. Effect of agonist and antagonists on guinea pig ileum
6. Estimation of serum biochemical parameters by using semi- autoanalyser
7. Effect of saline purgative on frog intestine
8. Insulin hypoglycemic effect in rabbit
9. Test for pyrogens (rabbit method)
10. Determination of acute oral toxicity (LD50) of a drug from a given data
11. Determination of acute skin irritation / corrosion of a test substance
12. Determination of acute eye irritation / corrosion of a test substance
13. Calculation of pharmacokinetic parameters from a given data
14. Biostatistics methods in experimental pharmacology(student's t test, ANOVA)
15. Biostatistics methods in experimental pharmacology (Chi square test, Wilcoxon Signed Rank test)

**Experiments are demonstrated by simulated experiments/videos*

Recommended Books (Latest Editions)

1. Rang H. P., Dale M. M., Ritter J. M., Flower R. J., Rang and Dale's Pharmacology, Churchil Livingstone Elsevier
2. Katzung B. G., Masters S. B., Trevor A. J., Basic and clinical pharmacology, Tata Mc Graw-Hill
3. Goodman and Gilman's, The Pharmacological Basis of Therapeutics
4. Marry Anne K. K., Lloyd Yee Y., Brian K. A., Robbin L.C., Joseph G. B., Wayne A. K., Bradley R.W., Applied Therapeutics, The Clinical use of Drugs. The Point Lippincott Williams & Wilkins
5. Mycek M.J, Gelnet S.B and Perper M.M. Lippincott's Illustrated Reviews-Pharmacology
6. K.D.Tripathi. Essentials of Medical Pharmacology, , JAYPEE Brothers Medical Publishers (P) Ltd, New Delhi.
7. Sharma H. L., Sharma K. K., Principles of Pharmacology, Paras medical publisher Modern Pharmacology with clinical Applications, by Charles R.Craig& Robert,
8. Ghosh MN. Fundamentals of Experimental Pharmacology. Hilton & Company, Kolkata,
9. Kulkarni SK. Handbook of experimental pharmacology. VallabhPrakashan,
10. N.Udupa and P.D. Gupta, Concepts in Chronopharmacology.

COURSE OUTCOMES-

By the end of this course, students will be able to:

CO	Statements
CO1	Possess a relevant knowledge in basic principles of pharmacology and its recent advances.
CO2	Understand the mechanism of drug action and its relevance in the treatment of different infectious diseases
CO3	Comprehend the principles of toxicology and treatment of various poisoningsand
CO4	Understand the general principles of various drugs and the handling of drugs by the body.
CO5	Appreciate correlation of pharmacology with related medical sciences.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets

Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Learning Outcomes

Course Outcome	Bloom's Level	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L1	M	M	H	-	L	-	L	-	L	-	H	-	H	M	L
CO2	L2	H	M	H	L	H	L	L	L	L	L	H	L	H	M	L
CO3	L2	L	M	H	M	L	L	L	L	M	L	H	M	M	L	-
CO4	L2	H	M	H	L	M	L	L	L	H	L	H	L	M	L	M
CO5	L4	M	M	M	H	H	H	H	M	M	M	M	H	M	L	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1,CO2,CO3,CO3,CO5
CD2	Tutorials/Assignments	CO1,CO2
CD3	Seminars	CO1
CD4	Self- learning advice using internets	CO1,CO2,CO3,CO4

BP 609 P. HERBAL DRUG TECHNOLOGY (Practical)

4 hours/ week

Scope/Objective:

This subject gives the student the knowledge of basic understanding of herbal drugindustry, 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

1. To perform preliminary phytochemical screening of crude drugs.
2. Determination of the alcohol content of Asava and Arista
3. Evaluation of excipients of natural origin
4. Incorporation of prepared and standardized extract in cosmetic formulations like creams, lotions and shampoos and their evaluation.
5. Incorporation of prepared and standardized extract in formulations like syrups, mixtures and tablets and their evaluation as per Pharmacopoeial requirements.
6. Monograph analysis of herbal drugs from recent Pharmacopoeias
7. Determination of Aldehyde content
8. Determination of Phenol content
9. Determination of total alkaloids

Recommended Books: (Latest Editions)

1. Textbook of Pharmacognosy by Trease & Evans.
2. Textbook of Pharmacognosy by Tyler, Brady & Robber.
3. Pharmacognosy by Kokate, Purohit and Gokhale
4. Essential of Pharmacognosy by Dr.S.H.Ansari
5. Pharmacognosy& Phytochemistry by V.D.Rangari
6. Pharmacopoeal standards for Ayurvedic Formulation (Council of Research in Indian Medicine & Homeopathy)
7. Mukherjee, P.W. Quality Control of Herbal Drugs: An Approach to Evaluation of Botanicals. Business Horizons Publishers, New Delhi, India, 2002.

COURSE OUTCOMES-

By the end of this course, students will be able to:

CO1	Understand raw material as source of herbal drugs from cultivation to herbal drug product.
CO2	Know the WHO and ICH guidelines for evaluation of herbal drugs.
CO3	Know the herbal cosmetics, natural sweeteners, nutraceuticals.
CO4	Appreciate patenting of herbal drugs, GMP.
CO5	Understand & explain significance of natural pesticides & explain source, chemistry &applications.

Course Delivery Methods (CD)	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets

Table: Mapping of Course Outcomes with Program Learning Outcomes

Course Outcomes	Blooms Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P010	PO11	PO12	PSO1	PSO2	PSO3
CO1	L1	H	M	M	-	H	-	H	H	H	H	-	L	M	M	M
CO2	L6	H	H	M	-	M	-	M	H	H	H	-	L	H	M	L
CO3	L1	H	H	_	L	M	-	M	H	H	H	-	L	M	L	-
CO4	L6	H	M	_	-	M	-	L	H	M	H	-	L	H	L	M
CO5	L6	M	M	H	M	M	H	M	H	M	M	M	M	M	-	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD:

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5,
CD2	Tutorials/Assignments	CO1, CO2, CO3, CO4,
CD3	Seminars	CO2,CO3,CO5,
CD4	Self- learning advice using internets	CO1,CO2,CO3,CO4,CO5

BP 610: ANANDAM

Objectives:

- To instil the joy of giving in young people, turning them into responsible citizens to build up a better society.
- To inculcate the habit of service in students across the University.
- A compulsory course of 2 credits per semester to be included in each program of University.
- Students to be excepted to engage in individual and group acts of service and goodness.

Action Plan:

Students will be expected to

- Do at least one act of individual service each day
- Record this act of service in a dedicated Register / Personal Diary
- Share this Register / Personal Diary day in the Anandam Class scheduled per week. The class interaction will include Personal Diary check, Showing of Community based motivation videos, Community based presentations by students, Role playing etc.
- Undertake one group service project for 64 hours every semester (outside college hours)
- Upload the report on the group project on the Anandam platform
- Participate in a sharing and presentation on the group service in the discussion sessions held once in week
- there will be some suggested projects and organizations that students can work with. Students can also suggest their own projects which others can join

Each student will finish the year with a portfolio of giving. This will include their Register / Personal Diaries and their reports on group service projects.

Semester - VII

Code No.	Paper	Type	Internal Marks	External Marks	Total Marks	L	T/P	Credit
BP701T	Instrumental Methods of Analysis – Theory	CORE	25	75	100	3	1	4
BP702T	Industrial Pharmacy II – Theory	CORE	25	75	100	3	1	4
BP703T	Pharmacy Practice – Theory	CORE	25	75	100	3	1	4
BP704T	Novel Drug Delivery System – Theory	CORE	25	75	100	3	1	4
BP705P	Instrumental Methods of Analysis –Practical	CORE	15	35	50	4	-	2
BP706PS	Practice School*	CORE	25	125	150	12	-	6
BP 707	ANANDAM	CEC	50	50	100	1	-	2
	TOTAL		**190**	**510**	**700**			**26**

* Non University Examination (NUE)

SEMESTER VII

BP701T. INSTRUMENTAL METHODS OF ANALYSIS (Theory)

45 Hours

Scope/Objective:

This subject deals with the application of instrumental methods in qualitative andquantitative analysis of drugs. This subject is designed to impart a fundamental knowledge on the principles and instrumentation of spectroscopic and chromatographic technique. This also emphasizes on theoretical and practical knowledge on modern analytical instruments that are used for drug testing.

Course Content:

Unit –I **10 Hours**

UV Visible spectroscopy

Electronic transitions, chromophores, auxochromes, spectral shifts, solvent effect on absorption spectra, Beer and Lambert's law, Derivation and deviations.

Instrumentation - Sources of radiation, wavelength selectors, sample cells, detectors-Photo tube, Photomultiplier tube, Photo voltaic cell, Silicon Photodiode.

Applications - Spectrophotometric titrations, Single component and multi component analysis

Fluorimetry

Theory, Concepts of singlet, doublet and triplet electronic states, internal and external conversions, factors affecting fluorescence, quenching, instrumentation and applications

Unit –II **10 Hours**

IR spectroscopy

Introduction, fundamental modes of vibrations in poly atomic molecules, sample handling, factors affecting vibrations

Instrumentation - Sources of radiation, wavelength selectors, detectors - Golay cell, Bolometer, Thermocouple, Thermister, Pyroelectric detector and applications

Flame Photometry-Principle, interferences, instrumentation and applications

Atomic absorption spectroscopy- Principle, interferences, instrumentation andapplications

Nepheloturbidometry- Principle, instrumentation and applications

Unit –III **10 Hours**

Introduction to chromatography

Adsorption and partition column chromatography-Methodology, advantages, disadvantages and applications.

Thin layer chromatography- Introduction, Principle, Methodology, Rf values, advantages, disadvantages and applications.

Paper chromatography-Introduction, methodology, development techniques, advantages, disadvantages and applications.

Electrophoresis–Introduction, factors affecting electrophoretic mobility, Techniques of paper, gel, capillary electrophoresis, applications.

Unit –IV **08 Hours**

Gas chromatography - Introduction, theory, instrumentation, derivatization, temperature programming, advantages, disadvantages and applications.

High performance liquid chromatography (HPLC)-Introduction, theory, instrumentation, advantages and applications.

Unit –V **07 Hours**

Ion exchange chromatography- Introduction, classification, ion exchange resins, properties, mechanism of ion exchange process, factors affecting ion exchange, methodology and applications.

Gel chromatography- Introduction, theory, instrumentation and applications, Affinity chromatography- Introduction, theory, instrumentation and applications.

Recommended Books: (Latest Editions)

1. A.H. Beckett & J.B. Stenlake's, Practical Pharmaceutical Chemistry Vol I & II, Stahlone Press of University of London.
2. A.I. Vogel, Text Book of Quantitative Inorganic analysis.
3. P. Gundu Rao, Inorganic Pharmaceutical Chemistry
4. Bentley and Driver's Textbook of Pharmaceutical Chemistry
5. John H. Kennedy, Analytical chemistry principles
6. Indian Pharmacopoeia.

COURSE OUTCOMES-

By the end of this course, students will be able to:

CO	**Statements**
CO1	Illuminate relevance & significance of Analytical Chemistry to Pharmaceutical Sciences.
CO2	Clarify basic principles of data treatment and datahandling.
CO3	Explain basic concepts and principles of aqueous acid base titrations and clarify need of non-aqueous acid basetitrations.
CO4	Clarify different terms, basic principles and reaction conditions of precipitation, Complexation and redoxreaction.
CO5	Understand and explain the difference between precipitation and gravimetricanalysis.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Analysis lab
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial lab visit

Mapping between Objectives and Outcomes

Mapping between Programme Outcomes (POs) and Course Outcomes (COs)

COs	Blooms Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L2	H	-	-	M	H	-	M	L	M	H	-	M	H	M	M
CO2	L3	H	M	H	H	H	M	H	M	H	H	-	-	H	-	L
CO3	L4	M	H	H	-	H	-	M	L	H	M	L	-	M	L	-
CO4	L4	H	M	-	-	H	H	-	-	H	H	-	H	H	M	M
CO5	L1	H	-	-	M	-	-	M	-	-	M	-	-	M	M	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2
CD2	Analysis lab	CO1,CO5
CD3	Seminars	CO1, CO2
CD4	Self- learning advice using internets	CO1,CO2
CD5	Industrial lab visit	CO4,CO3,CO5

BP 702 T. INDUSTRIAL PHARMACYII (Theory)

45 Hours

Scope/Objective:

This course is designed to impart fundamental knowledge on pharmaceuticalproduct development and translation from laboratory to market

Course Content:

Unit-I **10 Hours**

Pilot plant scale up techniques: General considerations - including significance ofpersonnel requirements, space requirements, raw materials, Pilot plant scale up considerations for solids, liquid orals, semi solids and relevant documentation, SUPAC guidelines, Introduction to platform technology.

Unit-II **10 Hours**

Technology development and transfer: 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) Documentation, Premises and equipments, qualification and validation, quality control, analytical method transfer, Approved regulatory bodies and agencies, Commercialization - practical aspects and problems (case studies), TT agencies in India - APCTD, NRDC, TIFAC, BCIL, TBSE /

SIDBI; TT related documentation - confidentiality agreement, licensing, MoUs, legal issues

Unit-III **10 Hours**

Regulatory affairs: Introduction, Historical overview of Regulatory Affairs, Regulatoryauthorities, Role of Regulatory affairs department, Responsibility of Regulatory Affairs Professionals

Regulatory requirements for drug approval: Drug Development Teams, Non-ClinicalDrug Development, Pharmacology, Drug Metabolism and Toxicology, General considerations of Investigational New Drug (IND) Application, Investigator's Brochure (IB) and New Drug Application (NDA), Clinical research / BE studies, Clinical Research Protocols, Biostatistics in Pharmaceutical Product Development, Data Presentation for FDA Submissions, Management of Clinical Studies.

Unit-IV **08 Hours**

Quality management systems: Quality management& Certifications: Concept of Quality, Total Quality Management, Quality by Design (QbD), Six Sigma concept, Out of Specifications (OOS), Change control, Introduction to ISO 9000 series of quality systems standards, ISO 14000, NABL, GLP

Unit-V **07 Hours**

Indian Regulatory Requirements: Central Drug Standard Control Organization (CDSCO) and State Licensing Authority: Organization, Responsibilities, Certificate of Pharmaceutical Product (COPP), Regulatory requirements and approval procedures for New Drugs.

Recommended Books: (Latest Editions)

1. Regulatory Affairs from Wikipedia, the free encyclopedia modified on 7th April available at http,//en.wikipedia.org/wiki/Regulatory_ Affairs.
2. International Regulatory Affairs Updates, 2005. available at http://www.iraup.com/about.php
3. Douglas J Pisano and David S. Mantus. Text book of FDA Regulatory Affairs A Guide for Prescription Drugs, Medical Devices, and Biologics' Second Edition.
4. Regulatory Affairs brought by learning plus, inc. available at http.//www.cgmp.com/ra.htm.

COURSE OUTCOMES-

By the end of this course, students will be able to:

CO1	Know the process of pilot plant and scale up of pharmaceutical dosage forms.
CO2	Understand the process of technology transfer from lab scale to commercial batch
CO3	Understand the approval process and regulatory requirements for drug products. Know different Laws and Acts that regulate pharmaceutical industry
CO4	Able to understand the Understand the process of technology transfer from lab scale to commercial batch.
CO5	Able to understand the different Laws and Acts that regulate pharmaceutical industry.

Course Delivery Methods (CD)	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Experiments, Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table: Mapping of Course Outcomes with ProgramLearning Outcomes

CO	Bloom Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L4	M	M	M	M	M	-	L	M	M	L	M	H	H	M	M
CO2	L4	M	M	M	M	M	-	L	M	M	L	M	H	H	M	L
CO3	L3	M	M	M	M	M	-	L	M	M	L	M	H	M	L	-
CO4	L4	M	M	M	M	M	-	L	M	M	L	M	M	H	M	M
CO5	L4	M	M	M	M	M	-	L	M	M	L	M	H	M	M	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1, CO2, CO3, CO4, CO5
CD3	Experiments, Seminars	CO2,CO3, CO4, CO5
CD4	Self- learning advice using internets	CO4, CO5
CD5	Industrial visit	CO4

BP 703T. PHARMACY PRACTICE (Theory)

45 Hours

Scope/ Objective:

In the changing scenario of pharmacy practice in India, for successful practice ofHospital Pharmacy, the students are required to learn various skills like drug distribution, drug information, and therapeutic drug monitoring for improved patient care. In community pharmacy, students will be learning various skills such as dispensing of drugs, responding to minor ailments by providing suitable safe medication, patient counselling for improved patient care in the community set up.

Unit I: 10 Hours

a) Hospital and it's organization

Definition, Classification of hospital- Primary, Secondary and Tertiary hospitals, Classification based on clinical and non- clinical basis, Organization Structure of a Hospital, and Medical staffs involved in the hospital and their functions.

b) Hospital pharmacy and its organization

Definition, functions of hospital pharmacy, Organization structure, Location, Layout and staff requirements, and Responsibilities and functions of hospital pharmacists.

c) Adverse drug reaction

Classifications- Excessive pharmacological effects, secondary pharmacological effects, idiosyncrasy, allergic drug reactions, genetically determined toxicity, toxicity following sudden withdrawal of drugs, Drug interaction- beneficial interactions, adverse interactions, and pharmacokinetic drug interactions, Methods for detecting drug interactions, spontaneous case reports and record linkage studies, and Adverse drug reaction reporting and management.

d) Community Pharmacy

Organization and structure of retail and wholesale drug store, types and design, Legal requirements for establishment and maintenance of a drug store, Dispensing of proprietary products, maintenance of records of retail and wholesale drug store.

Unit II: 10 Hours

a) Drug distribution system in a hospital

Dispensing of drugs to inpatients, types of drug distribution systems, charging policy and labelling, Dispensing of drugs to ambulatory patients, and Dispensing of controlled drugs.

b) Hospital formulary

Definition, contents of hospital formulary, Differentiation of hospital formulary and Drug list, preparation and revision, and addition and deletion of drug from hospital formulary.

c) Therapeutic drug monitoring

Need for Therapeutic Drug Monitoring, Factors to be considered during the Therapeutic Drug Monitoring, and Indian scenario for Therapeutic Drug Monitoring.

d) Medication adherence

Causes of medication non-adherence, pharmacist role in the medication adherence, and monitoring of patient medication adherence.

e) Patient medication history interview

Need for the patient medication history interview, medication interview forms.

f) Community pharmacy management

Financial, materials, staff, and infrastructure requirements.

Unit III: **10 Hours**

a) Pharmacy and therapeutic committee

Organization, functions, Policies of the pharmacy and therapeutic committee in including drugs into formulary, inpatient and outpatient prescription, automatic stop order, and emergency drug list preparation.

b) Drug information services

Drug and Poison information centre, Sourcesof drug information, Computerised services, and storage and retrieval of information.

c) Patient counseling

Definition of patient counseling; steps involved in patient counseling, and Special cases that require the pharmacist

d) Education and training program in the hospital

Role of pharmacist in the education and training program, Internal and external training program, Services to the nursing homes/clinics, Code of ethics for community pharmacy, and Role of pharmacist in the interdepartmental communication and community health education.

e) Prescribed medication order and communication skills

Prescribed medication order- interpretation and legal requirements, and Communication skills- communication with prescribers and patients.

Unit IV **8 Hours**

a) Budgetpreparation and implementation

Budget preparation and implementation

b) Clinical Pharmacy

Introduction to Clinical Pharmacy, Concept of clinical pharmacy, functions and responsibilities of clinical pharmacist, Drug therapy monitoring - medication chart review, clinical review, pharmacist intervention, Ward round participation, Medication history and Pharmaceutical care.Dosing pattern and drug therapy based on Pharmacokinetic & disease pattern.

c) Over the counter (OTC) sales

Introduction and sale of over the counter, and rational use of common over the counter medications.

Unit V **7 Hours**

a) Drug store management and inventory control

Organisation of drug store, types of materials stocked and storage conditions, Purchase and inventory control: principles, purchase procedure, purchase order, procurement and stocking, Economic order quantity, Reorder quantity level, and Methods used for the analysis of the drug expenditure

b) **Investigational use of drugs**

Description, principles involved, classification, control, identification, role of hospital pharmacist, advisory committee.

c) Interpretation of Clinical Laboratory Tests Blood chemistry, hematology, and urinalysis

Recommended Books (Latest Edition):

1. Merchant S.H. and Dr. J.S.Quadry. *A textbook of hospital pharmacy*, 4th ed. Ahmadabad: B.S. Shah Prakakshan; 2001.
2. Parthasarathi G, Karin Nyfort-Hansen, Milap C Nahata. *A textbook of ClinicalPharmacy Practice- essential concepts and skills,* 1st ed. Chennai: OrientLongman Private Limited; 2004.
3. William E. Hassan. *Hospital pharmacy*, 5th ed. Philadelphia: Lea & Febiger; 1986.
4. Tipnis Bajaj. *Hospital Pharmacy*, 1st ed. Maharashtra: Career Publications; 2008.
5. Scott LT. *Basic skills in interpreting laboratory data*, 4thed. American Society of Health System Pharmacists Inc; 2009.
6. Parmar N.S. *Health Education and Community Pharmacy*, 18th ed. India: CBS Publishers & Distributers; 2008.

Journals:

1. Therapeutic drug monitoring. ISSN: 0163-4356
2. Journal of pharmacy practice. ISSN : 0974-8326
3. American journal of health system pharmacy. ISSN: 1535-2900 (online)
4. Pharmacy times (Monthly magazine)

COURSE OUTCOMES-

By the end of this course, students will be able to:

CO	Statements
CO1	know various drug distribution methods in a hospital.Appreciate the pharmacy stores management and inventory control
CO2	Monitor drug therapy of patient through medication chart review and clinical review.Obtain medication history interview and counsel the patients
CO3	Identify drug related problems.Detect and assess adverse drug reactions
CO4	Interpret selected laboratory results (as monitoring parameters in therapeutics) of specific disease states.To know pharmaceutical care services
CO5	Do patient counseling in community pharmacy.Appreciate the concept of Rational drug therapy.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Lab visit
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Hospital visit & OPD

Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Learning Outcomes

Course Outcomes	Blooms Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P010	PO11	PO12	PSO1	PSO2	PSO3
CO1	L1	H	M	M	-	H	H	H	-	H	H	-	L	H	M	M
CO2	L6	H	H	M	-	M	M	H	-	H	H	-	L	H	M	L
CO3	L6	H	M	_	L	-	M	H	-	M	H	-	L	H	M	-
CO4	L2	H	H	_	L	M	M	H	-	H	H	-	L	H	M	M
CO5	L6	H	M	_	-	M	L	H	-	M	H	-	L	H	M	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3
CD2	Lab visit	CO2
CD3	Seminars	CO1, CO5
CD4	Self- learning advice using internets	CO1
CD5	Hospital visit & OPD	CO2,CO3,CO4

BP 704T: NOVEL DRUG DELIVERY SYSTEMS (Theory)

45 Hours

Scope/ Objective:

This subject is designed to impart basic knowledge on the area of novel drugdelivery systems.

Course content:

Unit-I **10 Hours**

Controlled drug delivery systems: Introduction, terminology/definitions and rationale, advantages, disadvantages, selection of drug candidates.Approaches to design controlled release formulations based on diffusion, dissolution and ion exchange principles. Physicochemical and biological properties of drugs relevant to controlled release formulations

Polymers: Introduction, classification, properties, advantages and application ofpolymers in formulation of controlled release drug delivery systems.

Unit-II **10 Hours**

Microencapsulation: Definition, advantages and disadvantages, microspheres/microcapsules, microparticles, methods of microencapsulation, applications

Mucosal Drug Delivery system: Introduction, Principles of bioadhesion /mucoadhesion, concepts, advantages and disadvantages, transmucosal permeability and formulation considerations of buccal delivery systems

Implantable Drug Delivery Systems: Introduction, advantages and disadvantages,concept of implantsand osmotic pump

Unit-III **10 Hours**

Transdermal Drug Delivery Systems: Introduction, Permeation through skin, factorsaffecting permeation, permeation enhancers, basic components of TDDS, formulation approaches

Gastroretentive drug delivery systems: Introduction, advantages, disadvantages,approaches for GRDDS – Floating, high density systems, inflatable and gastroadhesive systems and their applications

Nasopulmonary drug delivery system: Introduction to Nasal and Pulmonary routes ofdrug delivery, Formulation of Inhalers (dry powder and metered dose), nasal sprays, nebulizers

Unit-IV **08 Hours**

Targeted drug Delivery: Concepts and approaches advantages and disadvantages, introduction to liposomes, niosomes, nanoparticles, monoclonal antibodies and their applications

Unit-V **07 Hours**

Ocular Drug Delivery Systems: Introduction, intra ocular barriers and methods toovercome – Preliminary study, ocular formulations and ocuserts

Intrauterine Drug Delivery Systems: Introduction, advantages and disadvantages, development of intra uterine devices (IUDs) and applications

Recommended Books: (Latest Editions)

1. Y W. Chien, Novel Drug Delivery Systems, 2nd edition, revised and expanded, Marcel Dekker, Inc., New York, 1992.
2. Robinson, J. R., Lee V. H. L, Controlled Drug Delivery Systems, Marcel Dekker, Inc., New York, 1992.
3. Encyclopedia of Controlled Delivery. Edith Mathiowitz, Published by Wiley Interscience Publication, John Wiley and Sons, Inc, New York. Chichester/Weinheim
4. N.K. Jain, Controlled and Novel Drug Delivery, CBS Publishers & Distributors, New Delhi, First edition 1997 (reprint in 2001).
5. S.P. Vyas and R.K. Khar, Controlled Drug Delivery -concepts and advances, Vallabh Prakashan, New Delhi, First edition 2002.

Journals

1. Indian Journal of Pharmaceutical Sciences (IPA)
2. Indian Drugs (IDMA)
3. Journal of Controlled Release (Elsevier Sciences)
4. Drug Development and Industrial Pharmacy (Marcel & Decker)
5. International Journal of Pharmaceutics (Elsevier Sciences)

COURSE OUTCOMES-

By the end of this course, students will be able to:

CO1	Understand various approaches for development of novel drug delivery systems.
CO2	Understand the criteria for selection of drugs and polymers for the development of Novel drug delivery systems, their formulation and evaluation
CO3	Describe the Fundamental Concept of Modified Drug Release and Pre requisites of drug candidates, along with various approaches andclassification.
CO4	Describe the formulation, merits, demerits, application and evaluation of Novel Drug DeliverySystems.
CO5	Understand the concept of microencapsulation, merits, demerits and application, types ofmicroencapsulation and evaluation of microcapsules

Course Delivery Methods (CD)	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Experiments, Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table: Mapping of Course Outcomes with Program Learning Outcomes

Course Outcome	Bloom Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L2	H	H	H	-	-	-	-	M	M	-	H	L	H	M	-
CO2	L2	H	M	H	L	L	-	-	M	L	-	H	L	H	M	L
CO3	L3	H	H	H	L	M	-	-	M	M	-	H	M	M	L	-
CO4	L3	H	M	H	L	M	-	-	M	M	-	H	H	M	-	M
CO5	L3	M	M	M	L	M	-	L	M	L	-	M	H	M	L	-

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD:

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1, CO2, CO3, CO4, CO5
CD3	Experiments, Seminars	CO3, CO4, CO5
CD4	Self- learning advice using internets	CO4, CO5
CD5	Industrial visit	CO5

BP705P. INSTRUMENTAL METHODS OF ANALYSIS (Practical)

4 Hours/Week

Scope/Objective:

This subject deals with the application of instrumental methods in qualitative andquantitative analysis of drugs. This subject is designed to impart a fundamental knowledge on the principles and instrumentation of spectroscopic and chromatographic technique. This also emphasizes on theoretical and practical knowledge on modern analytical instruments that are used for drug testing.

1 Determination of absorption maxima and effect of solvents on absorption maxima of organic compounds
2 Estimation of dextrose by colorimetry
3 Estimation of sulfanilamide by colorimetry
4 Simultaneous estimation of ibuprofen and paracetamol by UV spectroscopy
5 Assay of paracetamol by UV- Spectrophotometry
6 Estimation of quinine sulfate by fluorimetry
7 Study of quenching of fluorescence
8 Determination of sodium by flame photometry
9 Determination of potassium by flame photometry
10 Determination of chlorides and sulphates by nephelo turbidometry
11 Separation of amino acids by paper chromatography
12 Separation of sugars by thin layer chromatography
13 Separation of plant pigments by column chromatography
14 Demonstration experiment on HPLC
15 Demonstration experiment on Gas Chromatography

Recommended Books (Latest Editions)

1. Instrumental Methods of Chemical Analysis by B.K Sharma
2. Organic spectroscopy by Y.R Sharma
3. Text book of Pharmaceutical Analysis by Kenneth A. Connors
4. Vogel's Text book of Quantitative Chemical Analysis by A.I. Vogel
5. Practical Pharmaceutical Chemistry by A.H. Beckett and J.B. Stenlake
6. Organic Chemistry by I. L. Finar
7. Organic spectroscopy by William Kemp
8. Quantitative Analysis of Drugs by D. C. Garrett
9. Quantitative Analysis of Drugs in Pharmaceutical Formulations by P. D. Sethi
10. Spectrophotometric identification of Organic Compounds by Silverstein.

COURSE OUTCOMES-

By the end of this course, students will be able to:

CO1	Perform experiment with accuracy and precision and knowledge of infrared spectroscopy.
CO2	Understand basic principle and instrumentation of UV-Visible spectroscopy.
CO3	Understand the chromatographic separation and analysis of drugs.Learn separation of analytes by chromatography and details of Mass spectroscopy.
CO4	Perform quantitative & qualitative analysis of drugs using various analytical instruments.
CO5	Understand NMR spectroscopy,electroanalytical methods: and radiochemical methods and they will help to identify the unknown compound.

Course Delivery Methods (CD)	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Experiments, Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit ,Analysis lab visit

Table: Mapping of Course Outcomes with Program Learning Outcomes

Course Outcome	Bloom Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L4	M	M	H	H	M	-	M	M	M	-	M	H	M	M	M
CO2	L2	H	M	H	M	M	H	M	H	M	L	M	M	H	M	L
CO3	L3	M	M	H	H	M	H	M	M	M	L	M	M	M	L	L
CO4	L2	H	M	H	H	M	H	M	H	M	L	M	M	M	-	M
CO5	L3	M	M	H	H	M	H	M	M	M	L	M	M	M	L	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1, CO2, CO3, CO4, CO5
CD3	Experiments, Seminars	CO2, CO3, CO4, CO5
CD4	Self- learning advice using internets	CO4, CO5
CD5	Industrial visit ,Analysis lab visit	CO2, CO3, CO4, CO5

BP 707: ANANDAM

Objectives:

- To instil the joy of giving in young people, turning them into responsible citizens to build up a better society.
- To inculcate the habit of service in students across the University.
- A compulsory course of 2 credits per semester to be included in each program of University.
- Students to be excepted to engage in individual and group acts of service and goodness.

Action Plan:

Students will be expected to

- Do at least one act of individual service each day
- Record this act of service in a dedicated Register / Personal Diary
- Share this Register / Personal Diary day in the Anandam Class scheduled per week. The class interaction will include Personal Diary check, Showing of Community based motivation videos, Community based presentations by students, Role playing etc.
- Undertake one group service project for 64 hours every semester (outside college hours)
- Upload the report on the group project on the Anandam platform
- Participate in a sharing and presentation on the group service in the discussion sessions held once in week
- there will be some suggested projects and organizations that students can work with. Students can also suggest their own projects which others can join

Each student will finish the year with a portfolio of giving. This will include their Register / Personal Diaries and their reports on group service projects.

Semester - VIII

Code No.	Paper	Type	Internal Marks	External Marks	Total Marks	L	T/P	Credit
BP801T	Bio-statistics and Research Methodology	CORE	25	75	100	3	1	4
BP802T	Social and Preventive Pharmacy	CORE	25	75	100	3	1	4
BP803ET	Pharma Marketing Management	ELECTIVE	50	150	200	6	2	8
BP804ET	Pharmaceutical Regulatory Science	ELECTIVE						
BP805ET	Pharmacovigilance	ELECTIVE						
BP806ET	Quality Control and Standardization of Herbals	ELECTIVE						
BP807ET	Computer Aided Drug Design	ELECTIVE						
BP808ET	Cell and Molecular Biology	ELECTIVE						
BP809ET	Cosmetic Science	ELECTIVE						
BP810ET	Experimental Pharmacology	ELECTIVE						
BP811ET	Advanced Instrumentation Techniques	ELECTIVE						
BP812ET	Dietary Supplements and Nutraceutical	ELECTIVE						
BP813PW	Project Work		-	150	150	12		6
BP 814	ANANDAM	CEC	50	50	100	1	-	2
	TOTAL		**150**	**500**	**650**			**24**

SEMESTER VIII

BP801T. BIOSTATISITCS AND RESEARCH METHODOLOGY (Theory)

45 Hours

Scope/Objective:

To understand the applications of Biostatics in Pharmacy. This subject deals withdescriptive statistics, Graphics, Correlation, Regression, logistic regression Probability theory, Sampling technique, Parametric tests, Non Parametric tests, ANOVA, Introduction to Design of Experiments, Phases of Clinical trials and Observational andExperimental studies, SPSS, R and MINITAB statistical software's, analyzing the statistical data using Excel**.**

Course content:

Unit-I **10 Hours**

Introduction: Statistics, Biostatistics, Frequency distribution

Measures of central tendency: Mean, Median, Mode- Pharmaceutical examples **Measures of dispersion**: Dispersion, Range, standard deviation, Pharmaceuticalproblems

Correlation: Definition, Karl Pearson'scoefficient of correlation, Multiple correlation - Pharmaceuticals examples

Unit-II **10 Hours**

Regression: Curve fitting by the method of least squares, fitting the lines y= a + bx and x= a + by, Multiple regression, standard error of regression– Pharmaceutical Examples **Probability:**Definition of probability, Binomial distribution, Normal distribution,Poisson's distribution, properties - problems

Sample, Population, large sample, small sample, Null hypothesis, alternative hypothesis, sampling, essence of sampling, types of sampling, Error-I type, Error-II type, Standard error of mean (SEM) - Pharmaceutical examples

Parametric test: t-test(Sample, Pooled or Unpaired and Paired) , ANOVA, (One wayand Two way), Least Significance difference

Unit-III **10 Hours**

Non Parametric tests: Wilcoxon Rank Sum Test, Mann-Whitney U test, Kruskal-Wallistest, Friedman Test

Introduction to Research: Need for research, Need for design of Experiments, Experiential Design Technique, plagiarism

Graphs: Histogram, Pie Chart, Cubic Graph, response surface plot, Counter Plot graph **Designing the methodology:** Sample size determination and Power of a study, Reportwriting and presentation of data, Protocol, Cohorts studies, Observational studies, Experimental studies, Designing clinical trial, various phases.

Unit-IV **8 Hours**

Blocking and confounding system for Two-level factorials

Regression modeling: Hypothesis testing in Simple and Multiple regressionmodels **Introduction to Practical components of Industrial and Clinical Trials Problems**:Statistical Analysis Using Excel, SPSS, MINITAB® , DESIGN OF EXPERIMENTS, R - Online Statistical Software's to Industrial and Clinical trial approach

Unit-V **7 Hours**

Design and Analysis of experiments:

Factorial Design: Definition, 2^2, 2^3design. Advantage of factorial design **Response Surface methodology**: Central composite design, Historical design, Optimization Techniques

Recommended Books (Latest edition):

1. Pharmaceutical statistics- Practical and clinical applications, Sanford Bolton, publisher Marcel Dekker Inc. NewYork.
2. Fundamental of Statistics – Himalaya Publishing House- S.C.Guptha
3. Design and Analysis of Experiments –PHI Learning Private Limited, R. Pannerselvam
4. Design and Analysis of Experiments– Wiley Students Edition, Douglas and C. Montgomery.

COURSE OUTCOMES-

By the end of this course, students will be able to:

CO	Statements
CO1	Demonstrate various methodology in research.Know the operation of M.S. Excel, SPSS, R and MINITAB®, DoE (Design of Experiment.
CO2	Know the various statistical techniques to solve statistical problems
CO3	Understand the methods of sampling and methods of representation of data. Appreciate statistical techniques in solving the problems.
CO4	Know the principal concepts about biostatistics
CO5	Understand relevant biostatistics methods which will help to know about the research outcomes

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Practice

Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Learning Outcomes

Course Outcome	Bloom's mapping	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L3	L	M	M	M	H	H	M	L	H	-	M	H	M	M	M
CO2	L2	M	M	H	L	-	-	-	L	H	-	L	H	H	M	-
CO3	L2	L	M	M	L	-	-	-	L	M	L	L	M	M	L	-
CO4	L1	M	L	H	L	-	-	-	L	L	-	L	L	M	-	M
CO5	L2	M	M	H	M	L	-	-	-	H	L	M	H	M	L	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2,CO4,CO5
CD2	Tutorials/Assignments	CO1,CO2,CO3
CD3	Seminars	CO1, CO2
CD4	Self- learning advice using internets	CO1,CO2,CO4
CD5	Practice	CO1,CO2

BP 802T SOCIAL AND PREVENTIVE PHARMACY

Hours: 45

Scope/Objective:

The purpose of this course is to introduce to students a number of health issues and their challenges. This course also introduced a number of national health programmes. The roles of the pharmacist in these contexts are also discussed.

Course content:

Unit I: 10 Hours

Concept of health and disease: Definition, concepts and evaluation of public health.Understanding the concept of prevention and control of disease, social causes of diseases and social problems of the sick.

Social and health education: Food in relation to nutrition and health, Balanced diet, Nutritional deficiencies, Vitamin deficiencies, Malnutrition and its prevention.

Sociology and health: Socio cultural factors related to health and disease, Impact ofurbanization on health and disease, Poverty and health

Hygiene and health: personal hygiene and health care; avoidable habits

Unit II: 10 Hours

Preventive medicine: General principles of prevention and control of diseases such ascholera, SARS, Ebola virus, influenza, acute respiratory infections, malaria, chicken guinea, dengue, lymphatic filariasis, pneumonia, hypertension, diabetes mellitus, cancer, drug addiction-drug substance abuse

Unit III: 10 Hours

National health programs, its objectives, functioning and outcome of the following:

HIV AND AIDS control programme, 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, National programme for control of blindness, Pulse polio programme.

Unit IV: 08 Hours

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: 07 Hours

Community services in rural, urban and school health: Functions of PHC, Improvement in rural sanitation, national urban health mission, Health promotion and education in school.

Recommended Books (Latest edition)*:*

1. Short Textbook of Preventive and Social Medicine, Prabhakara GN, 2nd Edition, 2010, ISBN: 9789380704104, JAYPEE Publications
2. Textbook of Preventive and Social Medicine (Mahajan and Gupta), Edited by Roy Rabindra Nath, Saha Indranil, 4th Edition, 2013, ISBN: 9789350901878, JAYPEE Publications
3. Review of Preventive and Social Medicine (Including Biostatistics), Jain Vivek, 6th Edition, 2014, ISBN: 9789351522331, JAYPEE Publications
4. Essentials of Community Medicine—A Practical Approach, Hiremath Lalita D, Hiremath Dhananjaya A, 2nd Edition, 2012, ISBN: 9789350250440, JAYPEE Publications
5. Park Textbook of Preventive and Social Medicine, K Park, 21st Edition, 2011, ISBN-14: 9788190128285, BANARSIDAS BHANOT PUBLISHERS.
6. Community Pharmacy Practice, Ramesh Adepu, BSP publishers, Hyderabad

Recommended Journals:

1. Research in Social and Administrative Pharmacy, Elsevier, Ireland

COURSE OUTCOMES-

By the end of this course, students will be able to:

CO	Statements
CO1	Explains the role of social science and its application
CO2	Summarize an understanding of the role of socio-cultural factors as determinants of health and behavior in health andsickness.
CO3	Acquire high consciousness/realization of current issuesrelated to health and pharmaceutical problems within the country and worldwide.
CO4	Understandtheroleoffamilyandcommunityinthedevelopmentofbehaviors. Have a critical way of thinking based on current healthcare development.
CO5	Developaholisticoutlooktowardthestructureofsocietyandcommunityresources. Evaluate alternative ways of solving problems related tohealth and pharmaceutical issues

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Community center visits

Mapping between Objectives and Outcomes
Mapping of Course Outcomes onto Program Learning Outcomes

Course Outcome	Bloom's Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L2	H	H	H	M	L	L	M	L	-	L	H	M	H	M	M
CO2	L2	H	H	M	L	H	L	M	M	-	L	M	L	H	M	L
CO3	L4	M	H	H	L	-	-	H	L	L	LM	H	L	M	L	-
CO4	L2	M	H	H	-	H	L	M	L	L		H	-	M	-	M
CO5	L2	H	H	M	-	L	-	-	H	-	H	M	-	M	L	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2 ,CO5
CD2	Tutorials/Assignments	CO1
CD3	Seminars	CO1, CO2,CO5
CD4	Self- learning advice using internets	CO1
CD5	Hospital visit & OPD	CO3,CO4

BP803ET. PHARMA MARKETING MANAGEMENT (Theory)

45 Hours

Scope/Objective:

The pharmaceutical industry not only needs highly qualified researchers, chemists and, technical people, but also requires skilled managers who can take the industry forward by managing and taking the complex decisions which are imperative for the growth of the industry. The Knowledge and Know-how of marketing management groom the people for taking a challenging role in Sales and Product management.

Unit I **10 Hours Marketing:**

Definition, general concepts and scope of marketing; Distinction between marketing & selling; Marketing environment; Industry and competitive analysis; analyzing consumer buying behavior; industrial buying behavior.

Pharmaceutical market:

Quantitative and qualitative aspects; size and composition of the market; demographic descriptions and socio-psychological characteristics of the consumer; market segmentation& targeting.Consumer profile; Motivation and prescribing habits of the physician; patients' choice of physician and retail pharmacist.Analyzing the Market;Role of market research.

Unit II **10 Hours Product decision:**

Classification, product line and product mix decisions, product life cycle, product portfolio analysis; product positioning; new product decisions; Product branding, packaging and labeling decisions, Product management in pharmaceutical industry.

Unit III **10 Hours**

Promotion:

Methods, determinants of promotional mix, promotional budget; An overview of personal selling, advertising, direct mail, journals, sampling, retailing, medical exhibition, public relations, online promotional techniques for OTC Products.

Unit IV **10 Hours Pharmaceutical marketing channels:**

Designing channel, channel members, selecting the appropriate channel, conflict in channels, physical distribution management: Strategic importance, tasks in physical distribution management.

Professional sales representative (PSR):

Duties of PSR, purpose of detailing, selection and training, supervising, norms for customer calls, motivating, evaluating, compensation and future prospects of the PSR.

Unit V **10 Hours Pricing:**

Meaning, importance, objectives, determinants of price; pricing methods and strategies, issues in price management in pharmaceutical industry. An overview of DPCO (Drug Price Control Order)and NPPA (National Pharmaceutical Pricing Authority).

Emerging concepts in marketing:

Vertical & Horizontal Marketing; RuralMarketing; Consumerism; Industrial Marketing; Global Marketing.

Recommended Books: (Latest Editions)

1. Philip Kotler and Kevin Lane Keller: Marketing Management, Prentice Hall of India, New Delhi
2. Walker, Boyd and Larreche: Marketing Strategy- Planning and Implementation, Tata MC GrawHill, New Delhi.
3. Dhruv Grewal and Michael Levy: Marketing, Tata MC Graw Hill
4. Arun Kumar and N Menakshi: Marketing Management, Vikas Publishing, India
5. Rajan Saxena: Marketing Management; Tata MC Graw-Hill (India Edition)
6. Ramaswamy, U.S & Nanakamari, S: Marketing Managemnt: Global Perspective, IndianContext, Macmilan India, New Delhi.
7. Shanker, Ravi: Service Marketing, Excell Books, New Delhi
8. Subba Rao Changanti, Pharmaceutical Marketing in India (GIFT – Excel series) Excel Publications.

COURSE OUTCOMES-

By the end of this course, students will be able to:

CO1	Explain the core concepts of marketing and the goals of the Marketing function
CO2	Analyze the environment and recommend appropriate Segmentation, Targeting and Positioning Strategy for a product and analyze the buying behavior of a given target market segment
CO3	Recommend suitable product, pricing, distribution and Marketing
CO4	Provide an understanding of marketing conceptsand techniques and their applications in the pharmaceutical industry.
CO5	Marketing Communication strategies for a brand to achieve the Marketing objective.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Community center visits

Table: Mapping of Course Outcomes with Program Learning Outcomes

Course Outcomes	Blooms Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P010	PO11	PO12	PSO1	PSO2	PSO3
CO1	L1	H	M	M	-	H	-	H	H	H	H	-	L	M	H	M
CO2	L6	H	H	M	-	M	-	M	H	H	H	-	L	H	M	L
CO3	L1	H	H	_	L	M	-	M	H	H	H	-	L	M	L	-
CO4	L6	H	M	_	-	M	-	L	H	M	H	-	L	M	-	M
CO5	L4	H	M	_	-	M	-	L	H	M	H	-	L	M	-	M

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1, CO2, CO3, CO4, CO5
CD3	Experiments, Seminars	CO3, CO4,CO2,
CD4	Self- learning advice using internets	CO4, CO5
CD5	Industrial visit	CO5,CO2,

BP804 ET: PHARMACEUTICAL REGULATORY SCIENCE (Theory)

45 Hours

Scope/Objective:

This course is designed to impart the fundamental knowledge on the regulatoryrequirements for approval of new drugs, and drug products in regulated markets of India & other countries like US, EU, Japan, Australia,UK etc. It prepares the students to learn in detail on the regulatory requirements, documentation requirements, and registration procedures for marketing the drug products.

Course content:

Unit I **10 Hours**

New Drug Discovery and development

Stages of drug discovery, Drug development process, pre-clinical studies, non-clinical activities, clinical studies, Innovator and generics, Concept of generics, Generic drug product development.

Unit II **10 Hours**

Regulatory Approval Process

Approval processes and timelines involved in Investigational New Drug (IND), New Drug Application (NDA), Abbreviated New Drug Application (ANDA). Changes to an approved NDA / ANDA.

Regulatory authorities and agencies

Overview of regulatory authorities of India, United States, European Union,Australia,

Japan, Canada (Organization structure and types of applications)

Unit III **10 Hours**

Registration of Indian drug product in overseas market

Procedure for export of pharmaceutical products, Technical documentation, Drug Master Files (DMF), Common Technical Document (CTD), electronic Common Technical

Document (eCTD), ASEAN Common Technical Document (ACTD) research.

Unit IV **08 Hours**

Clinical trials

Developing clinical trial protocols, Institutional Review Board / Independent Ethics committee - formation and working procedures, Informed consent process and procedures, GCP obligations of Investigators, sponsors & Monitors, Managing and Monitoring clinical trials, Pharmacovigilance - safety monitoring in clinical trials

Unit V **07Hours**

Regulatory Concepts

Basic terminology, guidance, guidelines, regulations, Laws and Acts, Orange book, Federal Register, Code of Federal Regulatory, Purple book

Recommended books (Latest edition):

1. Drug Regulatory Affairs by Sachin Itkar, Dr. N.S. Vyawahare, Nirali Prakashan.
2. The Pharmaceutical Regulatory Process, Second Edition Edited by Ira R. Berry and Robert P. Martin, Drugs and the Pharmaceutical Sciences,Vol.185. Informa Health care Publishers.
3. New Drug Approval Process: Accelerating Global Registrations By Richard A Guarino, MD, 5th edition, Drugs and the Pharmaceutical Sciences,Vol.190.
4. Guidebook for drug regulatory submissions / Sandy Weinberg. By John Wiley & Sons. Inc.
5. FDA Regulatory Affairs: a guide for prescription drugs, medical devices, and biologics /edited by Douglas J. Pisano, David Mantus.
6. Generic Drug Product Development, Solid Oral Dosage forms, Leon Shargel and Isader Kaufer, Marcel Dekker series, Vol.143
7. Clinical Trials and Human Research: A Practical Guide to Regulatory Compliance By Fay A. Rozovsky and Rodney K. Adams
8. Principles and Practices of Clinical Research, Second Edition Edited by John I. Gallin and Frederick P. Ognibene
9. Drugs: From Discovery to Approval, Second Edition By Rick Ng.

COURSE OUTCOMES-

By the end of this course, students will be able to:

CO1	Know about the process of drug discovery and development
CO2	Know the regulatory authorities and agencies governing the manufacture and sale of pharmaceuticals
CO3	Know the regulatory approval process and their registration in Indian and international markets
CO4	Fundamental knowledge on the regulatoryrequirements for approval of new drugs, and drug products in regulated markets of India & other countries like US, EU, Japan, Australia,UK etc.
CO5	learn in detail on the regulatory requirements, documentation requirements, and registration procedures for marketing the drug products..

Course Delivery Methods (CD)	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Experiments, Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table: Mapping of Course Outcomes with Program Learning Outcomes

Course Outcome	Bloom Level	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L2	H	H	H	-	-	-	-	M	M	-	H	L	M	M	M
CO2	L2	H	M	H	L	L	-	-	M	L	-	H	L	H	M	L
CO3	L3	H	H	H	L	M	-	-	M	M	-	H	M	H	L	-
CO4	L3	H	M	H	L	M	-	-	M	M	-	H	H	M	-	M
CO5	L3	M	M	M	L	M	-	L	M	L	-	M	H	M	M	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD:

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1, CO2, CO3, CO4, CO5
CD3	Experiments, Seminars	CO3, CO4, CO5
CD4	Self- learning advice using internets	CO4, CO5
CD5	Industrial visit	CO5

BP 805T: PHARMACOVIGILANCE (Theory)

45 hours

Scope/Objective:

This paper will provide an opportunity for the student to learn about development ofpharmacovigilance as a science, basic terminologies used in pharmacovigilance, global scenario of Pharmacovigilance, train students on establishing pharmacovigilance programme 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.

Course Content

Unit I **10 Hours**

Introduction to Pharmacovigilance

History and development of Pharmacovigilance, Importance of safety monitoring of Medicin,WHO international drug monitoring programme, Pharmacovigilance Program of India(PvPI)

Introduction to adverse drug reactions

Definitions and classification of ADRs, Detection and reporting,Methods in Causality assessment,Severity and seriousness assessment,Predictability and preventability assessment,Management of adverse drug reactions

Basic terminologies used in pharmacovigilance

Terminologies of adverse medication related events, Regulatory terminologies

Unit II **10 hours**

Drug and disease classification

Anatomical, therapeutic and chemical classification of drugs, International classification of diseases,Daily defined doses,International Non proprietary Names for drugs

Drug dictionaries and coding in pharmacovigilance

WHO adverse reaction terminologies,MedDRA and Standardised MedDRA queries,WHO drug dictionary,Eudravigilance medicinal product dictionary

Information resources in pharmacovigilance

Basic drug information resources, specialised resources for ADRs

Establishing pharmacovigilance programme

Establishing in a hospital, Establishment & operation of drug safety department in industry, Contract Research Organisations (CROs), establishing a national programme

Unit III **10 Hours**

Vaccine safety surveillance

Vaccine Pharmacovigilance, Vaccination failure, adverse events following immunization

Pharmacovigilance methods

Passive surveillance – Spontaneous reports and case series,Stimulated reporting,Active surveillance – Sentinel sites, drug event monitoring and registries,Comparative observational studies – Cross sectional study, case control study and cohort study,Targeted clinical investigations

Communication in pharmacovigilance

Effective communication in Pharmacovigilance,Communication in Drug Safety Crisis management,Communicating with Regulatory Agencies, Business Partners, Healthcare facilities & Media.

COURSE OUTCOMES-

By the end of this course, students will be able to:

Course Outcome	CO'S
CO1	Know that why drug safety monitoring is important? History and development of pharmacovigilance.
CO2	Know about National and international scenario of pharmacovigilance and about Dictionaries, coding and terminologies used in pharmacovigilance
CO3	Know the Detection of new adverse drug reactions and their assessment.International standards for classification of diseases and drugs and the adverse drug reaction reporting systems and communication in pharmacovigilance
CO4	Know the methods to generate safety data during pre clinical, clinical and post approval phases of drugs' life cycle .Drug safety evaluation in paediatrics, geriatrics, pregnancy and lactation
CO5	Know the Pharmacovigilance Program of India (PvPI) requirement for ADR reporting in India.ICH guidelines for ICSR, PSUR, expedited reporting, pharmacovigilance planning CIOMS requirements for ADR reporting

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Interaction with drug inspectors

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Bloom Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L5	H	M	L	-	M	H	M	H	H	M	H	M	H	M	M
CO2	L4	L	L	H	H	L	L	M	M	L	H	L	M	H	M	L
CO3	L2	M	H	M	H	H	M	H	L	M	-	M	H	H	L	L
CO4	L1	H	M	L	-	M	H	M	H	H	M	H	M	M	L	M
CO5	L3	L	L	H	H	L	L	M	M	L	H	L	M	H	L	-

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3
CD2	Tutorials/Assignments	CO1,CO2, CO3
CD3	Seminars	CO2,CO4
CD4	Self- learning advice using internets	CO1,CO2,CO5
CD5	Interaction with Drug inspectors	CO1, CO2, CO3

BP 806 ET. QUALITY CONTROL AND STANDARDIZATION OF HERBALS (Theory)

Scope/Objective:
In this subject the student learns about the various methods and guidelines forevaluation and standardization of herbs and herbal drugs. The subject also provides anopportunity for the student to learn cGMP, GAP and GLP in traditional system ofmedicines.

Course Contents:

Unit I **10 hours**

Basic tests for drugs – Pharmaceutical substances, Medicinal plants materials and dosage forms. WHO guidelines for quality control of herbal drugs. Evaluation of commercial crude drugs intended for use

Unit II **10 hours**

Quality assurance in herbal drug industry of cGMP, GAP, GMP and GLP intraditional system of medicine. WHO Guidelines on current good manufacturing Practices (cGMP) for Herbal Medicines WHO Guidelines on GACP for Medicinal Plants.

Unit III **10 hours**

EU and ICH guidelines for quality control of herbal drugs. Research Guidelines for Evaluating the Safety and Efficacy of Herbal Medicines

Unit IV **08 hours**

Stability testing of herbal medicines. Application of various chromatographic techniques in standardization of herbal products. Preparation of documents for new drug application and export registration GMP requirements and Drugs & Cosmetics Act provisions.

Unit V **07 hours**

Regulatory requirements for herbal medicines. WHO guidelines on safety monitoring of herbal medicines in pharmacovigilance systems Comparison of various Herbal Pharmacopoeias.
Role of chemical and biological markers in standardization of herbal products

Recommended Books: (Latest Editions

1. Pharmacognosy by Trease and Evans
2. Pharmacognosy by Kokate, Purohit and Gokhale
3. Rangari, V.D., Text book of Pharmacognosy and Phytochemistry Vol. I , Carrier Pub., 2006.
4. Aggrawal, S.S., Herbal Drug Technology. Universities Press, 2002.
5. EMEA. Guidelines on Quality of Herbal Medicinal Products/Traditional Medicinal Products,
6. Mukherjee, P.W. Quality Control of Herbal Drugs: An Approach to Evaluation of Botanicals. Business Horizons Publishers, New Delhi, India, 2002.
7. Shinde M.V., Dhalwal K., Potdar K., Mahadik K. Application of quality control principles to herbal drugs. International Journal of Phytomedicine 1(2009); p.4-8.
8. WHO. Quality Control Methods for Medicinal Plant Materials, World Health Organization, Geneva, 1998. WHO. Guidelines for the Appropriate Use of Herbal Medicines. WHO Regional Publications, Western Pacific Series No 3, WHO Regional office for the Western Pacific, Manila, 1998.
9. WHO. The International Pharmacopeia, Vol. 2: Quality Specifications, 3rd edn. World Health Organization, Geneva, 1981.
10. WHO. Quality Control Methods for Medicinal Plant Materials. World Health Organization, Geneva, 1999.
11. WHO. WHO Global Atlas of Traditional, Complementary and Alternative Medicine. 2 vol. set. Vol. 1 contains text and Vol. 2, maps. World Health Organization, Geneva, 2005.
12. WHO. Guidelines on Good Agricultural and Collection Practices (GACP) for Medicinal Plants. World Health Organization, Geneva, 2004.

COURSE OUTCOMES-

By the end of this course, students will be able to:

CO	**Statements**
CO1	Know WHO guidelines for quality control of herbal drugs
CO2	Know Quality assurance in herbal drug industry
CO3	Know the regulatory approval process and their registration in Indian and international markets
CO4	Appreciate EU and ICH guidelines for quality control of herbal drugs
CO5	learn cGMP, GAP and GLP in traditional system ofmedicines.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Learning Outcomes

Course Outcome	Bloom's Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L3	H	M	H	H	M	M	M	L	L	-	H	M	H	M	M
CO2	L1	M	M	H	L	L	L	-	L	-	L	L	L	M	M	-
CO3	L2	M	M	H	L	L	L	-	-	L	-	L	L	H	L	L
CO4	L3	M	H	H	H	H	H	H	M	M	M	H	H	M	-	M
CO5	L4	H	M	L	M	H	H	H	M	H	L	M	H	M	L	-

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1,CO2
CD2	Tutorials/Assignments	CO1,CO2
CD3	Seminars	CO1,CO2,CO3
CD4	Self- learning advice using internets	CO1,CO2
CD5	Industrial visit	CO4,CO5

BP 807 ET. COMPUTER AIDED DRUG DESIGN (Theory)

45 Hours

Scope/Objective:
This subject is designed to provide detailed knowledge of rational drug designprocess and various techniques used in rational drug design process.

Course Content:

Unit-I **10 Hours**

Introduction to Drug Discovery and Development Stages of drug discovery and development

Lead discovery and Analog Based Drug Design

Rational approaches to lead discovery based on traditional medicine, Random screening, Non-random screening, serendipitous drug discovery, lead discovery based on drug metabolism, lead discovery based on clinical observation.

Analog Based Drug Design: Bioisosterism, Classification, Bioisostericreplacement. Any three case studies

Unit-II **10 Hours**

Quantitative Structure Activity Relationship (QSAR)

SAR versus QSAR, History and development of QSAR, Types of physicochemical parameters, experimental and theoretical approaches for the determination ofphysicochemical parameters such as Partition, coefficient, Hammet's substituent constant and Tafts steric constant. Hansch analysis, Free Wilson analysis, 3D-QSAR approaches like COMFA and COMSIA.

Unit-III 1**0 Hours**

Molecular Modeling and virtual screening techniques

Virtual Screening techniques: Drug likeness screening, Concept ofpharmacophore mapping and pharmacophore based Screening,

Molecular docking: Rigid docking, flexible docking, manual docking, Docking based screening. *De novo* drug design.

Unit-IV **08 Hours**

Informatics & Methods in drug design

Introduction to Bioinformatics, chemoinformatics. ADME databases, chemical, biochemical and pharmaceutical databases.

Unit-V **07 Hours**

Molecular Modeling: Introduction to molecular mechanics and quantummechanics.Energy Minimization methods and Conformational Analysis, global conformational minima determination.

Recommended Books (Latest Editions)

1. Robert GCK, ed., "Drug Action at the Molecular Level" University Prak Press Baltimore.
2. Martin YC. "Quantitative Drug Design" Dekker, New York.
3. Delgado JN, Remers WA eds"Wilson &Gisvolds's Text Book of Organic Medicinal & Pharmaceutical Chemistry" Lippincott, New York.
4. Foye WO "Principles of Medicinal chemistry 'Lea & Febiger.
5. Koro lkovas A, Burckhalter JH. "Essentials of Medicinal Chemistry" Wiley Interscience.
6. Wolf ME, ed"The Basis of Medicinal Chemistry, Burger's Medicinal Chemistry" John Wiley & Sons, New York.
7. Patrick Graham, L., An Introduction to Medicinal Chemistry, Oxford University Press.
8. Smith HJ, Williams H, eds, "Introduction to the principles of Drug Design" Wright Boston.
9. Silverman R.B. "The organic Chemistry of Drug Design and Drug Action" Academic Press New York.

COURSE OUTCOMES-

By the end of this course, students will be able to:

CO	**Statements**
CO1	Design and discovery of lead molecules
CO2	The role of drug design in drug discovery process
CO3	The concept of QSAR and docking.
CO4	Various strategies to develop new drug like molecules.
CO5	The design of new drug molecules using molecular modeling software

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Computer lab visit

Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcomes

Course out Come	Bloom level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L3	H	H	H	H	H	M	H	M	L	H	M	H	H	H	L
CO2	L4	M	H	M	M	H	M	H	H	M	M	M	H	M	M	L
CO3	L3	H	H	M	H	H	M	L	H	M	M	M	H	H	L	L
CO4	L4	M	M	H	H	M	M	L	M	M	M	L	M	H	L	M
CO5	L1	L	H	H	H	H	H	L	H	M	M	L	M	M	L	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1,CO2,CO3
CD2	Tutorials/Assignments	CO1,CO2,CO3
CD3	Seminars	CO3,CO4,CO5
CD4	Self- learning advice using internets	CO5,CO2,
CD5	Computer lab visit	CO2,CO1,

BP808ET: CELL AND MOLECULAR BIOLOGY (Elective subject)

45 Hours

Scope/Objective:

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. This is done both on a microscopic and molecular level. Cell biology research encompasses both the great diversity of single-celled organisms like bacteria and protozoa, as well as the many specialized cells in multi-cellular organismssuch as humans, plants, and sponges.

Course content:

Unit I **10 Hours**

a) Cell and Molecular Biology: Definitions theory and basics and Applications.
b) Cell and Molecular Biology: History and Summation.
c) Properties of cells and cell membrane.
d) Prokaryotic versus Eukaryotic
e) Cellular Reproduction
f) Chemical Foundations – an Introduction and Reactions (Types)

Unit II **10 Hours**

a) DNA and the Flow of Molecular Information
b) DNA Functioning
c) DNA and RNA
d) Types of RNA
e) Transcription and Translation

Unit III **10 Hours**

a) Proteins: Defined **and** Amino Acids
b) Protein Structure
c) Regularities in Protein Pathways
d) Cellular Processes
e) Positive Control and significance of Protein Synthesis

Unit IV **08 Hours**

a) Science of Genetics
b) Transgenics and Genomic Analysis
c) Cell Cycle analysis
d) Mitosis and Meiosis
e) Cellular Activities and Checkpoints

Unit V **07 Hours**

a) Cell Signals: Introduction
b) Receptors for Cell Signals
c) Signaling Pathways: Overview
d) Misregulation of Signaling Pathways
e) Protein-Kinases: Functioning

Recommended Books (latest edition):

1. W.B. Hugo and A.D. Russel: Pharmaceutical Microbiology, Blackwell Scientific publications, Oxford London.
2. Prescott and Dunn. Industrial Microbiology, 4th edition, CBS Publishers & Distributors, Delhi.
3. Pelczar, Chan Kreig, Microbiology, Tata McGraw Hill edn.
4. Malcolm Harris, Balliere Tindall and Cox: Pharmaceutical Microbiology.
5. Rose: Industrial Microbiology.
6. Probisher, Hinsdill et al: Fundamentals of Microbiology, 9th ed. Japan
7. Cooper and Gunn's: Tutorial Pharmacy, CBS Publisher and Distribution.
8. Peppler: Microbial Technology.
9. Edward: Fundamentals of Microbiology.
10. N.K.Jain: Pharmaceutical Microbiology, Vallabh Prakashan, Delhi
11. Bergeys manual of systematic bacteriology, Williams and Wilkins- A Waverly Company.
12. B.R. Glick and J.J. Pasternak: Molecular Biotechnology: Principles and Applications of Recombinant DNA: ASM Press Washington D.C.
13. RA Goldshy et. al., Kuby Immunology.

COURSE OUTCOMES-

By the end of this course, students will be able to:

CO	Statements
CO1	To understand basic terminologies used in Molecular Biology as well as prefixes and suffixes used to identify plants parts and directional terms.
CO2	Summarize cellular functioning and composition.Describe the chemical foundations of cell biology.
CO3	Summarize the DNA properties of cell biology.Describe protein structure and function.
CO4	Describe cellular membrane structure and function.
CO5	Describe basic molecular genetic mechanisms.Summarize the Cell Cycle

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Lab visit
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial Visit ,Botanical garden visit

Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Learning Outcomes

Course Outcomes	Blooms Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P010	PO11	PO12	PSO1	PSO2	PSO3
CO1	L1	H	M	M	-	H	H	H	-	H	H	-	L	M	H	L
CO2	L6	H	H	M	-	M	M	H	-	H	H	-	L	M	-	L
CO3	L6	H	M	_	L	-	M	H	-	M	H	-	L	H	M	L
CO4	L1	H	H	_	L	M	M	H	-	H	H	-	L	H	L	-
CO5	L6	H	M	_	-	M	L	H	-	M	H	-	L	M	L	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3
CD2	Lab visit	CO2
CD3	Seminars	CO1, CO5
CD4	Self- learning advice using internets	CO1
CD5	Industrial visit ,Botanical garden visit	CO2,CO3,CO4

BP809ET. COSMETIC SCIENCE (Theory)

45Hours

Scope/Objective:
Understand the concepts of cosmetics, anatomy of skin v/s hair, general excipients used in cosmetics.

Unit I **10Hours**

Classification of cosmetic and cosmeceutical products
Definition of cosmetics as per Indian and EU regulations, Evolution of cosmeceuticals from cosmetics, cosmetics as quasi and OTC drugs
Cosmetic excipients: Surfactants, rheology modifiers, humectants, emollients, preservatives. Classification and application **Skin:** Basic structure and function of skin.
Hair: Basic structure of hair. Hair growth cycle.
Oral Cavity: Common problem associated with teeth and gums**.**

Unit II **10 Hours**

Principles of formulation and building blocks of skin care products:
Face wash, Moisturizing cream, Cold Cream, Vanishing cream and their advantages and disadvantages.Application of these products in formulation of cosmecuticals.
Antiperspants & deodorants- Actives & mechanism of action.
Principles of formulation and building blocks of Hair care products:
Conditioning shampoo, Hair conditioner, and anti-dandruff shampoo.Hair oils.
Chemistry and formulation of Para-phylene diamine based hair dye. Principles of formulation and building blocks of oral care products: Toothpaste for bleeding gums, sensitive teeth. Teeth whitening, Mouthwash.

Unit III **10 Hours**

Sun protection, Classification of Sunscreens and SPF.
Role of herbs in cosmetics:
Skin Care: Aloe and turmeric
Hair care: Henna and amla.
Oral care: Neem and clove
Analytical cosmetics: BIS specification and analytical methods for shampoo, skin-cream and toothpaste**.**

Unit IV **08 Hours**.

Principles of Cosmetic Evaluation: Principles of sebumeter, corneometer. Measurement of TEWL, Skin Color, Hair tensile strength, Hair combing properties
Soaps, and syndet bars. Evolution and skin benfits.

Unit V **07 Hours**

Oily and dry skin causes leading to dry skin, skin moisturisation. Basic understanding of the terms comedogenic, dermatitis. Cosmetic problems associated with Hair and scalp: Dandruff, Hair fall causes Cosmetic problems associated with skin: blemishes, wrinkles, acne, prickly heat and body odor.
Antiperspirants and Deodorants- Actives and mechanism of action

References

1) Harry's Cosmeticology, Wilkinson, Moore, Seventh Edition, George Godwin.
2) Cosmetics – Formulations, Manufacturing and Quality Control, P.P. Sharma, 4th Edition, Vandana Publications Pvt. Ltd., Delhi.
3) Text book of cosmelicology by Sanju Nanda & Roop K. Khar, Tata Publishers.

COURSE OUTCOMES-

By the end of this course, students will be able to:

CO	Statements
CO1	Explain formulation of cosmetics for hair, manufacturing & evaluation of hair shampoos, tonicsetc.
CO2	Summarize cellular functioning and composition.Describe the chemical foundations of cell biology.
CO3	Describe formulation of cosmetics for eyes, manufacturing & evaluation of eye mascara, shadow etc.
CO4	Understand formulation of manicure products like nail lacquer, removeretc. Learn formulation, manufacture & evaluation of baby cosmetics like baby oils, powdersetc.
CO5	Explain the concept of cosmeceuticals, history, difference between cosmetics & cosmeceuticals & cosmeceuticalagents.

Course Delivery Methods (CD)	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets

Table: Mapping of Course Outcomes with Program Learning Outcomes

Course Outcomes	Blooms Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2	PSO3
CO1	L1	H	M	M	-	H	-	H	H	-	H	H	L	M	H	L
CO2	L1	H	H	_	L	M	-	M	H	-	H	H	L	M	L	-
CO3	L6	H	M	_	-	M	-	L	H	-	M	H	L	H	-	L
CO4	L6	M	M	H	M	M	H	M	H	M	M	M	M	H	L	-
CO5	L4	L	M	M	-	-	-	L	L	M	L	L	M	M	L	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD:

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5,
CD2	Tutorials/Assignments	CO1, CO2, CO3, CO4,
CD3	Seminars	CO2,CO3,CO5,
CD4	Self- learning advice using internets	CO1,CO2,CO3,CO4,CO5,

BP810 ET. EXPERIMENTAL PHARMACOLOGY

45 Hours

Scope/Objective:
This subject is designed to impart the basic knowledge of preclinical studies inexperimental animals including design, conduct and interpretations of results.

Unit-1 **08 Hours**

Laboratory animals: Study of CPCSEA and OECD guidelines for maintenance, breeding and conduct of experiments on laboratory animals, Common lab animals: Description and applications of different species and strains of animals. Popular transgenic and mutant animals.
Techniques for collection of blood and common routes of drug administration in laboratory animals, Techniques of blood collection and euthanasia.

Unit-II **12 Hours**

Preclinical screening models:-

a. Introduction: Dose selection, calculation and conversions, preparation of drug solution/suspensions, grouping of animals and importance of sham negative and positive control groups. Rationale for selection of animal species and sex for the study.
b. Study of screening animal models for Diuretics, nootropics, anti-Parkinson's, antiasthmatics,

Preclinical screening models: for CNS activity- analgesic, antipyretic, anti-inflammatory, general anaesthetics, sedative and hypnotics, antipsychotic, antidepressant, antiepileptic, antiparkinsonism, Alzheimer's disease

Unit-III **10 Hours**

Preclinical screening models: For ANS activity, sympathomimetics, sympatholytics, parasympathomimetics, parasympatholytics, skeletal muscle relaxants, drug acting on eye, local anaesthetics.

Unit-IV **10 Hours**

Preclinical screening models: for CVS activity-antihypertensives, diuretics, antiarrhythmic, antidyslepidemic, anti aggregatory, coagulants and anticoagulants.
Preclinical screening models for other important drugs like antiulcer, antidiabetic, anticancer and antiasthmatics.

Unit-IV **05 Hours**

Research methodology and Bio-statistics Selectionof research topic, review of literature, research hypothesis and study design
Pre-clinical data analysis and interpretation using Students't' test and One-way ANOVA. Graphical representation of data.

Recommended Books (latest edition):

1. Fundamentals of experimental Pharmacology-by M.N.Ghosh
2. Hand book of Experimental Pharmacology-S.K.Kulakarni
3. CPCSEA guidelines for laboratory animal facility.
4. Drug discovery and Evaluation by Vogel H.G.
5. Drug Screening Methods by Suresh Kumar Gupta and S. K. Gupta
6. Introduction to biostatistics and research methods by PSS Sundar Rao and J Richard

COURSE OUTCOMES-

By the end of this course, students will be able to:

CO	Statements
CO1	Possess a relevant knowledge in basic principles of pharmacology and its recent advances.
CO2	Appreciate the applications of various commonly used laboratory animals.
CO3	Appreciate and demonstrate the various screening methods used in preclinicalresearch
CO4	Appreciate and demonstrate the importance of biostatistics and research methodology
CO5	Design and execute a research hypothesis independently

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets

Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Learning Outcomes

Course Outcome	Bloom's Level	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L1	M	M	H	-	L	-	L	-	L	-	H	-	M	H	-
CO2	L3	H	M	H	L	H	L	L	L	L	L	H	L	M	L	L
CO3	L2	L	M	H	M	L	L	L	L	M	L	H	M	H	M	L
CO4	L5	H	M	H	L	M	L	L	L	H	L	H	L	H	L	L
CO5	L4	M	M	M	H	H	H	H	M	M	M	M	H	M	M	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1,CO2,CO3,CO3,CO5
CD2	Tutorials/Assignments	CO1,CO2
CD3	Seminars	CO1
CD4	Self- learning advice using internets	CO1,CO2,CO3,CO4

BP 811 ET. ADVANCED INSTRUMENTATION TECHNIQUES

45 Hours

Scope/Objective:

This subject deals with the application of instrumental methods in qualitative andquantitative analysis of drugs. This subject is designed to impart advanced knowledge on the principles and instrumentation of spectroscopic and chromatographic hyphenated techniques. This also emphasizes on theoretical and practical knowledge on modern analytical instruments that are used for drug testing.

Course Content:

Unit-I **10 Hours Nuclear**

Magnetic Resonance spectroscopy

Principles of H-NMR and C-NMR, chemical shift, factors affecting chemical shift, coupling constant, Spin - spin coupling, relaxation, instrumentation and applications

Mass Spectrometry- Principles, Fragmentation, Ionization techniques–Electron impact, chemical ionization, MALDI, FAB, Analyzers-Time of flight and Quadrupole, instrumentation, applications

Unit-II 10 Hours

Thermal Methods of Analysis: Principles, instrumentation and applications of ThermogravimetricAnalysis (TGA), Differential Thermal Analysis (DTA), Differential Scanning Calorimetry (DSC)

X-Ray Diffraction Methods: Origin of X-rays, basic aspects of crystals, X-ray, Crystallography, rotating crystal technique, single crystal diffraction, powder diffraction, structural elucidation and applications.

Unit-III 10 Hours

Calibration and validation-as per ICH and USFDA guidelines **Calibration of following Instruments**

Electronic balance, UV-Visible spectrophotometer, IR spectrophotometer, Fluorimeter, Flame Photometer, HPLC and GC

Unit-IV 08 Hours

Radio immune assay: Importance, various components, Principle, differentmethods, Limitation and Applications of Radio immuno assay

Extraction techniques:General principle and procedure involved in the solidphase extraction and liquid-liquid extraction

Unit-V 07 Hours

Hyphenated techniques-LC-MS/MS, GC-MS/MS, HPTLC-MS.

Recommended Books (Latest Editions)

1. Instrumental Methods of Chemical Analysis by B.K Sharma
2. Organic spectroscopy by Y.R Sharma
3. Text book of Pharmaceutical Analysis by Kenneth A. Connors
4. Vogel's Text book of Quantitative Chemical Analysis by A.I. Vogel
5. Practical Pharmaceutical Chemistry by A.H. Beckett and J.B. Stenlake
6. Organic Chemistry by I. L. Finar
7. Organic spectroscopy by William Kemp
8. Quantitative Analysis of Drugs by D. C. Garrett
9. Quantitative Analysis of Drugs in Pharmaceutical Formulations by P. D. Sethi
10. Spectrophotometric identification of Organic Compounds by Silverstein.

COURSE OUTCOMES-

By the end of this course, students will be able to:

CO1	Understand the advanced instruments used and its applications in drug analysis.
CO2	Understand the chromatographic separation and analysis of drugs.
CO3	Understand the calibration of various analytical instruments
CO4	Perform quantitative & qualitative analysis of drugs using various analytical instruments.
CO5	Know analysis of drugs using various analytical instruments.

Course Delivery Methods (CD)	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Experiments, Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit ,Analysis lab visit

Table: Mapping of Course Outcomes with Program Learning Outcomes

Course Outcome	Bloom Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L4	M	M	H	H	M	-	M	M	M	-	M	H	H	H	L
CO2	L2	H	M	H	M	M	H	M	H	M	L	M	M	M	L	-
CO3	L3	M	M	H	H	M	H	M	M	M	L	M	M	M	M	M
CO4	L2	H	M	H	H	M	H	M	H	M	L	M	M	H	L	L
CO5	L3	M	M	H	H	M	H	M	M	M	L	M	M	M	M	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1, CO2, CO3, CO4, CO5
CD3	Experiments, Seminars	CO2, CO3, CO4, CO5
CD4	Self- learning advice using internets	CO4, CO5
CD5	Industrial visit ,Analysis lab visit	CO2, CO3, CO4, CO5

BP 812 ET. DIETARY SUPPLEMENTS AND NUTRACEUTICALS

No. of Hours: 3 Per Week **Tutorial: 1**

Scope/Objective:

This subject covers foundational topic that are important for understanding the need and requirements of dietary supplements among different groups in the population.

Unit I **07 hours**

a. Definitions of Functional foods, Nutraceuticals and Dietary supplements. Classification of Nutraceuticals, Health problems and diseases that can be prevented or cured by Nutraceuticals i.e. weight control, diabetes, cancer, heart disease, stress, osteoarthritis, hypertension etc.

b. Public health nutrition, maternal and child nutrition, nutrition and ageing, nutrition education in community.

c. Source, Name of marker compounds and their chemical nature, Medicinal uses and health benefits of following used as nutraceuticals/functional foods: Spirulina, Soyabean, Ginseng, Garlic, Broccoli, Gingko, Flaxseeds.

Unit II **15 hours**

Phytochemicals as nutraceuticals: Occurrence and characteristic features(chemical nature medicinal benefits) of following

a) Carotenoids- α and β-Carotene, Lycopene, Xanthophylls, leutin

b) Sulfides: Diallyl sulfides, Allyl trisulfide.

c) Polyphenolics: Reservetrol

d) Flavonoids- Rutin , Naringin, Quercitin, Anthocyanidins, catechins, Flavones

e) Prebiotics / Probiotics.: Fructo oligosaccharides, Lacto bacillum

f) Phyto estrogens : Isoflavones, daidzein, Geebustin, lignans

g) Tocopherols

h) Proteins, vitamins, minerals, cereal, vegetables and beverages as functional foods: oats, wheat bran, rice bran, sea foods, coffee, tea and the like.

Unit III **07 hours**

a) Introduction to free radicals: Free radicals, reactive oxygen species, production of free radicals in cells, damaging reactions of free radicals on lipids, proteins, Carbohydrates, nucleic acids.

b) Dietary fibres and complex carbohydrates as functional food ingredients..

Unit IV **10 hours**

a) Free radicals in Diabetes mellitus, Inflammation, Ischemic reperfusion injury, Cancer, Atherosclerosis, Free radicals in brain metabolism and pathology, kidney damage, muscle damage. Free radicals involvement in other disorders. Free radicals theory of ageing.

b) Antioxidants: Endogenous antioxidants – enzymatic and nonenzymatic antioxidant defence, Superoxide dismutase, catalase, Glutathione peroxidase, Glutathione Vitamin C, Vitamin E, α- Lipoic acid, melatonin, Synthetic antioxidants: Butylated hydroxy Toluene, Butylated hydroxy Anisole.

c) Fuctional foods for chronic disease prevention

Unit V **06 hours**

Effect of processing, storage and interactions of various environmental factors on the potential of nutraceuticals. Regulatory Aspects; FSSAI, FDA, FPO, MPO, AGMARK. HACCP and GMPs on Food Safety. Adulteration of foods.

a) Pharmacopoeial Specifications for dietary supplements and nutraceuticals.

References:

1. Dietetics by Sri Lakshmi
2. Role of dietary fibres and neutraceuticals in preventing diseases by K.T Agusti and P.Faizal: BSPunblication.
3. Advanced Nutritional Therapies by Cooper. K.A., (1996).
4. The Food Pharmacy by Jean Carper, Simon & Schuster, UK Ltd., (1988).
5. Prescription for Nutritional Healing by James F.Balch and Phyllis A.Balch 2nd Edn., Avery Publishing Group, NY (1997).
6. G. Gibson and C.williams Editors *2000 Functional foods* Woodhead Publ.Co.London.
7. Goldberg, I. *Functional Foods*. 1994. Chapman and Hall, New York.
8. Labuza, T.P. 2000 Functional Foods and Dietary Supplements: Safety, Good Manufacturing Practice (GMPs) and Shelf Life Testing in *Essentials of FunctionalFoods* M.K. Sachmidl and T.P. Labuza eds. Aspen Press.
9. Handbook of Nutraceuticals and Functional Foods, Third Edition (Modern Nutrition)
10. Shils, ME, Olson, JA, Shike, M. 1994 *Modern Nutrition in Health and Disease*. Eighth edition. Lea and Febiger

COURSE OUTCOMES-

By the end of this course, students will be able to:

CO	**Statements**
CO1	Understand the concepts behind the theoretical applications of dietary supplements.
CO2	Understand the need of supplements by the different group of people to maintain healthy life.
CO3	Understand the outcome of deficiencies in dietary supplements.
CO4	Appreciate the components in dietary supplements and the application.
CO5	Appreciate the regulatory and commercial aspects of dietary supplements including health claims.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Lab visit

Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Learning Outcomes

Course Outcome	Bloom's Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L3	H	M	H	H	M	M	M	L	L	-	H	M	M	M	L
CO2	L1	M	M	H	L	L	L	-	L	-	L	L	L	M	L	m-
CO3	L2	M	M	H	L	L	L	-	-	L	-	L	L	M	L	M
CO4	L3	M	H	H	H	H	H	H	M	M	M	H	H	H	M	L
CO5	L4	H	M	L	M	H	H	H	M	H	L	M	H	H	M	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1,CO2,
CD2	Tutorials/Assignments	CO1,CO2
CD3	Seminars	CO1,CO2,CO3
CD4	Self- learning advice using internets	CO1,CO2
CD5	Lab Visit	CO4,CO5

BP 814: ANANDAM

Objectives:

- To instil the joy of giving in young people, turning them into responsible citizens to build up a better society.
- To inculcate the habit of service in students across the University.
- A compulsory course of 2 credits per semester to be included in each program of University.
- Students to be accepted to engage in individual and group acts of service and goodness.

Action Plan:

Students will be expected to

- Do at least one act of individual service each day
- Record this act of service in a dedicated Register / Personal Diary
- Share this Register / Personal Diary day in the Anandam Class scheduled per week. The class interaction will include Personal Diary check, Showing of Community based motivation videos, Community based presentations by students, Role playing etc.
- Undertake one group service project for 64 hours every semester (outside college hours)
- Upload the report on the group project on the Anandam platform
- Participate in a sharing and presentation on the group service in the discussion sessions held once in week
- There will be some suggested projects and organizations that students can work with. Students can also suggest their own projects which others can join

Each student will finish the year with a portfolio of giving. This will include their Register / Personal Diaries and their reports on group service projects.

11. TEACHING-LEARNING PROCESS/ METHODOLOGY (TLM):

The teaching-learning process should be aimed at systematic exposition of basic concepts so as to acquire knowledge of pharmacy in a canonical manner. In this the various components of teaching learning process are summarized in the following heads.

1. **Class room Lectures:** The most common method of imparting knowledge is through lectures.There are diverse modes of delivering lectures such as through blackboard, power point presentation and other technology aided means. A judicious mix of these means is a key aspect of teaching-learning process.
2. **Tutorials:** To reinforce learning, to monitor progress, and to provide a regular pattern ofstudy, tutorials are essential requirements. During these tutorials, difficulties faced by the students in understanding the lectures, are dealt with. Tutorials are also aimed at solving problems associated with the concepts discussed during the lectures.
3. **Practical:** To provide scientific visualization and obtaining results of Pharmacy the practical sessions are conducted various labs. These sessions provide vital insights into scientific concepts and drawlearner's attention towards limitations of exercise therapy.
4. **Industrail visit:** Students may enhance their knowledge through industrial visit.
5. **Textbooks learning:** A large number of books are included in the list of references of eachcourse for enrichment and enhancement of knowledge.
6. **E-learning:** Learner may also access electronic resources and educational websites for better understanding and updating the concepts.
7. **Self-study materials:** Self-study material provided by the teachers is an integral part oflearning. It helps in bridging the gaps in the classroom teaching. It also provides scope for teachers to give additional information beyond classroom learning.
8. **Assignment/Problem solving:** Assignments at regular intervals involving applications of theory are necessary to assimilate basic concepts of courses. Hence, it is incumbent on the part of a learner to complete open-ended projects assigned by the teacher.
9. **Workshop & seminars:**Workshop and seminar on recent trends in the field of Pharmacy as well as medicines is organized time to time to update with the current scenario.

12. ASSESSMENT AND OUTCOME MESUAREMENT METHODS (AOMM):

A range of assessment methods which are appropriate to test the understanding of various concepts of courses will be used. Various learning outcomes will be assessed using time-bound examinations, problem solving, assignments and viva-voce examination. For various courses in this programme, the following assessment methods shall be adopted:

1- Scheduled/unscheduled tests

2- Problem solving sessions aligned with classroom lectures

3- Class Tests and semester end comprehensive examination

4- Practicals Evaluation Exercise

5- Case-based discussion
6- Direct observation of procedures
7- Multi-source feedback
8- Questionnaire

Examination and Evaluation:

I. The medium of instructions and examination shall be English.
II. Candidates shall be examined according to the scheme of examination and syllabus as approved by the BOS and Academic Council from time to time.
III. To pass each semester examination, a candidate must obtain at least 50% marks in each written paper, practical work semester examination.
IV. Each theory paper for the respective semester examination shall be set and evaluation of the answer books shall be done as per the University rules.
V. The assessment of External Evaluation i.e. End Term Semester Examination will be made out of 75 (Seventy Five) marks in theory Papers and Internal Evaluation of 25 (Twenty Five) marks.

Criterion for awarding Grading System:

Program/Course credit structure

As per the philosophy of Credit Based Semester System, certain quantum of academic work viz. theory classes, tutorial hours, practical classes, etc. are measured in terms of credits. On satisfactory completion of the courses, a candidate earns credits. The amount of credit associated with a course is dependent upon the number of hours of instruction per week in that course. Similarly, the credit associated with any of the other academic, co/extra-curricular activities is dependent upon the quantum of work expected to be put in for each of these activities per week.

12.1. Credit assignment

12.1.1. 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.

12.2. Minimum credit requirements

The minimum credit points required for award of a B. Pharm. degree is 244. These credits are divided into Theory courses, Tutorials, Practical, Practice School and Projectover 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.

13. TEACHERS TRAINING (TT):

Learning Outcomes Based Curriculum Framework (LOCF) Quality initiative of UGC based on Outcome Based Education (OBE) is being implemented by the University Grants Commission to enhance the Quality of Higher Education and that of Higher Education Learners and Teachers. Therefore, university arrange following activities for teachers training:

1. Workshops for LOCF implementation.
2. Seminar for LOCF implementation.
3. FDP on LOCF.
4. Outcome based higher education and understanding the learning objectives, learning outcomes, new approaches in the area of outcome measurement, preparing future ready teachers and students.
5. Developing a battery of quality speakers/educators to become resource persons to play role for Training of Trainers (TOT).

14. KEY WORDS:

AHP, LOCF, CBCS, Course Learning Outcomes, Employability, Graduate Attributes Communication Skills and Critical Thinking

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