

Raghavendra Institute of Pharmaceutical Education and Research (RIPER)-Autonomous

Accorded under Sections 2 (f) and 12 (B) of UGC act 1956 and Accredited by NBA (UG)
& NAAC-A Grade, Approved by PCI & AICTE, New Delhi

Academic Regulations (AR-21)

Program Structure & Syllabus

Effective from ACY 2021-2022

Bachelor of Pharmacy



(Applicable for the batch admitted from 2021 -2022)

: Awarding University:

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Introduction to the Document

The guidelines published in this document are official guidelines by the Board of studies (BoS) and Academic council of Raghavendra Institute of Pharmaceutical Education and Research (RIPER) - Autonomous, sponsored by Raghavendra Educational and Rural Development Society (RERDS), Anantapur, Andhra Pradesh. The document is a fusion product based on recommendations and guidelines stipulated for syllabus structure by UGC, AICTE, PCI, New Delhi.

- Academic regulations stipulated by Jawaharlal Nehru Technological University Anantapur (JNTUA), Ananthapuramu, Andhra Pradesh.
- Experts' opinion from the Board of Studies, Academic Council constituting approved Advisory boards members includes both academicians and researchers from reputed organizations at national and international levels.
- Suggestions and inputs from members of academic council and Board of studies.
- Recommendations based on feedback from alumni, employers, faculty, students, parents and other experts from allied area.

This *academic regulations, Program structure & Syllabus document* has been prepared to ensure quality system in teaching and learning process, examination, assessment, and functioning of other academic related matters to the satisfaction of stakeholders, such as students, parents, alumni, employers, faculty, etc. This document provides core principles of academic regulations duly approved by academic council and board of studies of this institution. The Implementation of these academic regulations shall lead to be considered in the institute and thereby enrich the quality of education and research in the field of pharmaceutical sciences. The guidelines shall aid the transparency and accountability in the administration set up. The list of objectives for implementing academic regulations and course structure through these guidelines are listed below,

- To improve the academic regulations and course structure.
- To strengthen the Industry-Institute interaction.
- To comply with rules and regulations of regulatory bodies like U G C , JNTUA, PCI, AICTE etc.,
- To meet the requirements of accreditation council and board.

- To enhance the quality of teaching-learning process and assessments.
- To provide career support programs, training for enhancing quality in placements and higher education.
- To place improved systems for feedback, self-appraisal of faculty and staff.
- To create bench marking with other institutes of repute.

Preamble

The regulations stated herein below shall be called as a document of “**Academic regulations, Program structure & Syllabus for B. Pharm**” for Raghavendra Institute of Pharmaceutical Education and Research (RIPER)-Autonomous.

- These regulations shall be in force from the batch admitted from 2021 -2022 by the date of ratification by the Academic council and Board of studies (BoS) of the institute.
- In the event of any doubt about the interpretation of these regulations, the matter shall be referred to Board of studies (BoS) and Academic council and their decision shall be final.
- The Board of studies (BoS) and Academic council shall have the authority to modify, amend and repeal any of the provisions of these regulations from time to time.

Definitions

- i. **“College”** means “Raghavendra Institute of Pharmaceutical Education & Research (RIPER) - Autonomous, Anantapur, Andhra Pradesh”.
- ii. **“Student”** means a candidate who has taken admission into B. Pharm course of this college as per the guidelines stipulated from time to time by the regulations of State Government of Andhra Pradesh and the Government of India for admissions into various courses of study and the affiliating university, i.e., Jawaharlal Nehru Technological University, Anantapur (JNTUA), Ananthapuramu, Andhra Pradesh.
- iii. **“Academic Council”** means the Academic council constituted as per the guidelines of UGC.
- iv. **“Board of Studies”** means Board of Studies constituted in each department as per the guidelines of UGC.
- v. **“Principal”** means the Head of the institution
- vi. **“Head of the Department”** means the Head of an Academic Department of the College.
- vii. **“Faculty member”** means the teacher (Assistant/Associate/Professor) working on regular or ad-hoc basis in any of the Academic Departments of the College.
- viii. **“Program”** means a candidate who has chosen to avail degree of B. Pharm of this college as per the marks/ rank awarded by the National/ University/ State common entrance tests, India.
- ix. **“Course”** *individual subjects described with content for instructions to the students.*
- x. **“Assessment”** means evaluation process for the outcome and grading in term of the marks.
- xi. **“Credit”** means a weight to the time requirements of the academic course in the institute.

Vision of the Institution

To create professionally competent and socially sensitive pharmacists, capable of working in multifaceted environment with newer evolving technology.

Mission of the Institution

To enable our students to develop into outstanding professionals and aware of the immense responsibilities to make the world better in the field of pharmacy.

Quality Policy

To formulate quality graduate through quality teaching and training in regard to versatile development of professional skills for their higher learning and career.

Vision of the Programme

To make committed and competent pharmacy graduates for the service of the Nation

Mission of the Programme

M1: Impart competent knowledge, and skills to pharmacy students by well qualified and committed faculty with state-of-the-art infrastructure.

M2: Create research, self-learning, eco- friendly ambience for the students and inculcate the societal responsibility in their minds to build a better healthcare system.

M3: Train the students to improve leadership qualities, ability to work in multifaceted environment with excellent communication skills.

M4: Encourage the students to become entrepreneurs and to make them job providers.

Programme Educational Outcomes

PEO 1: Graduate of the program will have successful technical /professional careers in pharmaceutical industry and/ or institute and/or Health care system.

PEO 2: Graduate of the program will continue to learn and adapt in the globe of constantly developing trends.

PEO 3: Graduate of the program will have foundation in science, formulation technology, synthetic knowledge, Discovery tools as per the requirement of Pharmaceutical sectors.

PEO 4: Graduates will possess professional and ethical attitude, effective communication skills, teamwork skills, multidisciplinary approach and an ability to correlate

Program Specific Outcomes

PSO 1: Accomplish a successful professional career in pharmaceutical industries, health care sector and health system research.

PSO 2: Adopt their higher learning for innovative and widening horizons in pharmaceutical and health care system to global standards.

PSO 3: Facilitate support to design and manufacture of pharmaceuticals and community services to public health.

PSO 4: Possess team based and multidisciplinary approach to broaden social contact and to resolve and manage issues in relation to public health.

Program Outcomes

PO1: Pharmacy Knowledge – Possess knowledge and comprehension of the core and basic knowledge associated with the profession of pharmacy, including biomedical sciences; pharmaceutical sciences; behavioural, social, and administrative pharmacy sciences; and manufacturing practices.

PO2: Planning abilities – Demonstrate effective planning abilities including time management, resource management, delegation skills and organizational skills. Develop and implement plans and organize work to meet deadlines.

PO3: Problem Analysis – Utilize the principles of scientific enquiry, thinking analytically, clearly, and critically, while solving problems and making decisions during daily practice. Find, analyse, evaluate, and apply information systematically and shall make defensible decisions.

PO4: Modern Tool Usage – Learn, select, and apply appropriate methods and procedures, resources, and modern pharmacy-related computing tools with an understanding of the limitations.

PO5: Leadership skills – Understand and consider the human reaction to change, motivation issues, leadership and team building when planning changes required for fulfilment of practice, professional and societal responsibilities. Assume participatory roles as responsible citizens or leadership roles when appropriate to facilitate improvement in health and well-being.

PO6: Professional Identity – Understand, analyse and communicate the value of their professional roles in society (e.g., health care professionals, promoters of health, educators, managers, employers, employees).

PO7: Pharmaceutical Ethics – Honour personal values and apply ethical principles in professional and social contexts. Demonstrate behaviour that recognizes cultural and personal variability in values, communication, and lifestyles. Use ethical Frameworks apply ethical principles while making decisions and take responsibility for the outcomes associated with the decisions.

PO8: Communication – Communicate effectively with the pharmacy community and with society at large, such as, being able to comprehend and write effective reports, make effective presentations and documentation, and give and receive clear instructions.

PO9: The Pharmacist and Society – Apply reasoning informed by the contextual knowledge to assess societal, health, safety and legal issues and the consequent responsibilities relevant to the professional pharmacy practice.

PO 10: Environment and sustainability – Understand the impact of the professional pharmacy solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO 11: Life-Long Learning – Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change. Self-assess and use feedback effectively from others to identify learning needs and to satisfy these needs on an ongoing basis.

Academic Regulations for Bachelor of Pharmacy (AR-21)

1. Short Title and Commencement

These regulations shall be called as “Academic Regulations for the Bachelor of Pharmacy (AR-21) Degree Program - Choice Based Credit System (CBCS) of the Raghavendra Institute of Pharmaceutical Education & Research (RIPER)-Autonomous, Anantapur”. They shall come into effect from the Academic Year 2021-22. The regulations framed are subject to modifications from time to time by Board of studies & Academic Council of RIPER-Autonomous.

2. Minimum qualification for admission

First Year B. Pharm: Admission to this programme shall be made subject to the eligibility and qualifications prescribed by the awarding university (JNTUA), State government of Andhra Pradesh/Govt. of India and as per regulatory bodies like All India Council for Technical Education (AICTE) and Pharmacy Council of India (PCI), New Delhi, from time to time.

- i. 10+2 examination with Physics and Chemistry as compulsory subjects along with one of the two subjects: Mathematics or Biology.
- ii. Any other qualification approved by the Pharmacy Council of India as equivalent to any of the above examinations.
- iii. Provided that a student should complete the age of 17 years on or before 31st December of the year of admission to the course.
- iv. Provided that there shall be reservation of seats for the students belonging to the Scheduled Castes, Scheduled Tribes and other Backward Classes in accordance with the instructions issued by the Central Government/State Government/Union Territory Administration as the case may be from time to time.

2.2. B. Pharm lateral entry (to third semester): A pass in D. Pharm. course from an institution approved by the Pharmacy Council of India under section 12 of the Pharmacy Act.

3. Duration of the program

The course of study for B. Pharm shall extend over a period of eight semesters (four academic years) and six semesters (three academic years) for lateral entry students. The curricula and syllabi for the program shall be prescribed from time to time by Board of studies & Academic Council of RIPER-Autonomous.

4. Medium of instruction and examinations: Medium of instruction and examination shall be in English.

5. Working days in each semester

Each semester shall consist of not less than 100 working days. The odd semesters shall be conducted from the month of June/July to November/December and the even semesters shall be conducted from December/January to May/June in every calendar year.

6. Attendance and progress

- A student shall be eligible to appear for the semester end examinations, if the student acquires a minimum of 75% of attendance in aggregate of all the subjects and not less than 50% in any of the subject.
- Shortage of attendance in aggregate up to 10% (65% and above, and below 75%) in each semester may be condoned by the college academic committee on genuine and valid grounds, based on the student's representation with supporting evidence.
- A stipulated fee shall be payable for condoning of shortage of attendance. Shortage of attendance below 65% in aggregate shall in no case be condoned.
- Students whose shortage of attendance is not condoned in any semester are not eligible to take their end examinations of that semester.

7. Program/Course credit structure

As per the philosophy of Choice Based Credit System (CBCS), 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.

Credit assignment

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.

Minimum credit requirements

The minimum credit points required for award of a B. Pharm. degree is 221[§]/222[#] (#Applicable ONLY for the students who have studied Mathematics / Physics / Chemistry at Intermediate/HSC and appearing for Remedial Biology (RB)course. [§]Applicable ONLY for the students who have studied Physics / Chemistry / Botany / Zoology at Intermediate/HSC and appearing for Remedial Mathematics (RM)course). These credits are divided into Theory courses, Tutorials, Practical, Practice School and Project, extra/co-curricular activities over the duration of eight semesters. The credits are distributed semester-wise as shown in Table IX. Courses generally progress in sequences, building competencies and their positioning indicates certain academic maturity on the part of the learners. Learners are expected to follow the semester-wise schedule of courses given in the syllabus.

The lateral entry students shall get 52 credit points transferred from their D. Pharm program. Such students shall take up additional remedial courses of ‘Communication Skills’ (Theory and Practical) and ‘Computer Applications in Pharmacy’ (Theory and Practical) equivalent to 3 and 4 credit points respectively, a total of 7 credit points to attain 59 credit points, the maximum of I and II semesters.

Audit Courses

All the students of II & IV Semester shall choose any one out of five audit courses. A candidate is required to submit report at the end of the semester to the examining authority of the RIPER-Autonomous. Satisfactory report from the concerned faculty is required to declare him/her as pass. However, Universal Human Values audit course is introduced by JNTUA in III semester. The student has to get a minimum of 50% in internal examination to declare him/her as pass. The maximum marks for this audit course (Universal Human Values) is 50.

8. Academic work

A regular record of attendance both in Theory and Practical shall be maintained by the teaching staff of respective courses. A faculty advisor/mentor shall be assigned to advise students on the programme, its Course Structure and Curriculum, Choice of Courses, based on his competence, progress, pre-requisites and interest.

9. Course structure: The course of study for B. Pharm shall include Semester Wise Theory & Practical as given in Table – I to VIII. The number of hours to be devoted to each theory, tutorial and practical course in any semester shall not be less than that shown in Table – I to VIII.

Table-I: Course of study for semester I

Course code	Name of the course	No. of hours	Tutorial	Credit points
BP101T	Human Anatomy and Physiology I– Theory (CC)	3	1	4
BP102T	Pharmaceutical Analysis I – Theory (CC)	3	1	4
BP103T	Pharmaceutics I – Theory (CC)	3	1	4
BP104T	Pharmaceutical Inorganic Chemistry – Theory (CC)	3	1	4
BP105T	Communication skills – Theory (SEC)	2	-	2
BP106RBT BP106RMT	Remedial Biology/ Remedial Mathematics – Theory (AECC)	2	-	2
BP107P	Human Anatomy and Physiology – Practical (CC)	4	-	2
BP108P	Pharmaceutical Analysis I – Practical (CC)	4	-	2
BP109P	Pharmaceutics I – Practical (CC)	4	-	2
BP110P	Pharmaceutical Inorganic Chemistry – Practical (CC)	4	-	2
BP111P	Communication skills – Practical (SEC)	2	-	1
BP112RBP	Remedial Biology – Practical (AECC)	2	-	1
BP113CE	Comprehensive online examination (AECC)	-	-	-
Total		34[§]/36[#]	4	29[§]/30[#]

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

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

CC: Core Course

AECC: Ability Enhancement Compulsory Course

SEC: Skill Enhancement Course

DSE: Discipline Specific Elective

GE: General Elective

Table-II: Course of study for semester II

Course Code	Name of the course	No. of Hours	Tutorial	Credit points
BP201T	Human Anatomy and Physiology II – Theory (CC)	3	1	4
BP202T	Pharmaceutical Organic Chemistry I – Theory (CC)	3	1	4
BP203T	Biochemistry – Theory (CC)	3	1	4
BP204T	Pathophysiology – Theory (CC)	3	1	4
BP205T	Computer Applications in Pharmacy – Theory (AECC)	3	-	3
BP206T	Environmental sciences – Theory (SEC)	3	-	3
BP207P	Human Anatomy and Physiology II – Practical (CC)	4	-	2
BP208P	Pharmaceutical Organic Chemistry I – Practical (CC)	4	-	2
BP209P	Biochemistry – Practical (CC)	4	-	2
BP210P	Computer Applications in Pharmacy – Practical (SEC)	2	-	1
BP211A1	Yoga & Stress Management#	2	-	-
BP211A2	Human Rights & Responsibilities#			
BP211A3	Constitution of India#			
BP211A4	Pedagogy studies#			
BP211A5	Soil and Water Conservation#			
BP212CE	Comprehensive online examination (AECC)	-	-	-
Total		34	4	29

Audit Course

CC: Core Course

AECC: Ability Enhancement Compulsory Course

SEC: Skill Enhancement Course

DSE: Discipline Specific Elective

GE: General Elective

Table-III: Course of study for semester III

Course code	Name of the course	No. of Hours	Tutorial	Credit points
BP301T	Pharmaceutical Organic Chemistry II – Theory (CC)	3	1	4
BP302T	Physical Pharmaceutics I – Theory (CC)	3	1	4
BP303T	Pharmaceutical Microbiology – Theory (CC)	3	1	4
BP304T	Pharmaceutical Engineering – Theory (CC)	3	1	4
BP305P	Pharmaceutical Organic Chemistry II – Practical (CC)	4	-	2
BP306P	Physical Pharmaceutics I – Practical (CC)	4	-	2
BP307P	Pharmaceutical Microbiology – Practical (CC)	4	-	2
BP 308P	Pharmaceutical Engineering – Practical (CC)	4	-	2
BP309CE	Comprehensive online examination (AECC)	-	-	-
BP310UHV	Universal Human Values#	2	-	-
Total		30	4	24

Audit Course

CC: Core Course

AECC: Ability Enhancement Compulsory Course

SEC: Skill Enhancement Course

DSE: Discipline Specific Elective

GE: General Elective

Table-IV: Course of study for semester IV

Course Code	Name of the course	No. of Hours	Tutorial	Credit points
BP401T	Pharmaceutical Organic Chemistry III– Theory (CC)	3	1	4
BP402T	Medicinal Chemistry I – Theory (CC)	3	1	4
BP403T	Physical Pharmaceutics II – Theory (CC)	3	1	4
BP404T	Pharmacology I – Theory (CC)	3	1	4
BP405T	Pharmacognosy and Phytochemistry I– Theory (CC)	3	1	4
BP406P	Medicinal Chemistry I – Practical (CC)	4	-	2
BP407P	Physical Pharmaceutics II – Practical (CC)	4		2
BP408P	Pharmacology I – Practical (CC)	4	-	2
BP409P	Pharmacognosy and Phytochemistry I – Practical (CC)	4	-	2
BP410A1	Disaster Management#	2	-	-
BP410A2	Personality development through life enlightenment skills#			
BP410A3	Drug abuse: Problem, prevention & management#			
BP410A4	Industrial Waste Management#			
BP410A5	English for Research Paper Writing#			
BP411CE	Comprehensive online examination (AECC)	-	-	-
Total		33	5	28

Audit Course

CC: Core Course

AECC: Ability Enhancement Compulsory Course

SEC: Skill Enhancement Course

DSE: Discipline Specific Elective

GE: General Elective

Table-V: Course of study for semester V

Course code	Name of the course	No. of Hours	Tutorial	Credit points
BP501T	Medicinal Chemistry II – Theory (CC)	3	1	4
BP502T	Industrial Pharmacy I – Theory (CC)	3	1	4
BP503T	Pharmacology II – Theory (CC)	3	1	4
BP504T	Pharmacognosy and Phytochemistry II– Theory (CC)	3	1	4
BP505T	Pharmaceutical Jurisprudence – Theory (AECC)	3	1	4
BP506P	Industrial Pharmacy I – Practical (CC)	4	-	2
BP507P	Pharmacology II – Practical (CC)	4	-	2
BP508P	Pharmacognosy and Phytochemistry II – Practical (CC)	4	-	2
BP509ET	Pharma Marketing Management (GE)	3	1	4
BP510ET	Health care dietary supplements (GE)			
BP511ET	Entrepreneurship Development (GE)			
BP512CE	Comprehensive online examination (AECC)	-	-	-
Total		30	6	30

CC: Core Course

AECC: Ability Enhancement Compulsory Course

SEC: Skill Enhancement Course

DSE: Discipline Specific Elective

GE: General Elective

Table-VI: Course of study for semester VI

Course code	Name of the course	No. of hours	Tutorial	Credit points
BP601T	Medicinal Chemistry III – Theory (CC)	3	1	4
BP602T	Pharmacology III – Theory (CC)	3	1	4
BP603T	Herbal Drug Technology – Theory (CC)	3	1	4
BP604T	Biopharmaceutics and Pharmacokinetics – Theory (CC)	3	1	4
BP605T	Pharmaceutical Biotechnology – Theory (CC)	3	1	4
BP606T	Biostatistics and Research Methodology (CC)	3	1	4
BP607P	Medicinal chemistry III – Practical (CC)	4	-	2
BP608P	Pharmacology III – Practical (CC)	4	-	2
BP609P	Herbal Drug Technology – Practical (CC)	4	-	2
BP610CE	Comprehensive online examination (AECC)	-	-	-
Total		30	6	30

CC: Core Course

AECC: Ability Enhancement Compulsory Course

SEC: Skill Enhancement Course

DSE: Discipline Specific Elective

GE: General Elective

Table-VII: Course of study for semester VII

Course code	Name of the course	No. of hours	Tutorial	Credit points
BP701T	Instrumental Methods of Analysis – Theory (CC)	3	1	4
BP702T	Industrial Pharmacy II – Theory (CC)	3	1	4
BP703T	Pharmaceutical Quality Assurance –Theory (CC)	3	1	4
BP704T	Novel Drug Delivery System – Theory (CC)	3	1	4
BP705P	Instrumental Methods of Analysis –Practical (CC)	4	-	2
BP706PS	Practice School (SEC)	12	-	6
BP707CE	Comprehensive online examination (AECC)	-	-	-
Total		28	4	24

CC: Core Course

AECC: Ability Enhancement Compulsory Course

SEC: Skill Enhancement Course

DSE: Discipline Specific Elective

GE: General Elective

Table-VIII: Course of study for semester VIII

Course code	Name of the course	No. of hours	Tutorial	Credit points
BP801T	Pharmacy Practice – Theory (CC)	3	1	4
BP802T	Social and Preventive Pharmacy (CC)	3	1	4
BP803ET	Pharmaceutical Regulatory Science (DSE)	3 + 3 = 6	1 + 1 = 2	4 + 4 = 8
BP804ET	Computer Aided Drug Design (DSE)			
BP805ET	Cell and Molecular Biology (DSE)			
BP806ET	Cosmetic Science (DSE)			
BP807ET	Experimental Pharmacology (DSE)			
BP808ET	Advanced Instrumentation Techniques (DSE)			
BP809ET	Quality Control and Standardization of Herbals (DSE)			
BP810PW	Project Work	12	-	6
BP811CE	Comprehensive online examination (AECC)	-	-	-
Total		24	4	22

CC: Core Course**AECC: Ability Enhancement Compulsory Course****SEC: Skill Enhancement Course****DSE: Discipline Specific Elective****GE: General Elective****Extracurricular/ Co-curricular activities**

S. No.	Name of the Category
1.	Add-on Courses-compulsory credit-1
2.	NSS, NCC and other social service activities- Compulsory credit-1
3.	Achievements- Compulsory credits- 2
4.	5th Credit can be any one of the above

Table-IX: Semester wise credits distribution

Semester	Credit Points
I	29 [§] /30 [#]
II	29
III	24
IV	28
V	30
VI	30
VII	24
VIII	22
Extracurricular/ Co-curricular activities	05*
Total credit points for the program	221[§]/222[#]

[§]Applicable ONLY for the students studied Physics / Chemistry / Botany / Zoology at Intermediate/HSC and appearing for Remedial Mathematics course.

[#]Applicable ONLY for the students studied Mathematics / Physics / Chemistry at Intermediate/HSC and appearing for Remedial Biology course.

Extracurricular/ Co-curricular activities -5 Credits

Rules and Regulations:

Categories

1. Add on courses **(1 credit)**
2. NSS, NCC and other social service activities **(1 credit)**
3. Achievements **(2 credits)**
4. **5th credit can be any one of the above three categories.**

Award of Credits

1. Add on courses (1 credit Compulsory) (In campus/Off campus) (Offline/online)

One credit -Each short-term course certificate as per UGC norms for add on courses.

(30hrs Duration/8 weeks).

Two credits- Diploma course certificate as per UGC norms for add on courses

(60hrs Duration/16 weeks).

Others discretion of Director of Academics/CE/Principal.

2. NSS, NCC and other social activities (1 Credit Compulsory)

(30 hours for One credit. 60 hours for Two credits)

Calculation of Hours

A. Three Commemoration day celebrations/Any other day celebration participation=1 hr. (i.e.- Independence Day, Republic day, Gandhi Jayanti, etc.)

B. One Participation in Rally = 2 hrs.

C. For one day camp participation= 3 hrs.

D. One day Yoga/training involving learn and practice participation =2 hrs.

E. One session of Plantation day- 2 hrs.

F. Donating blood donation at Blood donation camp at college or hospital- 5 hrs. (Maximum one per year allowed. Certificate is required in case in outside of the college)

G. One day participation in Clean India like activities at outside -5 hrs.

H. Three Awareness program participation-1hrs

I. One Street play performance/flash mob performance -3 hrs.

J. Four audience participation in programs (Discretion of NSS Officer/CE/Principal)- 1 hr.

K. Any performance in any of the events which are not listed here (Discretion of NSS officer/CE/Principal)-2 hrs.

L. One Social service merit certificate (Lion's club/Rotary club/Traffic police/Police volunteers/Other Govt. Organizations)-1 credit

M. Others discretion of NSS officer/CE/Principal.

3. Achievements (Compulsory Credits 2)

Note: (One credit is compulsory from listed research Scholar Initiative activities Only one credit can be obtained from own institute for any of the clause of the "Achievement" Category).

Research Scholarly Activities

- A. One publication – 1 credit
- B. One indexed Publication- 2 credits
- C. One IPC Participation-1 credit
- D. One IPC presentation (Oral/Poster)-2 Credits
- E. Local chapters like IPA/ISPOR/RSC publications or presentations-1 credit
- F. One Presentations at seminars/conferences at india-1 credit
- G. One Presentations at seminars/conferences at outside India-2 credits
- H. Four Conferences/seminars/workshops Participation national level -1 credit
- I. Three International level Conferences/seminars/workshops Participation at India - 1 credit
- J. Two International Conferences/seminars/workshops Participation at outside India -2 credit
- K. Others discretion of R&D Director/CE/Principal.

Certificates for Achievements (Sports/cultural/others)

- A. One National/State/District/University level certificate-2 credits (winner/runner)
- B. One National/State/District/University level certificate-1 credit (only when Participation certificate received).
- C. One Non-government/affiliated institution Merits/own institute level certificate-1 credit (winner/runner).
- D. Others discretion of NSS officer/CE/Principal.

Evaluation of Extracurricular/Co-curricular activities

A detailed report has to be prepared by the student, consisting of Extracurricular/Co-curricular activities (Proofs/Certificates of Add on courses, Research scholarly activities, Participation in social service activities like NSS & NCC). All these certificates shall be duly verified, signed and forwarded by the project guide to the internal & external evaluator along with their project work at the time of Project Viva Voce. Final award of credits shall be done by the internal & external evaluator.

10. Program Committee

1. The B. Pharm. program shall have a Program Committee constituted by the Head of the institution in consultation with all the Heads of the departments.
2. The composition of the Program Committee shall be as follows: A senior teacher/Principal shall be the Chairperson; One Teacher from each department handling B. Pharm courses/HODs of the departments; senior faculty.
3. Duties of the Program Committee:
 - i. Periodically reviewing the progress of the classes.
 - ii. Discussing the problems concerning curriculum, syllabus and the conduct of classes.
 - iii. Discussing with the course teachers on the nature and scope of assessment for the course and the same shall be announced to the students at the beginning of respective semesters.
 - iv. Communicating its recommendation to the Head of the institution on academic matters.
 - v. The Program Committee shall meet at least twice in a semester preferably at the end of each Sessional exam.

11. Examinations/Assessments

The scheme for internal assessment and end semester examinations is given in Table – X.

Tables-X: Schemes for internal assessments and end semester examinations semester wise

Semester I

Course code	Name of the course	Internal Assessment			End Semester Exams		Total Marks	
		Continuous Mode	Sessional Exams		Total	Marks		Duration (Hrs.)
			Marks	Duration (Hrs.)				
BP101T	Human Anatomy and Physiology I– Theory	10	15	1	25	75	3	100
BP102T	Pharmaceutical Analysis I – Theory	10	15	1	25	75	3	100
BP103T	Pharmaceutics I – Theory	10	15	1	25	75	3	100
BP104T	Pharmaceutical Inorganic Chemistry – Theory	10	15	1	25	75	3	100
BP105T	Communication skills – Theory	5	10	1	15	35	1.5	50
BP106RBT BP106RMT	Remedial Biology/ Mathematics – Theory	5	10	1	15	35	1.5	50
BP107P	Human Anatomy and Physiology – Practical	5	10	4	15	35	4	50
BP108P	Pharmaceutical Analysis I – Practical	5	10	4	15	35	4	50
BP109P	Pharmaceutics I – Practical	5	10	4	15	35	4	50
BP110P	Pharmaceutical Inorganic Chemistry – Practical	5	10	4	15	35	4	50
BP111P	Communication skills – Practical	5	5	2	10	15	2	25
BP112RBP	Remedial Biology – Practical	5	5	2	10	15	2	25
BP113CE	Comprehensive online examination	-	-	-	-	50	1	50
Total		75[§]/80[#]	125[§]/130[#]	24[§]/26[#]	200[§]/210[#]	575[§]/ 590[#]	34[§]/ 36[#]	775[§]/800[#]

[#]Applicable ONLY for the students studied Mathematics / Physics / Chemistry at HSC and appearing for Remedial Biology (RB)course.

[§]Applicable ONLY for the students studied Physics / Chemistry / Botany / Zoology at HSC and appearing for Remedial Mathematics (RM)course.

Semester II

Course code	Name of the course	Internal Assessment			End Semester Exams		Total Marks	
		Continuous Mode	Sessional Exams		Total	Marks		Duration (Hrs.)
			Marks	Duration (Hrs.)				
BP201T	Human Anatomy and Physiology II – Theory	10	15	1	25	75	3	100
BP202T	Pharmaceutical Organic Chemistry I – Theory	10	15	1	25	75	3	100
BP203T	Biochemistry – Theory	10	15	1	25	75	3	100
BP204T	Pathophysiology – Theory	10	15	1	25	75	3	100
BP205T	Computer Applications in Pharmacy – Theory	10	15	1	25	50	2	75
BP206T	Environmental sciences – Theory	10	15	1	25	50	2	75
BP207P	Human Anatomy and Physiology II – Practical	5	10	4	15	35	4	50
BP208P	Pharmaceutical Organic Chemistry I– Practical	5	10	4	15	35	4	50
BP209P	Biochemistry – Practical	5	10	4	15	35	4	50
BP210P	Computer Applications in Pharmacy – Practical	5	5	2	10	15	2	25
BP212CE	Comprehensive online examination	-	-	-	-	50	1	50
Total		80	125	20	205	570	31	775

Semester III

Course code	Name of the course	Internal Assessment			End Semester Exams		Total Marks	
		Continuous Mode	Sessional Exams		Total	Marks		Duration (Hrs.)
			Marks	Duration (Hrs.)				
BP301T	Pharmaceutical Organic Chemistry II – Theory	10	15	1	25	75	3	100
BP302T	Physical Pharmaceutics I –Theory	10	15	1	25	75	3	100
BP303T	Pharmaceutical Microbiology – Theory	10	15	1	25	75	3	100
BP304T	Pharmaceutical Engineering – Theory	10	15	1	25	75	3	100
BP305P	Pharmaceutical Organic Chemistry II – Practical	5	10	4	15	35	4	50
BP306P	Physical Pharmaceutics I – Practical	5	10	4	15	35	4	50
BP307P	Pharmaceutical Microbiology – Practical	5	10	4	15	35	4	50
BP308P	Pharmaceutical Engineering – Practical	5	10	4	15	35	4	50
BP309CE	Comprehensive online examination (AECC)	-	-	-	-	50	1	50
BP310UHV	Universal Human Values#	20	30	2	50	-	-	50
Total		80	130	22	210	490	29	700

Audit Course

Semester IV

Course code	Name of the course	Internal Assessment			End Semester Exams		Total Marks	
		Continuous Mode	Sessional Exams		Total	Marks		Duration (Hrs.)
			Marks	Duration (Hrs.)				
BP401T	Pharmaceutical Organic Chemistry III– Theory	10	15	1	25	75	3	100
BP402T	Medicinal Chemistry I – Theory	10	15	1	25	75	3	100
BP403T	Physical Pharmaceutics II – Theory	10	15	1	25	75	3	100
BP404T	Pharmacology I – Theory	10	15	1	25	75	3	100
BP405T	Pharmacognosy I – Theory	10	15	1	25	75	3	100
BP406P	Medicinal Chemistry I – Practical	5	10	4	15	35	4	50
BP407P	Physical Pharmaceutics II – Practical	5	10	4	15	35	4	50
BP408P	Pharmacology I – Practical	5	10	4	15	35	4	50
BP409P	Pharmacognosy I – Practical	5	10	4	15	35	4	50
BP411CE	Comprehensive online examination	-	-	-	-	50	1	50
Total		70	115	21	185	565	32	750

Semester V

Course code	Name of the course	Internal Assessment			End Semester Exams		Total Marks	
		Continuous Mode	Sessional Exams		Total	Marks		Duration (Hrs.)
			Marks	Duration (Hrs.)				
BP501T	Medicinal Chemistry II – Theory	10	15	1	25	75	3	100
BP502T	Industrial Pharmacy I– Theory	10	15	1	25	75	3	100
BP503T	Pharmacology II – Theory	10	15	1	25	75	3	100
BP504T	Pharmacognosy II – Theory	10	15	1	25	75	3	100
BP505T	Pharmaceutical Jurisprudence – Theory	10	15	1	25	75	3	100
BP506P	Industrial Pharmacy I– Practical	5	10	4	15	35	4	50
BP507P	Pharmacology II – Practical	5	10	4	15	35	4	50
BP508P	Pharmacognosy II – Practical	5	10	4	15	35	4	50
BP509ET	Pharma Marketing Management	10	15	1	25	75	3	100
BP510ET	Health Care Dietary Supplements							
BP511ET	Entrepreneurship Development							
BP512CE	Comprehensive online examination (AECC)	-	-	-	-	50	1	50
Total		75	120	18	195	605	31	800

Semester VI

Course code	Name of the course	Internal Assessment			End Semester Exams		Total Marks	
		Continuous Mode	Sessional Exams		Total	Marks		Duration (Hrs.)
			Marks	Duration (Hrs.)				
BP601T	Medicinal Chemistry III – Theory	10	15	1	25	75	3	100
BP602T	Pharmacology III – Theory	10	15	1	25	75	3	100
BP603T	Herbal Drug Technology – Theory	10	15	1	25	75	3	100
BP604T	Biopharmaceutics and Pharmacokinetics – Theory	10	15	1	25	75	3	100
BP605T	Pharmaceutical Biotechnology– Theory	10	15	1	25	75	3	100
BP606T	Biostatistics and Research Methodology – Theory	10	15	1	25	75	3	100
BP607P	Medicinal chemistry III – Practical	5	10	4	15	35	4	50
BP608P	Pharmacology III – Practical	5	10	4	15	35	4	50
BP609P	Herbal Drug Technology – Practical	5	10	4	15	35	4	50
BP610CE	Comprehensive online examination	-	-	-	-	50	1	50
Total		75	120	18	195	605	31	800

Semester VII

course code	Name of the course	Internal Assessment			End Semester Exams		Total Marks	
		Continuous Mode	Sessional Exams		Total	Marks		Duration (Hrs.)
			Marks	Duration (Hrs.)				
BP701T	Instrumental Methods of Analysis – Theory	10	15	1	25	75	3	100
BP702T	Industrial Pharmacy – Theory	10	15	1	25	75	3	100
BP703T	Pharmaceutical Quality Assurance – Theory	10	15	1	25	75	3	100
BP704T	Novel Drug Delivery System – Theory	10	15	1	25	75	3	100
BP705 P	Instrumental Methods of Analysis – Practical	5	10	4	15	35	4	50
BP706 PS	Practice School*	25	-	-	25	125	5	150
BP707CE	Comprehensive online examination	-	-	-	-	50	1	50
Total		70	70	8Hrs	140	510	22	650

* The subject experts at college level shall conduct examinations

Semester VIII

Course code	Name of the course	Internal Assessment			End Semester Exams		Total Marks	
		Continuous Mode	Sessional Exams		Total	Marks		Duration (Hrs.)
			Marks	Duration (Hrs.)				
BP801T	Pharmacy Practice – Theory	10	15	1	25	75	3	100
BP802T	Social and Preventive Pharmacy – Theory	10	15	1	25	75	3	100
BP803ET	Pharmaceutical Regulatory Science – Theory	10+10=20	15+15=30	1+1=2	25+25=50	75+75=150	3+3=6	100+100=200
BP804ET	Computer Aided Drug Design – Theory							
BP805ET	Cell and Molecular Biology – Theory							
BP806ET	Cosmetic Science – Theory							
BP807ET	Experimental Pharmacology – Theory							
BP808ET	Advanced Instrumentation Techniques – Theory							
BP808ET	Quality Control and Standardization of Herbals							
BP810PW	Project Work	-	-	-	-	150	4	150
BP811CE	Comprehensive online examination	-	-	-	-	50	1	50
Total		40	60	4	100	500	17	600

Internal assessment: Continuous mode

The marks allocated for Continuous mode of Internal Assessment shall be awarded as per the scheme given below.

Table-XI: Scheme for awarding internal assessment: Continuous mode

Theory		
Criteria	Maximum Marks	
Assignment	5	2.5
Student – Teacher interaction		
i. Seminar	3	1.5
ii. Group Discussion	2	1
Total	10	5
Practical		
Regular viva voce	5	

11.2.1. Sessional Exams

Two Sessional exams shall be conducted for each theory / practical course as per the Academic colander schedule. The scheme of question paper for theory and practical Sessional examinations is given below. Final sessional marks shall be arrived at by considering the marks secured by the student in both the mid examinations with 80% weightage to the better mid examination and 20% to the other. **The final sessional examinations shall be computed for internal assessment as per the requirements given in tables – X.**

Sessional exam shall be conducted for 30 marks for theory and shall be computed for 15 marks. **However, for the courses such as, Communication skills theory, Remedial biology theory shall be conducted for 30 marks and shall be computed for 10 marks.** Similarly, Sessional exam for practical shall be conducted for 40 marks and shall be computed for 10 marks. **However, for the courses such as, Communication skills practical, Remedial biology practical, Computer applications in pharmacy practical shall be conducted for 20 marks and shall be computed for 5 marks.**

Question paper pattern for theory sessional examinations

I.	MCQs	: 10×1=10
II.	Long answer (Answer 1 out of 2)	: 1×10=10
III.	Short answers (Answer 2 out of 3)	: 2×5=10
	Total	: 30 Marks

Question paper pattern for practical sessional examinations

I.	Synopsis	10
II.	Experiment	25
III.	Viva	05
	Total	: 40 Marks

Question paper pattern for practical sessional examinations (Communication skills practical, Remedial biology practical, Computer applications in pharmacy practical).

I.	Synopsis	05
II.	Experiment	10
III.	Viva	05
	Total	: 20 Marks

The End examinations shall be conducted as per the requirements given in tables – X.

Question paper pattern for end semester theory examinations

For 75 marks paper

I. Objective Type Questions (10 x 2) (Answer all the questions)	=	10 x 2 = 20
II. Long Answers (Answer 2 out of 3)	=	2 x 10 = 20
III. Short Answers (Answer 7 out of 9)	=	7 x 5 = 35

Total	=	75 marks

For 50 marks paper

I. Long Answers (Answer 2 out of 3)	=	2 x 10 = 20
II. Short Answers (Answer 6 out of 8)	=	6 x 5 = 30

Total	=	50 marks

For 35 marks paper

I. Long Answers (Answer 1 out of 2)	=	1 x 10 = 10
II. Short Answers (Answer 5 out of 7)	=	5 x 5 = 25

Total	=	35 marks

Question paper pattern for end semester practical examinations

For 35 Marks paper

I. Synopsis	=	5
II. Experiments	=	25
III. Viva voce	=	5

Total	=	35 marks

Question paper pattern for end semester practical examinations

For 15 marks paper

I. Synopsis	=	3
II. Experiments	=	10
III. Viva voce	=	2

Total	=	15 marks

12. Promotion and award of grades

A student shall be declared PASS and eligible for getting grade in a course of B. Pharm program if he/she secures at least 50% marks in that particular course including internal assessment. For example, to be declared as PASS and to get grade, the student has to secure a minimum of 50 marks for the total of 100 including continuous mode of assessment and end semester theory examination and has to secure a minimum of 25 marks for the total 50 including internal assessment and end semester practical examination.

13. Carry forward of marks

In case a student fails to secure the minimum 50% in any Theory or Practical course as specified in 12, then he/she shall reappear for the end semester examination of that course. However, his/her marks of the Internal Assessment shall be carried over and he/she shall be entitled for grade obtained by him/her on passing.

14. Improvement of internal assessment

- A candidate shall be given one chance to re-register for each subject provided the internal marks secured by a candidate are less than 50% and has failed in the end examination
- The candidate should have passed all the subjects for which the Internal Evaluation marks secured are more than 50%. Out of the subjects, if the candidate has failed in the examination due to Internal Evaluation marks secured being less than 50%, the candidate shall be given one chance for each Theory subject and for a maximum of three Theory subjects for Improvement of Internal evaluation marks.
- The candidate has to re-register for the chosen subjects and fulfill the academic requirements.
- For reregistration the candidates must apply to the college by paying the requisite fees and get approval before the start of the semester in which re-registration is required
- In the event of availing the Improvement of Internal evaluation marks, the internal evaluation marks as well as the End Examinations marks secured in the previous attempt(s) for the reregistered subjects stand cancelled.

15. Advanced supplementary examination

Advanced supplementary examination shall be conducted immediately after the declaration of results. The exact dates of examinations shall be notified from time to time.

16. Academic Progression:

No student shall be admitted to any examination unless he/she fulfills the norms given in

6. Academic progression rules are applicable as follows:

A student shall be eligible to carry forward all the courses of I, II and III semesters till the IV semester examinations. However, he/she shall not be eligible to attend the courses of V semester until all the courses of I and II semesters are successfully completed.

A student shall be eligible to carry forward all the courses of III, IV and V semesters till the VI semester examinations. However, he/she shall not be eligible to attend the courses of VII semester until all the courses of I, II, III and IV semesters are successfully completed.

A student shall be eligible to carry forward all the courses of V, VI and VII semesters till the VIII semester examinations. However, he/she shall not be eligible to get the course completion certificate until all the courses of I, II, III, IV, V and VI semesters are successfully completed.

A student shall be eligible to get his/her CGPA upon successful completion of the courses of I to VIII semesters within the stipulated time period as per the norms specified in 26.

A lateral entry student shall be eligible to carry forward all the courses of III, IV and V semesters till the VI semester examinations. However, he/she shall not be eligible to attend the courses of VII semester until all the courses of III and IV semesters are successfully completed.

A lateral entry student shall be eligible to carry forward all the courses of V, VI and VII semesters till the VIII semester examinations. However, he/she shall not be eligible to get the course completion certificate until all the courses of III, IV, V and VI semesters are successfully completed. A lateral entry student shall be eligible to get his/her CGPA upon successful completion of the courses of III to VIII semesters within the stipulated time period as per the norms specified in 26.

Any student who has given more than 4 chances for successful completion of I / III semester courses and more than 3 chances for successful completion of II / IV semester courses shall be permitted to attend V / VII semester classes ONLY during the subsequent academic year as the case may be. In simpler terms there shall NOT be any ODD BATCH for any semester.

Note: Grade AB should be considered as failed and treated as one head for deciding academic progression. Such rules are also applicable for those students who fail to register for examination(s) of any course in any semester.

17. Grading of performances

Letter grades and grade points allocations:

Based on the performances, each student shall be awarded a final letter grade at the end of the semester for each course. The letter grades and their corresponding grade points are given in Table – XII.

Table – XII: Letter grades and grade points equivalent to Percentage of marks and performances

Percentage of Marks Obtained	Letter Grade	Grade Point	Performance
90.00 – 100	O	10	Outstanding
80.00 – 89.99	A	9	Excellent
70.00 – 79.99	B	8	Good
60.00 – 69.99	C	7	Fair
50.00 – 59.99	D	6	Average
Less than 50	F	0	Fail
Absent	AB	0	Fail

A learner who remains absent for any end semester examination shall be assigned a letter grade of AB and a corresponding grade point of zero. He/she should reappear for the said evaluation/examination in due course.

18. The Semester grade point average (SGPA)

The performance of a student in a semester is indicated by a number called ‘Semester Grade Point Average’ (SGPA). The SGPA is the weighted average of the grade points obtained in all the courses by the student during the semester. For example, if a student takes five courses (Theory/Practical) in a semester with credits C₁, C₂, C₃, C₄ and C₅ and the student’s grade points in these courses are G₁, G₂, G₃, G₄ and G₅, respectively, and then students’ SGPA is equal to:

$$\text{SGPA} = \frac{C_1G_1 + C_2G_2 + C_3G_3 + C_4G_4 + C_5G_5}{C_1 + C_2 + C_3 + C_4 + C_5}$$

21. Project work

All the students shall undertake a project under the supervision of a teacher and submit a report. The area of the project shall directly relate any one of the elective subjects opted by the student in semester VIII. The project shall be carried out in group not exceeding 5 in number. The project report shall be submitted in triplicate (typed & bound copy not less than 25 pages).

The internal and external examiner appointed by the University shall evaluate the project at the time of the Practical examinations of other semester(s). Students shall be evaluated in groups for four hours (i.e., about half an hour for a group of five students). The projects shall be evaluated as per the criteria given below.

Evaluation of Dissertation Book:

Objective(s) of the work done	15 Marks
Methodology adopted	20 Marks
Results and Discussions	20 Marks
Conclusions and Outcomes	20 Marks

Total **75 Marks**

Evaluation of Presentation:

Presentation of work	25 Marks
Communication skills	20 Marks
Question and answer skills	30 Marks

Total **75 Marks**

Explanation: The 75 marks assigned to the dissertation book shall be same for all the students in a group. However, the 75 marks assigned for presentation shall be awarded based on the performance of individual students in the given criteria.

22. Industrial training (Desirable)

Every candidate shall be required to work for at least 150 hours spread over four weeks in a Pharmaceutical Industry/Hospital. It includes Production unit, Quality Control department, Quality Assurance department, Analytical laboratory, Chemical manufacturing unit, Pharmaceutical R&D, Hospital (Clinical Pharmacy), Clinical Research Organization, Community Pharmacy, etc. After the Semester – VI and before the commencement of Semester – VII, and shall submit satisfactory report of such work and certificate duly signed by the authority of training organization to the head of the institute.

23. Practice School

In the VII semester, every candidate shall undergo practice school for a period of 150 hours evenly distributed throughout the semester. The student shall opt any one of the domains for practice school declared by the program committee from time to time.

At the end of the practice school, every student shall submit a printed report (in triplicate) on the practice school he/she attended (not more than 25 pages). Along with the exams of semester VII, the report submitted by the student, knowledge and skills acquired by the student through practice school shall be evaluated by the subject experts at college level, and grade point shall be awarded.

24. Award of Ranks

Ranks and Medals shall be awarded on the basis of final CGPA. However, candidates who fail in one or more courses during the B. Pharm program shall not be eligible for award of ranks. Moreover, the candidates should have completed the B. Pharm program in minimum prescribed number of years, (four years) for the award of Ranks.

25. Withholding of results: If the candidate has any dues not paid institute or if any case of indiscipline or malpractice is pending against him/her, the result of the candidate shall be withheld and he will not be allowed / promoted into the next higher semester. The issue of awarding a degree is liable to be withheld in such cases.

26. Award of degree: Candidates who fulfill the requirements mentioned above shall be eligible for award of degree during the ensuing convocation.

27. Duration for completion of the program of study

The duration for the completion of the program shall be fixed as double the actual duration of the program and the students have to pass within the said period, otherwise they have to get fresh registration.

Program	B. Pharmacy
Semester	I
Name of the course	Human anatomy and Physiology-I (Theory)
Course Code	BP101T
Credits	4
Hours /week	3hours (lectures) & 1hour (Tutorial)
Pre / co-requisite/s	Nil

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

Course outcomes: Upon completion of this course the student should be able to

CO1: Use anatomical knowledge to predict physiological consequences, and use knowledge of function to predict the features of anatomical structures.

CO2: Synthesize ideas to make a connection between knowledge of anatomy and physiology and real-world situations, including healthy lifestyle decisions and homeostatic imbalances.

CO3: Describe the structure and functions of various organs of the human body

Theory course contents

Unit	Topics	No. of hours
I	<p>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.</p> <p>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)</p>	12

	<p>Paracrine c) Synaptic d) Endocrine</p> <p>Tissue level of organization</p> <p>Classification of tissues, structure, location and functions of epithelial, muscular and nervous and connective tissues.</p>	
II	<p>Integumentary system</p> <p>Structure and functions of skin</p> <p>Skeletal system</p> <p>Divisions of skeletal system, types of bone, salient features and functions of bones of axial and appendicular skeletal system.</p> <p>Organization of skeletal muscle, physiology of muscle contraction, neuromuscular junction.</p> <p>Joints</p> <p>Structural and functional classification, types of joints movements and its articulation.</p>	12
III	<p>Body fluids and blood</p> <p>Body fluids, composition and functions of blood, hemopoiesis, formation of hemoglobin, anemia, mechanisms of coagulation, blood grouping, Rh factors, transfusion, its significance and disorders of blood, Reticulo endothelial system.</p> <p>Lymphatic system</p> <p>Lymphatic organs and tissues, lymphatic vessels, lymph circulation and functions of lymphatic system.</p>	12
IV	<p>Peripheral nervous system</p> <p>Classification of peripheral nervous system: Structure and functions of sympathetic and parasympathetic nervous system.</p> <p>Origin and functions of spinal and cranial nerves.</p> <p>Special senses: Structure and functions of eye, ear, nose and tongue and their disorders.</p>	12
V	<p>Cardiovascular system</p> <p>Heart – anatomy of heart, blood circulation, blood vessels, structure and functions of artery, vein and capillaries, elements of conduction</p>	

	system of heart and heartbeat, its regulation by autonomic nervous system, cardiac output, cardiac cycle. Regulation of blood pressure, pulse, electrocardiogram and disorders of heart.	12
	Total	60

Learning Resources/Recommended Texts/Reference books/web resources

1. Tortora Gerard J, Derrickson Bryan. Principles of anatomy and physiology. 11th ed. Wiley: 2006.
2. Wilson K JW. Ross and Wilson's foundations of anatomy and physiology. 5th ed. Churchill Livingstone: Edinburg; 1981.
3. Guyton arthur C. Physiology of human body.6th ed. Brooks coole Publisher: 1983.
4. Chatterjee C C. Human physiology. Volume I & II. Medical allied agency: Calcutta; 2004.
5. Anne Waugh and Alon Grant. Ross and Wilson Anatomy & Physiology. 11th ed. Churchill Livingstone: 2010.
6. Guyton Arthur C. Text book of Medical Physiology. 10thed. Harcot Publishers: Singapore; 2000.
7. Inderbir Singh. Textbook of Human Histology. Jaypee Brother's Medical Publishers: New Delhi.

Program	B. Pharmacy
Semester	I
Name of the course	Pharmaceutical Analysis I – Theory
Course Code	BP 102T
Credits	4
Hours /week	3hours (lectures) & 1hour (Tutorial)
Pre / co-requisite/s	Nil

Scope: This course deals with the fundamentals of analytical chemistry and principles of electrochemical analysis of drugs.

Course Description:

The pharmaceutical analysis I course provides the knowledge of sources of errors, impurities and titrimetric analysis in quantitative pharmaceutical analysis and aid opportunity to develop awareness of drug quality and its control. It also covers different analytical techniques like Potentiometry, Conductometry, and Polarography techniques.

Course Outcomes: Upon successful completion of this course, the student should be able to

CO 1: Know the different types of errors, its minimization and sources of impurities in pharmaceuticals.

CO 2: Understand the principles of volumetric and electro chemical analysis methods.

CO 3: Develop analytical skills in the determination of percentage purity of the various pharmaceuticals.

Course Content

Unit	Topics	Hours
I (4 Weeks)	(a) Pharmaceutical analysis- Definition and scope Different techniques of analysis Methods of expressing concentration Primary and secondary standards. Preparation and standardization of various molar and normal solutions- Oxalic acid, sodium hydroxide,	16
	Hydrochloric acid, sodium thiosulphate, sulphuric acid, potassium permanganate and ceric ammonium sulphate.	

	<p>(b) Errors: Sources of errors, types of errors, methods of minimizing errors, accuracy, precision and significant figures</p> <p>(c) Pharmacopoeia, Sources of impurities in medicinal agents, limit tests.</p>	
II (2 Weeks)	Acid base titration: Theories of acid base indicators, classification of acid base titrations and theory involved in titrations of strong, weak, and very weak acids and bases, neutralization curves	8
	Non-aqueous titration: Solvents, acidimetry and alkalimetry titration and estimation of Sodium benzoate and Ephedrine HCl	
III (3 Weeks)	Precipitation titrations: Mohr's method, Volhard's, Modified Volhard's, Fajans method, estimation of sodium chloride.	12
	Complexometric titration: Classification, metal ion indicators, masking and demasking reagents, estimation of Magnesium sulphate, and calcium gluconate.	
	Gravimetry: Principle and steps involved in gravimetric analysis. Purity of the precipitate: co-precipitation and post precipitation, Estimation of barium sulphate. Basic Principles, methods and application of diazotisation titration.	
IV (3 Weeks)	Redox titrations Concepts of oxidation and reduction Types of redox titrations (Principles and applications)	12
	Cerimetry, Iodimetry, Iodometry, Bromatometry,	
	Dichrometry, Titration with potassium iodate	
V (3 Weeks)	Electrochemical methods of analysis Conductometry- Introduction, Conductivity cell, Conductometric titrations, applications.	12
	Potentiometry - Electrochemical cell, construction and working of 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 and working of dropping mercury electrode and rotating platinum electrode, applications.	
TOTAL		60

Learning Resources/Recommended Texts/Reference books/web resources

1. Vogel AI. Textbook of quantitative chemical analysis. Fifth ed. Newyork: Longman Scientific & Technical; 1989. ISBN 0582446937
2. Indian pharmacopeia. (2014). Government of India, Ministry of health and family welfare. Vol 1, 2, 3. Ghaziabad: Published by Indian Pharmacopeial commission.
3. The British Pharmacopoeia. (2014). The commission of human medicines pursuant to the medicines act 1968, Vol 1 to 5, London: Published by stationery office on behalf of the medicines and health care products regulatory agency (MHRA).
4. The United states pharmacopoeia-National formulary. (USP 37-NF 32). Rockville: Published by the United States Pharmacopeial convention.
5. The European pharmacopoeia. (2008). sixth ed., Strasbourg: Published by the council of Europe.
6. The Japanese Pharmacopoeia. (2006). 13th ed., Japan: Published by the society of Japanese Pharmacopoeia, under the supervision of the R & D division, Pharmaceutical affairs bureau, Ministry of health & welfare.
7. Skoog DA, James HF, Crouch SR. Principles of Instrumental Analysis. Sixth ed. India: Cengage Learning; 2007. ISBN-13: 978-0495012016, ISBN-10: 0495012017.
8. Connors KA. A textbook of Pharmaceutical Analysis. Third ed. India: Wiley India Pvt. Ltd; 1982. ISBN: 8LGYW9TY5P8.

Program	B. PHARMACY
Semester	I
Name of the course	Pharmaceutics-1
Course Code	BP103T
Credits	4
Hours/week	3hours(lectures) and 1 hour (Tutorial)
Pre/ co-requisite/s	Nil

Course Description

This course is designed to impart a fundamental knowledge on the preparatory pharmacy with arts and science of preparing the different conventional dosage forms.

Course outcome

At the end of the theory course, the student will be able to

CO 1: Define various medical and pharmaceutical terms

CO 2: Explain various principles and procedures involved in formulation of different types of dosage forms

CO 3: Demonstrate professional way of handling the prescription and pharmaceutical incompatibilities

CO 4: Calculate different pharmaceutical calculations involved in formulation

Course content

Unit	Topics	Hours
I (4 Weeks)	Historical background and development of profession of pharmacy: History of profession of Pharmacy in India in relation to pharmacy education, industry and organization, Pharmacy as a career,	16
	Pharmacopoeias: Introduction to IP, BP, USP and Extra Pharmacopoeia.	
	Pharmaceutical calculations: Weights and measures – Imperial & Metric system, Calculations involving percentage solutions, allegation, proof spirit and isotonic solutions based on freezing point and molecular weight	
	Posology: Definition, Factors affecting posology. Pediatric dose calculations based on age, body weight and body surface area.	
II (3 weeks)	Dosage forms: Introduction to dosage forms, classification and definitions., Prescription: Definition, Parts of prescription, handling of Prescription and Errors in prescription	12

	<p>Solid Dosage forms:</p> <p>Powders: Definition, classification, advantages and disadvantages, Simple & compound powders – official preparations, dusting powders, effervescent, efflorescent and hygroscopic powders, eutectic mixtures. Geometric dilutions.</p>	
	<p>Liquid dosage forms: Advantages and disadvantages of liquid dosage forms. Excipients used in formulation of liquid dosage forms. Solubility enhancement techniques.</p>	
III (3 weeks)	<p>Monophasic liquids: Definitions and preparations of Gargles, Mouthwashes, Throat Paint, Eardrops, Nasal drops, Enemas, Syrups, Elixirs, Liniments and Lotions.</p>	12
	<p>Biphasic liquids:</p> <p>Suspensions: Definition, advantages and disadvantages, classifications, Preparation of suspensions; Flocculated and Deflocculated suspension & stability problems and methods to overcome.</p>	
	<p>Emulsions: Definition, classification, emulsifying agent, test for the identification of type of Emulsion, Methods of preparation & stability problems and methods to overcome.</p>	
IV (2 Weeks)	<p>Suppositories: Definition, types, advantages and disadvantages, types of bases, methods of preparations. Displacement value & its calculations, evaluation of suppositories.</p>	10
	<p>Pharmaceutical incompatibilities: Definition, classification, physical, chemical and therapeutic incompatibilities with examples.</p>	
V (2 Weeks)	<p>Semisolid dosage forms: Definitions, classification, mechanisms and factors influencing dermal penetration of drugs.</p>	10
	<p>Preparation of ointments, pastes, creams and gels. Excipients used in semi solid dosage forms. Evaluation of semi solid dosages forms</p>	
TOTAL		60

Recommended reference Books

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.

Program	B. Pharmacy
Semester	I
Name of the course	Pharmaceutical Inorganic Chemistry – Theory
Course Code	BP 104T
Credits	4
Hours /week	3hours (lectures) & 1hour (Tutorial)
Pre / co-requisite/s	Nil

Scope: This subject deals with the monographs of inorganic compounds and pharmaceuticals.

Course description: Pharmaceutical Inorganic chemistry course mainly deals with fundamentals of chemical composition, preparation methods, properties, identification tests, storage, assay & medicinal uses of various inorganic pharmaceuticals according to their monographs mentioned in the various pharmacopoeias. This course provides knowledge on sources of impurities, methods to determine the impurities in inorganic drugs and gives the importance of radiopharmaceuticals in the various fields.

Course Outcomes: Upon successful completion of this course, the student should be able to:

CO 1: State the concept & content of specifications mentioned in monograph for various categories of inorganic pharmaceuticals along with their medicinal uses.

CO 2: Demonstrate the knowledge of various types of errors and various sources of impurities in the pharmaceuticals.

CO 3: Apply the suitable principles in determination of purity by limit tests and percentage purity by assay methods as per the pharmacopoeias (Indian Pharmacopoeia, British Pharmacopoeia, United States Pharmacopoeia)

Course Content

Unit	Topics	Hours
I (3 Weeks)	Impurities in pharmaceutical substances: History of Pharmacopoeia, Sources and types of impurities,	12
	Principle involved in the limit test for Chloride, Sulphate, Iron, Lead	
	Principle involved in the limit test for Arsenic, Heavy metals and modified limit test for Chloride and Sulphate.	
<i>General methods of preparation, assay for the compounds superscripted with asterisk (*),</i>		

<i>properties and medicinal uses of inorganic compounds belonging to the following classes</i>		
II (4 Weeks)	Acids, Bases and Buffers: Concepts of acid and bases – Arrhenius, Bronsted-Lowry and Lewis. Concept of pH and buffer, types of buffers with examples	16
	Major extra and intracellular electrolytes: Functions of major physiological 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 dental caries, Desensitizing agents, Calcium carbonate, Sodium fluoride, and Zinc eugenol cement.	
III (3 Weeks)	Gastrointestinal agents Acidifiers: Ammonium chloride* and Dil. HCl Antacid: Ideal properties of antacids, combinations of antacids, Sodium Bicarbonate*, Aluminum hydroxide gel, Magnesium hydroxide mixture	12
	Cathartics: Magnesium sulphate, Sodium orthophosphate, Kaolin and Bentonite	
	Antimicrobials: Mechanism, classification, Potassium permanganate, Boric acid, Hydrogen peroxide*, Chlorinated lime*, Iodine and its preparations	
IV (3 Weeks)	Miscellaneous compounds Expectorants: Potassium iodide, Ammonium chloride*. Emetics: Copper sulphate*, Sodium potassium tartarate	10
	Haematinics: Ferrous sulphate*, Ferrous gluconate Poison and Antidote: Sodium thiosulphate*, Activated charcoal, Sodium nitrite	
	Astringents: Zinc Sulphate, Potash Alum	
V	Radiopharmaceuticals: Radio activity, Measurement of	10

(3 Weeks)	radioactivity, Properties of α , β , γ radiations, Half-life,	
	Radioisotopes and study of radioisotopes - Sodium iodide I^{131} , Storage conditions, precautions & pharmaceutical application of radioactive substances.	
	Revision	
TOTAL		60

Learning Resources/Recommended Texts/Reference books/web resources

Text Books:

1. A.H.Beckett and J.B.Stenlake. Practical pharmaceutical chemistry. Part-I. The Athlone press: University of London; 1968.
2. J.H Block, E.Roche, T.O Soine and C.O. Wilson. Inorganic Medical and Pharmaceutical Chemistry. Lea & Febiger Philadelphia PA; 1974.
3. G.R. Chatwal. Pharmaceutical Chemistry – Inorganic. Fifth edition. Himalaya Publishing House: Mumbai, India; 2014.
4. A.A. Napoleon. Pharmaceutical Titrimetric Analysis Theory and Practical. Second ed. Kalaimani Publishers & Distributers: Kanchipuram; 2013.
5. J. Mendham, R.C. Denney, J. D. Barnes and M.J.K. Thomas. Vogel's Quantitative Chemical Analysis. Sixth edition. Pearson education Delhi; 2000.

References:

1. Gary L. Miessler, Paul J. Fischer and Donald A. Tarr. Inorganic chemistry. Fifth edition. Pearson education New Delhi; 2014.
2. P. Gundu Rao. Pharmaceutical and Medicinal Inorganic Chemistry. First edition. Vallabh Prakashan Delhi; 2008.
3. G.D. Tuli, R.D. Madan, S.K. Basu and Satya Prakash. Advanced Inorganic Chemistry. Volume 1. Published by S. Chand & Company Ltd; 2014.
4. William L. Jolly. Modern Inorganic Chemistry. Second edition. Mc Graw-Hill: New York; 1984.
5. A.H.Beckett and J.B.Stenlake. Textbook of Pharm. Analysis. CBS Publishers, Delhi.
6. Indian Pharmacopoeia.

Program	B. Pharm
Semester	I
Name of the course	Communication Skills
Course Code	BP105T
Credits	2
Hours /week	2
Pre / co-requisite/s	Nil

Course Description: This course will prepare the young pharmacy student to interact effectively with doctors, 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 Learning Outcomes: Upon completion of this course, the student shall be able to:

CO1: Understand the behavioral needs for a Pharmacist to function effectively in the areas of pharmaceutical operation.

CO2: Communicate effectively (Verbal and Non-Verbal)

CO3: Effectively manage the team as a team player.

CO4: Develop interview skills, Leadership qualities and essentials.

Theory Course: Contents

UNIT	Topic	Hours
I	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, Cultural Barriers, Language Barriers, Gender Barriers, Interpersonal Barriers, Psychological Barriers, Emotional Barriers. Perspectives in Communication: Introduction, Visual Perception, Language, Other factors affecting our Perspective – Past Experiences, Prejudices, Feelings, Environment.	07
II	Elements of Communication: Introduction, Face to Face Communication – Tone of Voice, Body Language (Non – Verbal communication), Verbal Communication, Physical Communication.	07

	Communication Styles: Introduction, The Communication Styles Matrix with example for each – Direct Communication Style, Spirited Communication Style, Systematic Communication Style, Considerate Communication Style.	
III	Basic Listening Skills: Introduction, Self – Awareness, Active Listening, Becoming an Active Listening in Difficult Situations. Effective Written Communication: Introduction, When and When Not to Use Written Communication – Complexity of the Topic, Amount of Discussion’ Required, Shades of Meaning, Formal Communication. Writing Effectively: Subject Line, Put the Main Point First, Know Your Audience, Organization of the Message.	07
IV	Interview Skills: Purpose of an interview, Do’s and Don’t’s of an interview. Giving Presentations: Dealing with Fears, planning your Presentation, Structuring Your Presentation, Delivering Your Presentation, Techniques of Delivery.	05
V	Group Discussion: Introduction, Communication skills in group discussion, Do’s and Don’t’s of group discussion.	04
	Total	30

Recommended Books: (Latest Editions)

1. Basic communication skills for Technology, Andreha.J. Ruther Ford, 2nd Edition, Pearson Education, 2011.
2. Communication skills, Sanjay Kumar, Pushpalata, 1st Edition, Oxford Press, 2011.
3. Organizational Behaviorur, Stephen . P . Robbins, 1st Edition, Pearson, 2013
4. Brilliant – Communication skills, Gill Hasson, 1st Edition, Pearson Life, 2011
5. The Ace of soft skills : Attitude, Communication and Etiquette for success, Gopala Swamy Ramesh, 5th Edition, 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, 2nd Edition, New arrivals – PHI, 2011.

8. Soft skill for everyone, Butter Field, 1st Edition, Cengage Learning India Pvt.Ltd, 2011
9. Soft skills and professional communication, Francis Peters SJ, 1st Edition, Mc Graw Hill Education, 2011
10. Effective communication, John Adair, 4th Edition, Pan Mac Millan, 2009.

Program	B. Pharm
Semester	I
Name of the course	Remedial Biology (Theory)
Course Code	BP 106RBT
Credits	2
Hours /week	2 Hours (Lectures)
Pre / co-requisite/s	Nil

Course Description: To learn and understand the components of living world, structure and functional system of plant and animal kingdom.

Course Learning Outcomes:

Upon completion of the course, the student shall be able to

CO1: Know the classification and salient features of five kingdoms of life

CO2: Understand the basic components of anatomy & physiology of plant

CO3: Know understand the basic components of anatomy & physiology animal with special reference to human

Theory Course: Contents

UNIT	Topic	Hours
I	<p>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, Protista, 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 & Dicotyledons.</p>	07

II	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 volumes	07
III	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	07

	Parts of female reproductive system Parts of male reproductive system Spermatogenesis and Oogenesis Menstrual cycle	
IV	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.	05
V	Plant respiration: Respiration, glycolysis, fermentation (anaerobic). Plant growth and development Phases and rate of plant growth, Condition of growth, Introduction to plant growth regulators Cell - The unit of life Structure and functions of cell and cell organelles. Cell division Tissues Definition, types of tissues, location and functions.	04
	Total	30

Text Books

1. Text book of Biology by S. B. Gokhale
2. 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. D.Outlines of Zoology by M. Ekambaranathaayyer and T. N. Ananthkrishnan.
5. E. A manual for pharmaceutical biology practical by S.B. Gokhale and C. K. Kokate

Program	B. Pharm
Semester	I
Name of the course	Remedial Mathematics
Course Code	BP106RMT
Credits	2
Hours /week	2 hours (lectures)
Pre / co-requisite/s	Nil

Course Description: This is an introductory course in mathematics. This subject deals with the Introduction to Algebra, Trigonometry, Co-Ordinate geometry, Differential Calculus, Integral Calculus, Differential Equations, Laplace Transforms.

Course Learning Outcomes: Upon successful completion of this course, the student should be able to:

CO 1: Define Algebra, Trigonometry, Co-Ordinate geometry, Differential Calculus, Integral Calculus, Differential Equations, Laplace Transforms and their applications.

CO 2: Solve the problems of different types by applying theory.

CO 3: Appreciate the important applications of Mathematics in Pharmacy.

Theory Course: Contents

Unit	Topics	Hours
I	Algebra: Arithmetic Progression –Geometric Progression, Logarithms: Logarithm of a real number to an arbitrary base, theorems on Logarithms, application of logarithms in Pharmaceutical computations and Partial fractions.	5
II	Trigonometry: Trigonometric ratios and the relations between them, Sin (A+B), Cos (A+B), Tan (A+B) formulae only, Trigonometric ratios of multiple and submultiple angles.	5
III	Co-Ordinate Geometry Distance between points, Area of a Triangle, Co-Ordinates of a point dividing a given line segment in a given ratio, equation to a straight line in different forms.	5

IV	Differential calculus: Limit of a function differentiation, derivatives of trigonometric functions, logarithmic and partial differentiation, Maxima and minima (elementary).	4
V	Integration: Definition of integration, indefinite of integrals, standard integrals, fundamental rules of Integration, Integration by substitution, integration by parts and definite Integrals, properties of definite Integrals	5
VI	Differential Equations: Order and degree, formation of the differential equation, solutions of the first order and first-degree differential equations (variable separable). Applications of first order and first-degree differential equation: law of natural growth and decay, Newton's law of cooling.	6
VII	Laplace transforms: Definition, elementary functions, Properties of linearity and shifting, transforms of multiplication by tn	2
Total		30

Learning Resources/Recommended Texts/Reference books/web resources

1. Intermediate first and second year mathematics text books printed and published by Telugu Academy.
2. P. Seshagiri Rao. A Text book of Remedial Mathematics. Pharma med press; 2008.

Program	B. Pharm
Semester	I
Name of the course	Human Anatomy & Physiology – I Practical
Course Code	BP107P
Credits	2
Hours /week	4 hours (Practical)
Pre / co-requisite/s	Nil

Course outcomes

CO 1: Identify the various tissues and organs of different systems of human body.

CO 2: Perform the various experiments related to special senses and nervous system.

CO 3: Appreciate coordinated working pattern of different organs of each system.

Practical Course: Contents

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

14	Recording of Blood pressure.
15	Revision

Learning Resources/Recommended Texts/Reference books/web resources

1. Tortora Gerard J, Derrickson Bryan. Principles of anatomy and physiology. 11th ed. Wiley: 2006.
2. Wilson K JW. Ross and Wilson's foundations of anatomy and physiology. 5th ed. Churchill Livingstone: Edinburg; 1981.
3. Guyton arthur C. Physiology of human body.6th ed. Brooks coole Publisher: 1983.
4. Chatterjee C C. Human physiology. Volume I & II. Medical allied agency: Calcutta; 2004.
5. Anne Waugh and Alon Grant. Ross and Wilson Anatomy & Physiology. 11th ed. Churchill Livingstone: 2010.
6. Guyton Arthur C. Text book of Medical Physiology. 10thed. Harcot Publishers: Singapore; 2000.
7. Kale S R,Kale R R.practical human anatomy and physiology.19th ed. Pune. Nirali prakashan;2009.
8. Goyal R K, Natvar M P, Shah S A. Practical anatomy, Physiology and biochemistry,1st ed. Publisher: B S Shah Publisher: Ahmadabad; 1988.
9. C.L. Ghai. Textbook of Practical Physiology. Jaypee brother's medical publishers.
10. K. Srinageswari Rajeev Sharma. Practical workbook of Human Physiology. Jaypee brother's medical publisher

Program	B. Pharmacy
Semester	I
Name of the course	Pharmaceutical Analysis I – Practical
Course Code	BP 108P
Credits	2
Hours /week	4 Hours
Pre / co-requisite/s	Nil

Course Description: The Pharmaceutical Analysis – I practical course describes the fundamental skills of limit tests, standardization and assay methods for the various pharmaceutical products. It also provides the awareness of determinate and indeterminate errors while performing the analysis like Potentiometry, Conductometry.

Course Outcomes: Upon successful completion of this course, the student should be able to

CO 1: Illustrate the limits of chloride, sulphate & heavy metals content in various pharmaceuticals.

CO 2: Understand the quantitative standardization and assay methods by volumetric analysis.

CO 3: Adapt various electrochemical techniques to quantify the acids & bases.

Week	Topic
I. Limit test of the following	
1	Chloride
2	Sulphate
3	Iron
4	Arsenic
II. Preparation and standardization of	
5	Sodium hydroxide
6	Sulphuric acid
7	Sodium thiosulfate
8	Potassium permanganate
9	Ceric ammonium sulphate
III Assay of the following compounds along with Standardization of Titrant	
10	Ammonium chloride by acid base titration

11	Ferrous sulphate by Cerimetry
12	Copper sulphate by Iodometry
13	Calcium gluconate by Complexometry
14	Hydrogen peroxide by Permanganometry
15	Sodium benzoate by non-aqueous titration
16	Sodium Chloride by precipitation titration
IV. Determination of Normality by electro-analytical methods	
17	Conductometric titration of strong acid against strong base
18	Conductometric titration of strong acid and weak acid against strong base
19	Potentiometric titration of strong acid against strong base

Learning Resources/Recommended Texts/Reference books/web resources

1. Vogel AI. Textbook of quantitative chemical analysis. Fifth ed. New York: Longman Scientific & Technical; 1989. ISBN 0582446937
2. Indian pharmacopeia. (2014). Government of India, Ministry of health and family welfare. Vol 1, 2, 3. Ghaziabad: Published by Indian Pharmacopeial commission.
3. The British Pharmacopoeia. (2014). The commission of human medicines pursuant to the medicines act 1968, Vol 1 to 5, London: Published by stationery office on behalf of the medicines and health care products regulatory agency (MHRA).
4. The United states pharmacopoeia-National formulary. (USP 37-NF 32). Rockville: Published by the United States Pharmacopeial convention.
5. Skoog DA, James HF, Crouch SR. Principles of Instrumental Analysis. Sixth ed. India: Cengage Learning; 2007. ISBN-13: 978-0495012016, ISBN-10: 0495012017.
6. Connors KA. A textbook of Pharmaceutical Analysis. Third ed. India: Wiley India Pvt. Ltd; 1982. ISBN: 8LGYW9TY5P8.
7. Napoleon AA. Pharmaceutical titrimetric analysis, India: Kalaimani publishers and distributors; 2013.

Program	B. Pharm
Semester	I
Name of the course	Pharmaceutics I – Practical
Course Code	BP109P
Credits	2
Hours /week	4 hours

Course Description: The General Pharmacy and Dosage forms practical course is aimed to train the students on formulation of different types of dosage forms. This course also deals with pharmaceutical calculations which are essential in compounding and utilization of dosage forms. This course also provides the skills to identify various incompatibilities in handling of prescriptions.

Course Learning Outcomes: Upon successful completion of this course, the student should be able to:

CO 1: Identify various incompatibilities in handling of Prescriptions

CO 2: Calculate different pharmaceutical calculations involved in formulation.

CO 3: Formulate different types of dosage forms.

Practical Course Contents:

S. No	Experiments
1	Syrups Syrup IP'66 Orange Syrup
2	Elixirs Piperazine citrate elixir Paracetamol pediatric elixir
3	Linctus Terpin Hydrate Linctus IP'66 Iodine Throat Paint (Mandles Paint)
4	Solutions Strong solution of ammonium acetate Cresol with soap solution

	Lugol's solution
5	Suspensions Calamine lotion Magnesium Hydroxide mixture Aluminium Hydroxide gel
6	Emulsions Turpentine Liniment Liquid paraffin emulsion
7	Powders and Granules ORS powder (WHO) Effervescent granules Dusting powder Divided powders
8	Suppositories Glycero gelatin suppository Cocoa butter suppository Zinc Oxide suppository
9	Semisolids: Sulphur ointment, Non staining-iodine ointment with methyl salicylate
10	Gargles and Mouthwashes: Iodine gargle, Chlorhexidine mouthwash Phenol Gargel

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.

Program	B. Pharmacy
Semester	I
Name of the course	Pharmaceutical Inorganic Chemistry – Practical
Course Code	BP 110P
Credits	2
Hours /week	4 hours
Pre / co-requisite/s	Nil

Course Description: Pharmaceutical inorganic chemistry laboratory course aimed to train the students on experimental techniques for the determination of impurities and their limits as per the pharmacopoeias. This course also deals with identification of various cations & anions of inorganic compounds by their chemical tests. This course also provides laboratory skills related to calibration and percentage purity analysis by volumetric titrations as per monographs specified in various pharmacopoeias.

Course Outcomes: Upon successful completion of this course, the student should be able to

CO 1: Perform the limit tests, assay methods to know the impurities limit, and percentage purity of the pharmaceuticals.

CO 2: Differentiate various cations and anions by chemical tests.

CO 3: Identify the purity of the various pharmaceuticals by suitable methods

Week	TOPICS
Limit tests for the following ions	
1	Limit test for Chlorides
2	Limit test for Sulphates
3	Modified limit test for Chlorides and Sulphates
4	Limit test for Iron
5	Limit test for Lead
6	Limit test for Arsenic
Identification tests for the following	
7	Identification tests for Ferrous sulphate
8	Identification tests for Sodium bicarbonate
9	Identification tests for Potassium chloride

Test for purity	
10	Swelling power of Bentonite
11	Neutralizing capacity of aluminum hydroxide gel
12	Estimation of Sodium carbonate and sodium hydroxide in mixture
13	Estimation of borax and boric acid mixture
Preparation of inorganic pharmaceuticals	
14	Boric acid
15	Potash alum

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. Indian Pharmacopoeia
8. Pharmacopoeia.

Program	B. Pharm
Semester	I
Name of the course	Communication Skills -Practical
Course Code	BP111P
Credits	1
Hours /week	2 hours
Pre / co-requisite/s	Nil

Course Description: This course will prepare the young pharmacy student to interact effectively with doctors, 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 Learning Outcomes: Upon completion of this course, the student shall be able to:

CO1: Understand the behavioral needs for a Pharmacist to function effectively in the areas of pharmaceutical operation.

CO2: Communicate effectively (Verbal and Non-Verbal).

Practical Course: Contents

S. No.	Topic
1.	Basic communication covering the following topics: Meeting People, Asking Questions, Making Friends, what did you do? Do's and Don'ts.
2.	Pronunciations covering the following topics: Pronunciation (Consonant Sounds), Pronunciation and Nouns, Pronunciation (Vowel Sounds).
3.	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 Editions)

1. Basic communication skills for Technology, Andreha.J. Ruther Ford, 2nd Edition, Pearson Education, 2011.
2. Communication skills, Sanjay Kumar, Pushpalata, 1st Edition, Oxford Press, 2011.
3. Organizational Behaviour, Stephen. P. Robbins, 1st Edition, Pearson, 2013.
4. Brilliant – Communication skills, Gill Hasson, 1st Edition, Pearson Life, 2011.

5. The Ace of soft skills: Attitude, Communication and Etiquette for success, Gopala Swamy Ramesh, 5th Edition, 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, 2nd Edition, New arrivals – PHI, 2011.
8. Soft skill for everyone, Butter Field, 1st Edition, Cengage Learning India Pvt.Ltd, 2011.
9. Soft skills and professional communication, Francis Peters SJ, 1st Edition, Mc Graw Hill Education, 2011.
10. Effective communication, John Adair, 4th Edition, Pan Mac Millan, 2009.

Program	B. Pharm
Semester	II
Name of the course	Human Anatomy & Physiology – II
Course Code	BP201T
Credits	4
Hours /week	3 (Lectures) + 1 (Tutorial)
Pre / co-requisite/s	Nil

Scope: This course aimed to provide fundamental knowledge on the structure and functions of the human body. This course deals with the role of hormones and its regulation. This course describes the structure and functions of various organ systems of the human body like nervous, digestive, respiratory, urinary, endocrine, reproductive systems. This course describes about basics of genetics.

Course outcomes: Upon completion of this course the student should be able to

CO1. Describe the structure and functions of various organs of the human body.

CO2. Explain the various hormones and their imbalances.

CO3. Synthesize ideas to make a connection between knowledge of anatomy and physiology and real-world situations, including healthy lifestyle decisions and homeostatic imbalances.

Unit	Topics	No. of hours
I	<p>Nervous system</p> <p>Organization of nervous system, neuron, neuroglia, classification and properties of nerve fiber, electrophysiology, action potential, nerve impulse, receptors, synapse, neurotransmitters.</p> <p>Central nervous system: Meninges, ventricles of brain and cerebrospinal fluid. Structure and functions of brain (cerebrum, brain stem, cerebellum), spinal cord (gross structure, functions of afferent and efferent nerve tracts, reflex activity)</p>	12
II	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.	12
III	<p>Respiratory system</p> <p>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.</p> <p>Urinary system</p> <p>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.</p>	12
IV	<p>Endocrine system</p> <p>Classification of hormones, mechanism of hormone action, structure and functions of pituitary gland, thyroid gland, parathyroid gland, adrenal gland, pancreas, pineal gland, thymus and their disorders.</p>	12
V	<p>Reproductive system</p> <p>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.</p>	12
	Total	60

Learning Resources/Recommended Texts/Reference books/web resources

1. Tortora Gerard J, Derrickson Bryan. Principles of anatomy and physiology. 11th ed. Wiley: 2006.
2. Wilson K JW. Ross and Wilson's foundations of anatomy and physiology. 5th ed. Churchill Livingstone: Edinburg; 1981.
3. Guyton arthur C. Physiology of human body.6th ed. Brooks coole Publisher: 1983.

4. Chatterjee C C. Human physiology. Volume I & II. Medical allied agency: Calcutta; 2004.
5. Anne Waugh and Alon Grant. Ross and Wilson Anatomy & Physiology. 11th ed. Churchill Livingstone: 2010.
6. Guyton Arthur C. Text book of Medical Physiology. 10thed. Harcot Publishers: Singapore; 2000.
7. Inderbir Singh. Textbook of Human Histology. Jaypee Brother's Medical Publishers: New Delhi.

Program	B. Pharmacy
Semester	II
Name of the course	Pharmaceutical Organic Chemistry-I
Course Code	BP202T
Credits	4
Hours /week	3 (Lectures) + 1 (Tutorial)
Pre / co-requisite/s	Nil

Course Description: The Pharmaceutical Organic Chemistry-I course is aimed to present fundamental in chemistry of organic compounds. It emphasizes on basic nomenclature, physical and chemical properties of various organic compounds. The course will describe the pharmaceutical importance of these functional groups, isomerism and their molecular structures and properties in chemistry of drug substances. This also deals with various mechanisms involved in synthesis and reaction of chemical compounds.

Course Learning Outcomes:

Upon successful completion of this course, the student should be able to:

CO1: Define the nomenclature, physical and chemical properties of a molecule in relation to the structure of organic compounds.

CO2: Write the structure, name and the type of isomerism of the organic compound

CO3: Explain the possible mechanism and the intermediate product involved in a chemical reaction

CO4: Identify and confirm the unknown organic compound

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	Topics	Hours
I (3 weeks)	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	8

	isomerisms in organic compounds	
II (4 Weeks)	Alkanes*, Alkenes* and Conjugated dienes* SP3 hybridization in alkanes, Halogenation of alkanes, uses of paraffins.	15
	Stabilities of alkenes, SP2 hybridization in alkenes E1 and E2 reactions–kinetics, order of reactivity of alkyl halides, rearrangement of carbocations, Saytzeffs orientation and evidences.	
	E1 versus E2 reactions, Factors affecting E1 and E2 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	
III (3 Weeks)	Alkyl halides* SN1 and SN2 reactions - kinetics, order of reactivity of alkyl halides, stereochemistry and rearrangement of carbocations.	15
	SN1 versus SN2 reactions, Factors affecting SN1 and SN2 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.	
IV (3 Weeks)	Carbonyl compounds* (Aldehydes and ketones) Nucleophilic addition, Electromeric effect, aldol condensation, Crossed Aldol condensation,.	12
	Cannizzaro reaction, Crossed Cannizzaro reaction, Benzoin	

	condensation, Perkin condensation, qualitative tests, Structure and uses of Formaldehyde, Paraldehyde, Acetone, Chloral hydrate, Hexamine, Benzaldehyde, Vanilin, Cinnamaldehyde	
V (3 Weeks)	Carboxylic acids Acidity of carboxylic acids, effect of substituents on acidity, inductive effect and qualitative tests for carboxylic acids. Chemistry, reactivity and qualitative tests of esters and amides.	10
	Aliphatic amines- Basicity, effect of substituent on Basicity. Qualitative test, Structure and uses of ethanolamine, Ethylenediamine, Amphetamine	
	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	
Total		60

References

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. Organic Chemistry by Vogel
6. Organic Chemistry by McGraw Hill
7. Organic reactions and mechanism by Jerry March
8. Organic chemistry by Solomons and Graham

Program	B. Pharmacy
Semester	II
Name of the course	Biochemistry
Course Code	BP203T
Credits	4
Hours /week	3 (Lectures) + 1 (Tutorial)
Pre / co-requisite/s	Nil

Course Description

Biochemistry deals with complete understanding of the molecular levels of the chemical 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 Learning Outcomes: Upon successful completion of this course, the student should be able to:

CO 1: Define enzymes, enzyme inhibitors, carbohydrates, proteins, lipids and nucleic acids, electron transport chain and oxidative phosphorylation.

CO 2: Explain the chemistry, classification, uses and metabolism of carbohydrates, proteins, lipids and nucleic acids.

CO 3: Discuss the metabolic disorders of carbohydrates, proteins, lipids and nucleic acids. Synthesize DNA and RNA

CO 4: Analyze the constituents present in urine.

Unit	Topics	Hours
I (3 Weeks)	Biomolecules Introduction, classification, chemical nature and biological role of carbohydrate, lipids, nucleic acids, amino acids and proteins.	12
	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	
II (3Weeks)	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.	12
	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	
III (4 Weeks)	Lipid metabolism: β -Oxidation of saturated fatty acid (Palmitic acid) Formation and utilization of ketone bodies; ketoacidosis De novo synthesis of fattyacids (Palmitic acid) ,	16
	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 (Phenylketonuria, Albinism, alkeptonuria, tyrosinemia)	
	Significance of biological substances; 5-HT, melatonin, dopamine, noradrenaline, adrenaline. Catabolism of heme; hyperbilirubinemia and jaundice	
	Nucleic acid metabolism and genetic information transfer. Biosynthesis of purine and pyrimidine nucleotides.	10

IV (3 Weeks)	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	
V (3 Weeks)	Enzymes: Introduction, properties, nomenclature and IUB classification of enzymes Enzyme kinetics (Michaelis plot, Line Weaver Burke plot) Enzyme inhibitors with examples Regulation of enzymes:	10
	enzyme induction and repression, allosteric enzymes regulation Therapeutic and diagnostic applications of enzymes and isoenzymes	
	Coenzymes –Structure and biochemical functions	
Total		60

Program	B. Pharm
Semester	II
Name of the course	Pathophysiology
Course Code	BP204T
Credits	4
Hours /week	3 (Lectures) + 1 (Tutorial)
Pre / co-requisite/s	Nil

Scope: The Pathophysiology course is designed to impart a thorough knowledge of the relevant aspects of pathology of various conditions and understanding of basic pathophysiological mechanisms. The course covers the basics of cell biology, inflammation, mechanism of body defense, abnormal cell growth and focuses on the pathophysiology of common disease processes of human body system.

Course Outcomes: Upon successful completion of this course, the student should be able to:

CO 1: Define the basic terminology related to pathophysiology.

CO 2: Describe the etiology and pathogenesis of the selected disease states.

CO 3: Name the signs, symptoms and complications of the diseases.

CO 4: Define the basic approach to diagnosis and diagnostic procedures of human diseases.

CO 5: Correlate the Pathophysiology with prognosis, medical treatment of the diseases.

Theory Course: Contents

Unit	Topics	Hours
I	<p>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.</p> <p>Basic mechanism involved in the process of inflammation and repair: Introduction, Clinical signs of inflammation, Different types</p>	

	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	12
II	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	12
III	Hematological Diseases: Iron deficiency, megaloblastic anemia (Vit B12 and folic acid), sickle cell anemia, thalassemia, hereditary acquired anemia, hemophilia. Endocrine system: Diabetes, thyroid diseases, disorders of sex hormones. Nervous system: Epilepsy, Parkinson's disease, stroke, psychiatric disorders: depression, schizophrenia and Alzheimer's disease. Gastrointestinal system: Peptic Ulcer	12
IV	Inflammatory bowel diseases, jaundice, hepatitis (A, B, C, D, E, F) alcoholic liver disease. Disease of bones and joints: Rheumatoid arthritis, osteoporosis and gout. Diseases of bones and joints: Rheumatoid Arthritis, Osteoporosis, Gout. Principles of cancer: Classification, etiology and pathogenesis of cancer. Principles of Cancer: Classification, etiology and pathogenesis of Cancer.	12
V	Infectious Diseases: Meningitis, Typhoid, Leprosy, Tuberculosis, Urinary Tract Infections. Sexually transmitted diseases: AIDS, Syphilis, Gonorrhea	12
	Total	60

Learning Resources/Recommended Texts/Reference books/web resources

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. 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.

Program	B. Pharm
Semester	II
Name of the course	Computer Applications in Pharmacy
Course Code	BP205T
Credits	3
Hours /week	3
Pre / co-requisite/s	Nil

Course Description: The Computer Applications In Pharmacy course is aimed at to learn the fundamentals of computers like scope, classification of computers, their number system, software, data base, application of computer in pharmacy and role of management information system used in the organizations.

Computer is mandatory in this advanced era and pharmacy and related subjects are not exception to it. This review mainly focuses on the various applications, software's and use of computers in pharmacy. Computer science and technology is deeply utilized in pharmacy field everywhere like in pharmacy colleges, pharmaceutical industries, research centers, hospital pharmacy and many more. Computer significantly reduces the time, expenditure, and manpower required for any kind of work. Development of various software's makes it trouble-free to handle huge data. In short, computers are playing critical role in pharmacy field, without computers pharmacy research will be long-lasting and expensive.

Course Learning Outcomes: Upon successful completion of this course, the student should be able to:

CO1: Demonstrates the introduction of computers.

CO2: State importance of computers, processing the data in MS-Office.

CO3: Navigate a Windows operating system environment as well as install and operate basic software utilities

CO4: Identifies the development life cycle of system.

CO5: Demonstrates the maintenance of pharmacy drug database.

CO6: Recognize basic technologies related to an office environment

Theory Course: Contents

UNIT	Topic	Hours
I	Introduction to Computers: Number system: Binary number system, Decimal number system, Octal number system, Hexadecimal number systems. Conversion decimal to binary, binary to decimal, octal to binary etc., Binary addition, subtraction, multiplication, division One's complement, Two's complement method. 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.	12
II	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.	10
III	Application of computers in Pharmacy: Drug information storage and retrieval, 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.	10
IV	Bioinformatics: Introduction, Objective of Bioinformatics, Bioinformatics Databases, Concept of Bioinformatics, Impact of Bioinformatics in Vaccine Discovery.	8

V	Computers as data analysis in Preclinical development: Chromatographic data analysis (CDS), Laboratory Information management System (LIMS) and Text Information Management System (TIMS).	5
Total		45

Recommended Books: (Latest Editions)

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

Program	B. Pharmacy
Semester	II
Name of the course	Environmental Sciences – Theory
Course Code	BP 206T
Credits	3
Hours /week	3 Hours (lectures)
Pre / co-requisite/s	Nil

Course description: Environmental Sciences is the scientific study of the environmental system and the 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 Outcomes: Upon completion of the course, the student shall be able to

CO 1: Create the awareness about environmental problems among learners.

CO 2: Impart basic knowledge about the environment, its allied problems and develop an attitude of concern for the environment.

CO 3: Motivate learner to participate in environment protection and environment improvement.

CO 4: Acquire skills to help the concerned individuals in identifying and solving environmental problems.

Course Content

Unit	Topic	Hours
I (6 Weeks)	<p>The Multidisciplinary nature of environmental studies Natural Resources</p> <p>Renewable and non-renewable resources: Natural resources and associated problems of the following-In context to INDIA.</p> <p>a) Forest resources: Types, distribution, Uses and deforestation and its consequences. Conservation of Forests.</p> <p>b) Water resources: Types, distribution and conservation of water sources</p> <p>c) Mineral resources: Distribution and conservation</p> <p>d) Food resources: Sources of food, supply and security context</p> <p>e) Energy resources: overview on types.</p>	18

	f) Land resources: overview on types, Distribution and conservation	
II (5 Weeks)	Ecosystems Concept of an ecosystem. Structure and function of an ecosystem. <i>Introduction, types, characteristic features, structure and function of the ecosystems</i> Forest ecosystem Grassland ecosystem; Desert ecosystem, Desertification causes and consequence. Aquatic Ecosystem: Fresh water and marine ecosystem. Biodiversity: Levels of biodiversity and its conservation methods, Role of International organization like UNFCCC, IUCCD, IUCBD and etc. in Ecosystem.	15
III (4 Weeks)	Environmental Pollution: Causes, consequences and overview on preventive measures in India for the following Air pollution, Water pollution, Soil pollution	12
TOTAL		45

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 Publishing Pvt. Ltd., Ahmedabad – 380 013, India.
4. Brunner R.C., 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480p
5. Clark R.S., Marine Pollution, Clarendon 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. Down of Earth, Centre for Science and Environment
8. Shankar IAS, Environment.2021, Shankar IAS Academy, Chennai.
9. Goh Cheng Leong, Certificate Physical and Human Geography, Oxford University Press YMCA Library, New Delhi.

Program	B. Pharm
Semester	II
Name of the course	Human Anatomy & Physiology – II Practical
Course Code	BP207P
Credits	2
Hours /week	4 hours (Practical)
Pre / co-requisite/s	Nil

Scope: This course is aimed to train the students on experimental techniques and allows the verification of physiological processes discussed in theory classes through experiments on living tissue, intact animals or normal human beings. This course also aimed to expertise the students on identification of various types of tissues & organ systems of the human body.

Course Outcomes: Upon successful completion of this course, the student should be able to:

CO 1: Understand the coordinated working pattern of different organs of each system

CO 2: Explain different family planning methods.

CO 3: Estimate tidal volumes, vital capacity, temperature and basal mass index

CO 4: Demonstrate laboratory procedures used to examine anatomical structures and evaluate physiological functions of each organ system.

Practical Course: Contents

Week	Topics
1	Study the integumentary and special senses using specimen, models, etc.,
2	Study of the nervous system using specimen, models, etc.,
3	Study of the endocrine system using specimen, models, etc
4	Demonstrate the general neurological examination
5	Demonstrate the function of olfactory nerve
6	Examine the different types of taste.
7	Demonstrate the visual acuity and reflex activity
8	Recording of body temperature and basal mass index
9	Demonstrate positive and negative feedback mechanism.
10	Determination of tidal volume and vital capacity.
11	Study of digestive, respiratory, cardiovascular systems, urinary and

	reproductive systems with the help of models, charts and specimens.
12	Study of family planning devices and pregnancy diagnosis test.
13	Demonstration of total blood count by cell analyser
14	Permanent slides of vital organs and gonads.
	Revision

Learning Resources/Recommended Texts/Reference books/web resources

1. Tortora Gerard J, Derrickson Bryan. Principles of anatomy and physiology. 11th ed. Wiley: 2006.
2. Wilson K JW. Ross and Wilson's foundations of anatomy and physiology. 5th ed. Churchill Livingstone: Edinburg; 1981.
3. Guyton arthur C. Physiology of human body.6th ed. Brooks coole Publisher: 1983.
4. Chatterjee C C. Human physiology. Volume I & II. Medical allied agency: Calcutta; 2004.
5. Anne Waugh and Alon Grant. Ross and Wilson Anatomy & Physiology. 11th ed. Churchill Livingstone: 2010.
6. Guyton Arthur C. Text book of Medical Physiology. 10thed. Harcot Publishers: Singapore; 2000.
7. Kale S R,Kale R R.practical human anatomy and physiology.19th ed. Pune. Nirali prakashan;2009.
8. Goyal R K, Natvar M P, Shah S A. Practical anatomy, Physiology and biochemistry,1st ed. Publisher: B S Shah Publisher: Ahmadabad; 1988.
9. C.L. Ghai. Textbook of Practical Physiology. Jaypee brother's medical publishers.
10. K. Srinageswari Rajeev Sharma. Practical workbook of Human Physiology. Jaypee brother's medical publishers.

Program	B. Pharm
Semester	II
Name of the course	Pharmaceutical Organic Chemistry-I Practical
Course Code	BP208P
Credits	2
Hours /week	4 hours (lectures)
Pre / co-requisite/s	Nil

Course Description: The pharmaceutical organic chemistry I laboratory course is aimed to train the students on experimental techniques for the determination of physical constants of organic compounds. This course also deals with wet laboratory-based experiments on identification of various chemical classes of organic compounds using basic principle of organic chemistry. This course also provides the laboratory skills related to reaction design, chemical synthesis and purification process for few organic medicinal compounds.

Course Learning Outcomes: Upon successful completion of this course, the student should be able to:

CO1: Demonstrate the skills on determination of various physical properties of organic molecules.

CO2: Differentiate various classes of organic compounds by experimental techniques.

CO3: Perform chemical reaction and purification of organic compounds of pharmaceutical interest.

CO4: Analyze the identification of the organic compounds with different functional groups.

S. No	Name of the experiment
I	1. Preliminary test: Color, odour, aliphatic/aromatic compounds, saturation and unsaturation, etc. 2. Detection of elements like Nitrogen, Sulphur and Halogen by Lassaigne's test 3. Solubility test 4. Functional group test like Phenols, Amides/ Urea, Carbohydrates, Amines, Carboxylic acids, Aldehydes and Ketones, Alcohols, Esters, Aromatic and Halogenated Hydrocarbons, Nitro compounds and Anilides. 5. Melting point/Boiling point of organic compounds 6. Identification of the unknown compound from the literature using meltingpoint/boiling point.

	7. Preparation of the derivatives and confirmation of the unknown compound by melting point/ boiling point. 8. Minimum 5 unknown organic compounds to be analyzed systematically.
II	Preparation of suitable solid derivatives from organic compounds
III	Construction of molecular models

Recommended Books (Latest Editions)

1. Practical Organic Chemistry by Mann and Saunders.
2. Vogel's text book of Practical Organic Chemistry
3. Advanced Practical organic chemistry by N.K. Vishnoi.
4. Introduction to Organic Laboratory techniques by Pavia, Lampman and Kriz.
5. Reaction and reaction mechanism by Ahluwaliah/Chatwal
6. Systematic Experiments

Program	B. Pharmacy
Semester	II
Name of the course	Biochemistry Practical
Course Code	BP209P
Credits	2
Hours /week	4 hours (lectures)
Pre / co-requisite/s	Nil

Course Description: The pharmaceutical Biochemistry laboratory course is aimed to train the students on experimental techniques for the identification of carbohydrates, proteins, amino acids and lipids. This course also deals with experiments on estimation of constituents in urine and blood and their significance in diagnosis of various diseases.

Course Learning Outcomes: Upon successful completion of this course, the student should be able to:

CO 1: Identify the carbohydrates proteins and lipids based upon chemical tests.

CO 2: Quantify the sugars, proteins and lipids in blood and serum.

CO 3. Demonstrate the skills on determination of various constituents present in urine.

Course content

Week	Name of the experiment
1	Qualitative analysis of carbohydrates (Glucose, Fructose, Lactose, Maltose, Sucrose and starch)
2	Identification tests for Proteins (albumin and Casein)
3	Determination of Glucose in sample by benedict's reagent method
4	Quantitative analysis of Proteins (Biuret method)
5	Qualitative analysis of urine for abnormal constituents
6	Qualitative analysis of urine for normal constituents
7	Determination of blood creatinine
8	Determination of blood sugar
9	Preparation of buffer solution and measurement of pH
10	Determination of chlorides in urine
11	Determination of urea in blood

12	Study the effect of Temperature on Salivary amylase activity.
13	Study the effect of Energy on Salivary amylase activity
14	Estimation of Na ⁺ /K ⁺ levels in serum

Recommended Books (Latest Editions)

- 1 Practical Biochemistry by R.C. Gupta and S. Bhargavan
- 2 Introduction of Practical Biochemistry by David T. Plummer. (3rd Edition)
- 3 Practical Biochemistry for Medical students by Rajagopal and Ramakrishna
- 4 Practical Biochemistry by Harold Varley.

Program	B. Pharm
Semester	II
Name of the course	Computer Applications in Pharmacy (Practical)
Course Code	BP210P
Credits	1
Hours /week	2 hours (Practical)
Pre / co-requisite/s	Nil

Course Description: The Pharmacognosy and Phytochemistry I laboratory course is aimed to train the students regarding practical skills of different computer technologies, programming languages and development of web pages. This course also deals with laboratory-based experiments on maintenance of database in MS-Access, formation of queries, exporting queries, tables, forms and reports to web page.

Course Learning Outcomes: Upon successful completion of this course, the student should be able to:

CO 1: Demonstrates the introduction of MS-Access, CRUD operations on data base.

CO2: State importance of tables, queries, forms and reports.

CO 2: Demonstrate knowledge on creation of web pages, working with tables and queries.

Practical Course: Contents

S. No.	Topic
4.	Design a questionnaire using a word processing package to gather information about a particular disease.
5.	Create a HTML web page to show personal information.
6.	Retrieve the information of a drug and its adverse effects using online tools.
7.	Creating mailing labels Using Label Wizard, generating label in MS WORD.
8.	Create a database in MS Access to store the patient information with the required fields Using access.
9.	Design a form in MS Access to view, add, delete and modify the patient record in the database.
10.	Generating report and printing the report from patient database.
11.	Creating invoice table using – MS Access.

12.	Drug information storage and retrieval using MS Access.
13.	Creating and working with queries in MS Access.
14.	Exporting Tables, Queries, Forms and Reports to web pages.
15.	Exporting Tables, Queries, Forms and Reports to XML pages.

Recommended Books: (Latest Editions)

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.

Program	B. Pharmacy
Semester	III
Name of the course	Pharmaceutical Organic Chemistry II – Theory
Course Code	BP 301T
Credits	4
Hours /week	3hours (lectures) & 1hour (Tutorial)
Pre / co-requisite/s	Nil

Course description: This subject deals with general methods of preparation and reactions of some organic compounds. Reactivity of benzene, polynuclear compounds and cycloalkane compounds also studied here. The syllabus emphasizes on mechanisms and orientation of reactions. This course also deals with the chemistry of fats and oils.

Course Outcomes: Upon completion of the course, the student shall be able to

1. Read the evidences in the derivation of structure of benzene, its reactivity, orientation towards the reactions and polynuclear compounds.
2. Interpret the effect of substituents on acidity or basicity, reactivity and uses of different phenols, aromatic amines and carboxylic acids.
3. Judge the reactivity/stability of organic compounds like fats, oils and cycloalkanes.

Course Content

Unit	Topics	Hours
<i>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</i>		
I (4 Weeks)	Benzene and its derivatives Analytical, synthetic and other evidences in the derivation of structure of benzene, Orbital picture, resonance in benzene, aromatic characters, Huckel's rule.	16
	Reactions of benzene - nitration, sulphonation, halogenation- reactivity, Friedel crafts alkylation- reactivity, limitations, Friedel crafts acylation.	
	Substituents, effect of substituents on reactivity and orientation of mono	

	substituted benzene compounds towards electrophilic substitution reaction.	
	Structure and uses of DDT, Saccharin, BHC and Chloramine	
II (3 Weeks)	Phenols* - Acidity of phenols, effect of substituents on acidity, qualitative tests, structure and uses of phenol, cresols, resorcinol, naphthols.	12
	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 and important reactions of benzoic acid.	
III (2 Weeks)	Polynuclear hydrocarbons: Synthesis, reactions	8
	Structure and medicinal uses of Naphthalene, Phenanthrene, Anthracene, Diphenylmethane, Triphenylmethane and their derivatives.	
IV (3 Weeks)	Cyclo alkanes* Stabilities – Baeyer’s strain theory, limitation of Baeyer’s strain theory, Coulson and Moffitt’s modification,	12
	Sachse Mohr’s theory (Theory of strainless rings), reactions of cyclopropane and cyclobutane only.	
V (3 Weeks)	Fats and Oils a. Fatty acids – reactions.	12
	b. Hydrolysis, Hydrogenation, Saponification and Rancidity of oils, Drying oils.	
	c. Analytical constants – Acid value, Saponification value, Ester value, Iodine value, Acetyl value, Reichert Meissl (RM) value – significance and principle involved in their determination.	
TOTAL		60

Learning Resources/Recommended Texts/Reference books/web resources

1. Allyn, Bacon. Morrison and Boyd: Organic Chemistry. 7thEd. Pearson education; New Delhi: 2011.
2. T.W. Solomons. Organic Chemistry. 8thEd. University of South Florida, John Wiley & Sons, Inc; New York: 2004.
3. Arun Bahl, B.S. Bahl. Advanced Organic Chemistry. S.Chand and limited; New Delhi: 2010.
4. I.L. Finar. Organic Chemistry. Longman, Scientific & Technical. 5thEd. Co published in USA with John Wiley & Sons, Inc; New York: 2004.
5. Zimmerman and Zimmerman. Elements of Organic Chemistry. 2ndEd. Collier Macmillan Publishers; London: 1983.
6. O. P Agarwal. Organic chemistry Reaction and Reagents. 26th Ed. Goel Publishing House. New Delhi: 1996.

Program	B. Pharmacy
Semester	III
Name of the course	Physical pharmaceutics-1 Theory
Course Code	BP 302TP
Credits	4
Hours /week	3+1
Pre / co-requisite/s	Nil

Course Description

The course deals with the various physical and physicochemical properties, and principals 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 outcome

At the end of the theory course, the student 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 and determination of expiry date of formulation

CO3 Demonstrate use of physicochemical properties in the formulation development and evaluation of dosage forms.

Course Content:

Unit	Contents	Hours
1	<p>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.</p> <p>Physicochemical properties of drug molecules: Refractive index, optical rotation, dielectric constant, dipole moment, dissociation constant, determinations, and applications.</p>	12

2	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, Phase Rule. Partially miscible liquids, Critical solution temperature and applications. Distribution law, its limitations and applications.	12
3	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.	12
4	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, solubilization, detergency, adsorption at solid interface.	12
5	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.	12
Total		60

Recommended reference Books

1. Sinko P.J. Martin's Physical Pharmacy and Pharmaceutical Sciences. 5th ed. New Delhi: Wolters Kluwer Health Pvt. Ltd.; 2007.
2. Subramanyam C.V.S. Essentials of Physical Pharmacy. 1st ed. Delhi: VallabhPrakashan; 2008.
3. Manavalan. R, Ramaswamy. C. Physical pharmaceutics. 2nded. Tamilnadu: Vigneshpublisher; 2008.
4. Experimental Pharmaceutics by Eugene, Parott.
5. Tutorial Pharmacy by Cooper and Gunn.

6. Stocklosam J. Pharmaceutical Calculations, Lea &Febiger, Philadelphia.
7. Liberman H.A, Lachman C., Pharmaceutical Dosage forms, Tablets, Volume-1 to 3, MarcelDekkar Inc.
8. Liberman H.A, Lachman C, Pharmaceutical Dosage forms. Disperse systems, volume 1, 2, 3. Marcel Dekkar Inc.
9. Laboratory Manual of Physical Pharmaceutics, C.V.S. Subramanyam, J. Thimma settee
10. Test book of Physical Phramacy, by Gaurav Jain &Roop K. Khar. <http://www.e-booksdirectory.com> 12.<http://www.jblearning.com>

Program	B. Pharm
Semester	III
Name of the course	Pharmaceutical Microbiology Theory
Course Code	BP 303 T
Credits	4
Hours /week	3+1 hours

Course Description: The course deals with the various aspects of microorganisms, its classification, morphology, laboratory cultivation identification and maintenance. It also discusses with sterilization of pharmaceutical products, equipment, media etc.

Course Learning Outcomes: Upon successful completion of this course, the student should be able to:

CO01: Understand methods of identification, cultivation and preservation of various microorganisms.

CO2: To understand the importance and implementation of sterilization in pharmaceutical processing and industry

CO3: Learn sterility testing of pharmaceutical products.

CO 4: Carried out microbiological standardization of Pharmaceuticals.

CO5: Understand the cell culture technology and its applications in pharmaceutical industries.

Theory course contents

Unit	Topic	Hours
I	Introduction, history of microbiology, its branches, scope and its importance. Introduction to Prokaryotes and Eukaryotes. Study of different type of microscopes: Types of Light and electron microscopy and their techniques. Study of ultra-structure and morphological classification of bacteria, nutritional requirements and classification of bacteria based on nutrient requirement, raw materials used for culture media and physical parameters for growth, growth curve, isolation and preservation methods for pure cultures, cultivation of aerobic and anaerobic microbes, quantitative measurement of bacterial growth (total & viable count).	15

II	<p>Identification of bacteria using staining techniques (simple, Grams' & Acid-fast staining) and biochemical tests (Extra and intra cellular enzyme tests).</p> <p>Study of principle, procedure, merits, demerits and applications of physical, chemical gaseous, radiation and mechanical method of sterilization.</p> <p>Industrial sterilization methods and equipments/setup employed for the same.</p> <p>Sterility validation.</p>	15
III	<p>Study of morphology, classification, reproduction/replication and Cultivation of Fungi and Viruses.</p> <p>Classification and mode of action of disinfectants.</p> <p>Factors influencing disinfection and antiseptics</p> <p>Evaluation of Disinfectants, antiseptics, bactericidal & Bacteriostatic agents.</p> <p>Sterility testing of products (solids, liquids, ophthalmic and other sterile Products) according to IP, BP and USP.</p>	10
IV	<p>Designing of aseptic area, laminar air flow equipments; study of different sources of contamination in an aseptic area and methods of prevention, Clean area classification.</p> <p>Principles and methods of microbiological assay for Standardization of antibiotics, vitamins and amino acids.</p> <p>Assessment of antimicrobial activity and MIC.</p>	10
V	<p>Sources and types of microbial contaminants in pharmaceuticals. Assessment of microbial contamination and spoilage.</p> <p>Preservation of pharmaceutical products using antimicrobial agents,</p> <p>Evaluation of microbial stability of formulations.</p> <p>Growth of animal cells in culture, general procedure for cell culture.</p> <p>Types of animal cell cultures/</p> <p>Application of cell cultures in pharmaceutical industry and research.</p>	10
Total		60

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. Rose: Industrial Microbiology.
5. Probisher, Hinsdill et al: Fundamentals of Microbiology, 9th ed. Japan Cooper and Gunn's: Tutorial Pharmacy, CBS Publisher and Distribution.
6. Pepler: Microbial Technology.
7. I.P., B.P., U.S.P. - latest editions.
8. Ananthnarayan : Text Book of Microbiology, Orient-Longman, Chennai
9. Edward: Fundamentals of Microbiology.
10. N.K.Jain: Pharmaceutical Microbiology, Vallabh Prakashan, Delhi
11. Bergey's manual of systematic bacteriology, Williams and Wilkins- a Waverly Company

Program	B. Pharm
Semester	III
Name of the course	Pharmaceutical Engineering – Theory
Course Code	BP304T
Credits	4
Hours /week	3+1 hours

Course Description:

This course is designed to impart a fundamental knowledge on the art and science of various unit operations used in pharmaceutical industry. This course emphasizes pharmaceutical importance of different equipment's, their construction, working applications, merits and demerits.

Course Learning Outcomes: Upon completion of this course the student should be able to:

CO 1: Define various unit operations and material handling techniques used in Pharmaceutical industries.

CO 2: Recognize significance of plant lay out design for optimum use of resources.

CO 3: Demonstrate various processes involved in pharmaceutical manufacturing process.

CO 4: Appraise the various preventive methods used for corrosion control in Pharmaceutical industries.

Theory Course Contents:

Unit	Topic	Hours
I	<p>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.</p> <p>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.</p> <p>Flow of fluids: Types of manometers, Reynolds number and its significance, Bernoulli's theorem and its applications, Energy losses, Orifice meter, Venturi meter, Pitot tube and Roto meter.</p>	14

II	<p>Heat Transfer: Objectives, applications & Heat transfer mechanisms. Fourier's law, Heat transfer by conduction, convection & radiation. Heat interchangers & heat exchangers.</p> <p>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.</p> <p>Distillation: Basic Principles and methodology of simple distillation, flash distillation, fractional distillation, distillation under reduced pressure, steam distillation & molecular distillation</p>	14
III	<p>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.</p> <p>Mixing: Objectives, applications & factors affecting mixing, Difference between solid 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,</p>	12
IV	<p>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.</p> <p>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.</p>	10
V	<p>Materials of pharmaceutical plant construction, Corrosion and its prevention: Factors affecting during materials selected for Pharmaceutical</p>	10

	plant construction, Theories of corrosion, types of corrosion and their prevention. Ferrous and nonferrous metals, inorganic and organic nonmetals, basic of material handling systems.	
Total		60

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 – McCabe 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.

Program	B. Pharmacy
Semester	III
Name of the course	Pharmaceutical Organic Chemistry II – Practical
Course Code	BP 305P
Credits	2
Hours /week	4 hours
Pre / co-requisite/s	Nil

Course Description: The Pharmaceutical Organic Chemistry II laboratory course aimed to train the students on laboratory techniques for purification of organic compounds. This course also deals with experiments on identification of purity and standard of the oils by their analytical constants. This course also provides the laboratory skills related to reaction design, chemical synthesis and purification process for few organic medicinal compounds.

Course Learning Outcomes: Upon successful completion of this course, the student should be able to:

CO 1: Demonstrate the skills on separation & purification of various organic molecules.

CO 2: Analyze the analytical constants (values) by different tests to find the purity of oils.

CO 3: Identify the preparation mechanism and purification process of the various organic compounds.

Week	TOPICS
Experiments involving laboratory techniques	
1	Recrystallization
2	Steam distillation
Determination of following oil values (including standardization of reagents)	
3	Acid value
4	Saponification value
5	Iodine value
Preparation of compounds	
6	Benzanilide/Phenyl benzoate from Aniline/ Phenol by acylation reaction.
7	2,4,6-Tribromo aniline/Para bromo acetanilide from Aniline/ Acetanilide by halogenation (Bromination) reaction.

8	5-Nitro salicylic acid/Meta di nitro benzene from Salicylic acid / Nitro benzene by nitration reaction.
9	Benzoic acid from Benzyl chloride by oxidation reaction.
10	Benzoic acid/ Salicylic acid from alkyl benzoate/ alkyl salicylate by hydrolysis reaction.
11	1-Phenyl azo-2-naphthol from Aniline by diazotization and coupling reactions.
12	Benzil from Benzoin by oxidation reaction.
13	Dibenzal acetone from Benzaldehyde by Claisen Schmidt reaction

Recommended Books (Latest Editions)

1. Vogel, A.I, Tatchell A.R, Furnis B.S, Hannaford A.J, Smith P.W.G. Practical Organic Chemistry. 5th Ed. Pearson Publishers Prentice Hall; New Delhi: 1996.
2. R.K. Bansal, Laboratory Manual of Organic Chemistry, 5th Ed. New Age International; New Delhi 2007.
3. O.P. Agarwal, Advanced Practical Organic Chemistry, 3rd Ed. Goel Publication; Meerut: 2011.
4. F.G.Mann & B.C. Saunders, Practical Organic Chemistry, 4th Ed. Chaman enterprises; New 5. Delhi: 2004.

Program	B. Pharmacy
Year & Semester	III
Name of the course	Physical pharmaceutics-1 (Practical)
Course Code	BP 306P
Credits	2
Hours /week	4 hours
Pre / co-requisite/s	Nil

Course Description

The Physical Pharmacy – I laboratory course is aimed to train the students on experimental techniques for the determination of Physico - chemical properties. This course also deals with wet laboratory-based experiments on identification critical solution temperatures of binary phase systems. This course also provides the laboratory skills related to determination of pH, physical & colligative properties.

Course Outcomes

At the end of the practical course of experiments, the student will be able to

CO 1: Demonstrate the skills on determination of various physical properties of drug molecules.

Co 2: Operate equipment's like pH meter, Refractometer etc.

CO 3: Calculate the buffer capacities of pharmaceutical buffers by experimental techniques.

S. No.	Description of Activity /Experiments	Hours
1	Determination the solubility of drug at room temperature	3
2	Determination of pKa value by Half Neutralization/ Henderson Hassel Balch equation.	3
3	Determination of Partition co- efficient of benzoic acid in benzene and water	3
4	Determination of Partition co- efficient of Iodine in CCl ₄ and water	3
5	Determination of % composition of NaCl in a solution using phenol-water system by CST method	3

6	Determination of surface tension of given liquids by drop count and drop weight method	3
7	Determination of HLB number of a surfactant by saponification method	3
8	Determination of Freundlich and Langmuir constants using activated char coal	3
9	Determination of critical micellar concentration of surfactants	3
10	Determination of stability constant and donor acceptor ratio of PABA-Caffeine complex by solubility method	3
11	Determination of stability constant and donor acceptor ratio of Cupric-Glycine complex by pH titration method	3

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. LaboratoryManual 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

Program	B. Pharm
Year	III
Name of the course	Pharmaceutical Microbiology (Lab)
Course Code	BP 307P
Paper	Practical
Hours /week	4 hours (laboratory)
Pre / co-requisite/s	Nil

Course Description: The course is designed to focus on identification, nutritional requirements of microorganisms. Since microbiology is an upcoming and fascinating branch of biological sciences, medical and pharmaceutical sciences, the approach of performing experiments will lead to success of learning the subject.

Course Learning Outcomes: Upon successful completion of this course, the student should be able to:

CO 1: Learn about microbial techniques related to Sterilization, Aseptic handling as well as microbial utilization in the Pharma industry

CO2: Learn procedure to cultivate and identification of the microorganisms in the laboratory

CO3: Learn about the utilization of microbes in assay of various pharmaceuticals.

Practical Course: Contents

Week	Topics
1	Introduction and study of different equipments, e.g., B.O.D. incubator, laminar flow, aseptic hood, autoclave, hot air sterilizer, deep freezer, refrigerator, microscopes used in experimental microbiology.
2	Sterilization and preparation of Nutrient Broth
3	Sterilization and Preparation of Nutrient slant, Deep tube and petri plate
4	Aseptic transfer of organism into Nutrient Broth
5	Aseptic transfer of Organism into Slant.
6	Isolation of pure culture of micro-organisms by Different streak plate techniques
7	Isolation of pure culture of micro-organisms Spread and Pour plate technique
8	Simple and Negative staining

9	Grams' staining
10	Acid Fast Staining
11	Microbiological assay of antibiotics by cup plate/Disc plate method.
12	Sterility testing of pharmaceuticals
13	Bacteriological analysis of water
14	Biochemical tests (IMViC Tests/Intra and Extracellular enzyme tests)
15	Revision/Assessment

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. Rose: Industrial Microbiology.
5. Probisher, Hinsdill et al: Fundamentals of Microbiology, 9th ed. Japan Cooper and Gunn's: Tutorial Pharmacy, CBS Publisher and Distribution.
6. Pepler: Microbial Technology.
7. I.P., B.P., U.S.P. - latest editions.
8. Ananthnarayan : Text Book of Microbiology, Orient-Longman, Chennai
9. Edward: Fundamentals of Microbiology.
10. N.K.Jain: Pharmaceutical Microbiology, Vallabh Prakashan, Delhi
11. Bergey's manual of systematic bacteriology, Williams and Wilkins- a Waverly Company.

Program	B. Pharm
Semester	III
Name of the course	Pharmaceutical Engineering – Practical
Course Code	BP308P
Credits	2
Hours /week	4 hours

Course Description: The Pharmaceutical Engineering Practical course is aimed to train the students on handling of equipments related to size reduction, size separation and mixing. This course also deals with determination of humidity using thermometers, rate of drying, rate of filtration, rate of evaporation and extraction by distillation.

Course Learning Outcomes: Upon successful completion of this course, the student should be able to:

CO 1: Operate major equipments used in pharmaceutical industry

CO 2: Experiment to determine various parameters and factors effecting of unit processes.

CO3: Construct plots related to various unit operations.

Practical Course Contents:

S. No	Experiments
1.	Calculation of efficiency of steam distillation.
2.	Determination of overall heat transfer coefficient by heat exchanger.
3.	Construction of drying curves (for calcium carbonate and starch).
4.	Determination of moisture content and loss on drying.
5.	Determination of humidity of air by a) Wet and dry bulb temperatures b) Dew point method.
6.	Description of Construction working and application of rotary tablet machine, fluidized bed coater, fluid energy mill, de humidifier.
7.	Evaluation of size distribution of tablet granulations by sieving – Construction of various size frequency curves including arithmetic and logarithmic probability plots.
8.	Verification of the laws of size reduction using ball mill and determining Kicks, Rittinger's, Bond's coefficients, power requirement and critical speed of Ball Mill.

9.	Demonstration of colloid mill, planetary mixer, fluidized bed dryer, freeze dryer
10	Study of factors affecting Rate of Filtration and Evaporation (Surface area, Concentration and Thickness/ viscosity)
11	Study of effect of time on the Rate of Crystallization.
12	Calculation of uniformity Index for given sample by using Double Cone Blender.

Recommended reference Books

1. Introduction to chemical engineering – Walter L Badger & Julius Banchemo, Latest edition.
2. Solid phase extraction, Principles, techniques and applications by Nigel J.K. Simpson- Latest edition.
3. Unit operation of chemical engineering – McCabe 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.

Program	B. Pharmacy
Semester	IV
Name of the course	Pharmaceutical Organic Chemistry III – Theory
Course Code	BP 401T
Credits	4
Hours /week	3hours (lectures) & 1hour (Tutorial)
Pre / co-requisite/s	Nil

Course description: This subject imparts knowledge on stereo-chemical aspects of organic compounds and organic reactions, important named reactions, chemistry of important heterocyclic compounds. It also emphasizes on medicinal and other uses of organic compounds.

Course Outcomes: At the end of the course, the student shall be able to

CO 1: Understand the methods of preparation and properties of organic compounds

CO 2: Explain the stereo chemical aspects of organic compounds and stereo chemical reactions

CO 3: know the medicinal uses and other applications of organic compounds

Course Content

Unit	Topics	Hours
Note: To emphasize on definition, types, mechanisms, examples, uses/applications		
I (3 Weeks)	Stereo isomerism: Optical isomerism – Optical activity, enantiomerism, diastereoisomerism, meso compounds Elements of symmetry, chiral and achiral molecules,	12
	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.	
II (3 Weeks)	Geometrical isomerism Nomenclature of geometrical isomers (Cis Trans, EZ, Syn Anti systems), Methods of determination of configuration of geometrical isomers.	12
	Conformational isomerism in Ethane, n-Butane and Cyclohexane.	

	Stereo isomerism in biphenyl compounds (Atropisomerism) and conditions for optical activity. Stereospecific and stereoselective reactions	
III (3 Weeks)	Heterocyclic compounds: Nomenclature and classification	12
	Synthesis, reactions and medicinal uses of following compounds/derivatives Pyrrole, Furan, and Thiophene.	
	Relative aromaticity and reactivity of Pyrrole, Furan and Thiophene	
IV (3 Weeks)	Synthesis, reactions and medicinal uses of following compounds/derivatives Pyrazole, Imidazole, Oxazole and Thiazole.	12
	Pyridine, Quinoline, Isoquinoline, Acridine and Indole.	
	Basicity of pyridine Synthesis and medicinal uses of Pyrimidine, Purine, azepines and their derivatives	
V (3 Weeks)	Reactions of synthetic importance, Metal hydride reduction (NaBH_4 and LiAlH_4), Clemmensen reduction, Birch reduction, Wolff Kishner reduction,	12
	Oppenauer-oxidation and Dakin reaction, Beckmann rearrangement and Schmidt rearrangement, Claisen-Schmidt condensation.	
	Revision	
TOTAL		60

Learning Resources/Recommended Texts/Reference books/web resources

1. Allyn, Bacon. Morrison and Boyd: Organic Chemistry. 7thEd. Pearson education; New Delhi: 2011.
2. T.W. Solomons. Organic Chemistry. 8thEd. University of South Florida, John Wiley & Sons, Inc; New York: 2004.
3. Arun Bahl, B.S. Bahl. Advanced Organic Chemistry. S.Chand and limited; New Delhi: 2010.
4. I.L. Finar. Organic Chemistry. Longman, Scientific & Technical. 5thEd. Co published in USA with John Wiley & Sons, Inc; New York: 2004.
5. Zimmerman and Zimmerman. Elements of Organic Chemistry. 2ndEd. Collier Macmillan Publishers; London: 1983.
6. O. P Agarwal. Organic chemistry Reaction and Reagents. 26th Ed. Goel Publishing House. New Delhi: 1996.

Program	B. Pharmacy
Semester	IV
Name of the course	Medicinal Chemistry I – Theory
Course Code	BP 402T
Credits	4
Hours /week	3hours (lectures) & 1hour (Tutorial)
Pre / co-requisite/s	Nil

Course description: This course 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 Outcomes: Upon completion of the course, the student shall be able to

CO 1: Understand the chemistry of drugs with respect to their pharmacological activity

CO 2: Identify the drug metabolic pathways, adverse effect and therapeutic value of drugs

CO 3: Know the Structural Activity Relationship (SAR) of different class of drugs

CO 4: Write the chemical synthesis of some drugs

Course Content

Unit	Topics	Hours
<i>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 (*)</i>		
I (3 Weeks)	Introduction to Medicinal Chemistry History and development of medicinal chemistry Physicochemical properties in relation to biological action	12
	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.	

II (3 Weeks)	<p>Drugs acting on Autonomic Nervous System</p> <p>Adrenergic Neurotransmitters: Biosynthesis and catabolism of catecholamine. Adrenergic receptors (Alpha & Beta) and their distribution.</p>	12
	<p>Sympathomimetic agents: SAR of Sympathomimetic agents</p> <p>Direct acting: Nor-epinephrine, Epinephrine, Phenylephrine*, Dopamine, Methyldopa, Clonidine, Dobutamine, Isoproterenol, Terbutaline, Salbutamol*, Bitolterol, Naphazoline, Oxymetazoline and Xylometazoline.</p> <p>Indirect acting agents: Hydroxyamphetamine, Pseudoephedrine, Propylhexedrine.</p> <p>Agents with mixed mechanism: Ephedrine, Metaraminol.</p>	
	<p>Adrenergic Antagonists:</p> <p>Alpha adrenergic blockers: Tolazoline*, Phentolamine, Phenoxybenzamine, Prazosin, Dihydroergotamine, Methysergide.</p> <p>Beta adrenergic blockers: SAR of beta blockers, Propranolol*, Metibranolol, Atenolol, Betazolol, Bisoprolol, Esmolol, Metoprolol, Labetolol, Carvedilol.</p>	
III (3 Weeks)	<p>Cholinergic neurotransmitters: Biosynthesis and catabolism of acetylcholine. Cholinergic receptors (Muscarinic & Nicotinic) and their distribution.</p> <p>Parasympathomimetic agents: SAR of Parasympathomimetic agents</p> <p>Direct acting agents: Acetylcholine, Carbachol*, Bethanechol, Methacholine, Pilocarpine.</p> <p>Indirect acting/ Cholinesterase inhibitors (Reversible & Irreversible): Physostigmine, Neostigmine*, Pyridostigmine, Edrophonium chloride, Tacrine hydrochloride, Ambenonium chloride, Isoflurophate, Echothiophate iodide, Parathione, Malathion.</p> <p>Cholinesterase reactivator: Pralidoxime chloride.</p>	12

	<p>Cholinergic Blocking agents: SAR of cholinolytic agents</p> <p>Solanaceous alkaloids and analogues: Atropine sulphate, Hyoscyamine sulphate, Scopolamine hydrobromide, Homatropine hydrobromide, Ipratropium bromide*.</p> <p>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.</p>	
<p>IV (3 Weeks)</p>	<p>Drugs acting on Central Nervous System</p> <p>A. Sedatives and Hypnotics:</p> <p>Benzodiazepines: SAR of Benzodiazepines, Chlordiazepoxide, Diazepam*, Oxazepam, Chlorazepate, Lorazepam, Alprazolam, Zolpidem</p> <p>Barbiturtes: SAR of barbiturates, Barbital*, Phenobarbital, Mephobarbital, Amobarbital, Butabarbital, Pentobarbital, Secobarbital</p> <p>Miscellaneous:</p> <p>Amides & imides: Glutethimide.</p> <p>Alcohol & their carbamate derivatives: Meprobomate, Ethchlorvynol.</p> <p>Aldehyde & their derivatives: Triclofos sodium, Paraldehyde.</p> <p>B. Antipsychotics</p> <p>Phenothiazines: SAR of Phenothiazines - Promazine hydrochloride, Chlorpromazine hydrochloride*, Triflupromazine, Thioridazine hydrochloride, Piperacetazine hydrochloride, Prochlorperazine maleate, Trifluoperazine hydrochloride.</p> <p>Ring Analogues of Phenothiazines: Chlorprothixene, Thiothixene, Loxapine succinate, Clozapine.</p> <p>Fluro buterophenones: Haloperidol, Droperidol, Risperidone.</p>	<p>12</p>

	<p>Beta amino ketones: Molindone hydrochloride.</p> <p>Benzamides: Sulpieride.</p>	
	<p>C. Anticonvulsants: SAR of Anticonvulsants, mechanism of anticonvulsant action</p> <p>Barbiturates: Phenobarbitone, Methabarbital.</p> <p>Hydantoins: Phenytoin*, Mephenytoin, Ethotoin</p> <p>Oxazolidine diones: Trimethadione, Paramethadione</p> <p>Succinimides: Phensuximide, Methsuximide, Ethosuximide*</p> <p>Urea and monoacyl ureas: Phenacemide, Carbamazepine*</p> <p>Benzodiazepines: Clonazepam</p> <p>Miscellaneous: Primidone, Valproic acid, Gabapentin, Felbamate</p>	
V (3 Weeks)	<p>Drugs acting on Central Nervous System</p> <p>General anesthetics:</p> <p>Inhalation anesthetics: Halothane*, Methoxyflurane, Enflurane, Sevoflurane, Isoflurane, Desflurane.</p> <p>Ultra-short acting barbiturates: Methohexital sodium*, Thiamylal sodium, Thiopental sodium.</p> <p>Dissociative anesthetics: Ketamine hydrochloride. *</p>	12
	<p>Narcotic and non-narcotic analgesics</p> <p>Morphine and related drugs: SAR of Morphine analogues, Morphine sulphate, Codeine, Meperidine hydrochloride, Anilerdine hydrochloride, Diphenoxylate hydrochloride, Loperamide hydrochloride, Fentanyl citrate*, Methadone hydrochloride*, Propoxyphene hydrochloride, Pentazocine, Levorphanol tartarate.</p> <p>Narcotic antagonists: Nalorphine hydrochloride, Levallorphan tartarate, Naloxone hydrochloride.</p>	
	<p>Anti-inflammatory agents: Sodium salicylate, Aspirin, Mefenamic acid*, Meclofenamate, Indomethacin, Sulindac, Tolmetin, Zomepriac, Diclofenac, Ketorolac, Ibuprofen*, Naproxen, Piroxicam, Phenacetin, Acetaminophen, Antipyrine, Phenylbutazone.</p>	
TOTAL		60

Learning Resources/Recommended Texts/Reference books/web resources

1. William O. Foye, Textbook of Medicinal Chemistry, Lea Febiger, Philadelphia.
2. Graham. L. Patrick, an Introduction to Medicinal Chemistry, Oxford University publishers.
3. JH Block & JM Beale (Eds), Wilson & Griswold's textbook of organic Medicinal Chemistry and pharmaceutical chemistry, 11th Ed, Lipcolt, Raven, Philadelphia, 2004
4. Rama Rao Nadendla, Medicinal Chemistry, Mc Millan Publishers.
5. Hansch, Comprehensive medicinal chemistry, Vol 1 – 6 Elsevier pergmon press, Oxford.
6. D. Abraham (Ed), Burger Medicinal chemistry and Drug discovery, Vol. 1 & 2, 6th Ed, John Wiley & Sons, New York 2003.
7. M. Atherden, Bentley and Driver's Textbook of Pharmaceutical Chemistry Ed: 1. Oxford University Press, Delhi.
8. Daniel lednicer, Strategies for Organic Drug Synthesis and Design, John Wiley, N. Y. 1998.
9. D. Lednicer, Organic drug synthesis, Vol, 1 – 6, J. Wiley N.Y.

Program	B. Pharmacy
Semester	IV
Name of the course	Physical pharmaceutics-II Theory
Course Code	BP403T
Credits	2
Hours /week	4 hours
Pre / co-requisite/s	Nil

Course Description: The course deals with the various physical and physicochemical properties, and principles involved in dosage forms/formulations. The theoretical 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 outcome

At the end of the theory course, the student will be able to

CO 1: Define the fundamental aspects of solubility, distribution, flow of liquids & solids.

CO 2: Recognize the importance of micromeritics, rheology & interfacial phenomenon in manufacturing of dosage form

CO 3: Apply the principles of diffusion and complexation in formulations

CO 4: Test the drug decomposition kinetics & stability of dispersed systems

Course Content

Unit	Topics	Hours
I (3 Weeks)	Colloidal dispersions: Classification of dispersed systems & their general characteristics, size & shapes of colloidal particles,	12
	Classification of colloids & comparative account of their general properties.	
	Optical, kinetic & electrical properties. Stability of colloids. Effect of electrolytes, coacervation, peptization & protective action.	
II (3 Weeks)	Rheology: Newtonian systems, law of flow, kinematic viscosity, effect of temperature, non-Newtonian systems, pseudoplastic, dilatant, plastic,	12
	thixotropy, thixotropy in formulation, determination of viscosity by capillary, falling Sphere, rotational viscometers	
	Deformation of solids: Plastic and elastic deformation, Heckel equation, Stress, Strain, Elastic Modulus	
III	Coarse dispersion: Suspension, interfacial properties of suspended	12

(3 Weeks)	particles, settling in suspensions, 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.	
IV (3 Weeks)	Micromeritics: Particle size and distribution, mean particle size, number and weight distribution, particle number, methods for determining particle size by different methods,	12
	particle shape, specific surface, methods for determining surface area,	
	Permeability, adsorption, derived properties of powders, porosity, packing arrangement, densities, bulkiness & flow properties.	
V (3 Weeks)	Drug stability: Reaction kinetics: zero, pseudo-zero, first & second order, units of basic rate constants, determination of reaction order.	12
	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.	
TOTAL		60

Learning Resources/Recommended Texts/Reference books/web resources

1. Sinko P.J. Martin's Physical Pharmacy and Pharmaceutical Sciences. 5th ed. New Delhi: Wolters Kluwer Health Pvt.Ltd.,; 2007.
2. Subramanyam C.V.S. Essentials of Physical Pharmacy. 1st ed. Delhi: Vallabh Prakashan; 2008.
3. Manavalan. R, Ramaswamy. C. Physical pharmaceutics. 2nd ed. Tamilnadu: Vignesh publisher; 2008.
4. Experimental Pharmaceutics by Eugene, Parott.
5. Tutorial Pharmacy by Cooper and Gunn.
6. Stocklosam J. Pharmaceutical Calculations, Lea &Febiger, Philadelphia.

Program /Year/Sem	B. Pharm
Semester	IV
Name of the course	Pharmacology- I (Theory)
Course Code	BP 404 T
Credits	4
Hours /week	3+1 hours (lectures)
Pre / co-requisite/s	Nil

Scope: This course aimed to provide basic knowledge on principles of general pharmacology such as sources of drug, drug development phases, routes of drug administration, mechanism of drug action and pharmacokinetic aspects like drug absorption, distribution, metabolism and excretion. Subsequently, this course also covers about the drugs acting on central and peripheral nervous system.

Course Outcomes: Upon successful completion of this course, the student should be able to:

CO.1. Appraise the different stages of drug discovery and development

CO.2. Recall the pharmacological actions of different categories of drugs

CO.3. Explain the mechanism of drug action at organ system/sub cellular/ macromolecular levels.

CO.4. Apply the basic pharmacological knowledge in the prevention and treatment of various diseases.

Theory Course: Contents

Unit	Topics	Hours
I	General Pharmacology 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 noncompetitive), spare receptors, addiction, tolerance, dependence, tachyphylaxis, idiosyncrasy, allergy. Pharmacokinetics- Membrane transport, absorption, distribution, metabolism and excretion of drugs. Enzyme induction, enzyme inhibition,	12
II	General Pharmacology Pharmacodynamics- Principles and mechanisms of drug action. Receptor	12

	<p>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.</p> <p>Adverse drug reactions.</p> <p>Drug interactions (pharmacokinetic and pharmacodynamic)</p> <p>Drug discovery and clinical evaluation of new drugs -Drug discovery phase, preclinical evaluation phase, clinical trial phase, phases of clinical trials and pharmacovigilance.</p>	
III	<p>2. Pharmacology of drugs acting on peripheral nervous system</p> <p>a. Organization and function of ANS.</p> <p>b. Neurohumoral transmission, co-transmission and classification of neurotransmitters.</p> <p>Para sympathomimetics, Parasympatholytics, Sympathomimetics, sympatholytics.</p> <p>Neuromuscular blocking agents and skeletal muscle relaxants (peripheral).</p> <p>Local anesthetic agents.</p> <p>Drugs used in myasthenia gravis and glaucoma</p>	12
IV	<p>3. Pharmacology of drugs acting on central nervous system</p> <p>Neurohumoral transmission in the C.N.S. special emphasis on importance of various neurotransmitters like with GABA, Glutamate, Glycine, serotonin, dopamine.</p> <p>General anesthetics and pre-anesthetics.</p> <p>Sedatives, hypnotics and centrally acting muscle relaxants.</p> <p>Anti-epileptics</p> <p>Alcohols and disulfiram</p>	12
V	<p>3. Pharmacology of drugs acting on central nervous system</p>	12

Psychopharmacological agents: Antipsychotics, antidepressants, anti-anxiety agents, anti-manics and hallucinogens. Drugs used in Parkinson's disease and Alzheimer's disease. CNS stimulants and nootropics. Opioid analgesics and antagonists	Total	60
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Recommended Books (Latest Editions)

1. Rang H. P., Dale M. M., Ritter J. M., Flower R. J., Rang and Dale's Pharmacology, Churchill 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.

Program	B. Pharm
Semester	IV
Name of the course	Pharmacognosy and Phytochemistry I
Course Code	BP405T
Credits	4
Hours /week	3+1
Pre / co-requisite/s	Nil

Course Description: The Pharmacognosy and Phytochemistry I course is aimed at the fundamentals of Pharmacognosy like scope, classification of crude drugs, their identification and evaluation, phytochemicals present in them and their medicinal properties. The subject deals with cultivation and plant tissue culture aspects of medicinal plants.

Course Learning Outcomes: Upon successful completion of this course, the student should be able to:

CO1: Demonstrates the introduction to pharmacognosy.

CO2: State importance of Natural sources of drugs, scientific names, active constituents, uses of drugs

CO3: Identifies the cultivation and plant tissue culture aspects of medicinal plants.

CO4: Recognize the importance of crude drugs belong to Fibers, Carbohydrates, Proteins, Lipids and marine drugs.

Theory Course: Contents

UNIT	Topic	Hours
I	<p>Introduction to Pharmacognosy: Definition, history, scope and development of Pharmacognosy Sources of Drugs – Plants, Animals, Marine & Mineral source. Organized drugs, unorganized drugs.</p> <p>Classification of drugs: Alphabetical, morphological, taxonomical, chemical, pharmacological, chemo taxonomical classification of drugs.</p> <p>Quality control of Drugs of Natural Origin: Adulteration of drugs of natural origin. Evaluation by organoleptic, microscopic, physical, chemical and biological methods and</p>	15

	properties. Quantitative microscopy of crude drugs including lycopodium spore method, leaf constants, Camera Lucida and diagrams of microscopic objects to scale with Camera Lucida.	
II	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.	15
III	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.	12
IV	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	10
V	Study of biological source, chemical nature and uses of drugs of natural origin containing following drugs Plant Products: Fibers - Cotton, Jute, Hemp Primary metabolites: General introduction, detailed study with respect to chemistry, sources, preparation, evaluation, therapeutic uses 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, serrati peptidase, urokinase, streptokinase, pepsin). Lipids (Waxes, fats, fixed oils): Castor oil, Chaulmoogra oil, Wool	08

	Fat, Bees Wax	
	Marine Drugs: Novel medicinal agents from marine sources.	
	Total	60

Recommended Books: (Latest Editions)

1. W.C.Evans, Trease and Evans Pharmacognosy, 16th edition, W.B. Saunders & 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), IstEdn, 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

Program	B. Pharmacy
Semester	IV
Name of the course	Medicinal Chemistry I – Practical
Course Code	BP 406P
Credits	2
Hours /week	4 hours
Pre / co-requisite/s	Nil

Course Description: The Medicinal chemistry I laboratory course is aimed to train the students on experimental techniques for the determination and Synthesis of different biologically active compound libraries and evaluation of their biological activity using cytotoxicity assays. Analysis of structure activity relationships using the data generated. This course also provides the laboratory skills related to reaction design, chemical synthesis and purification process for few medicinal compounds.

Course Outcomes: Upon successful completion of this course, the student should be able to:

CO 1: Perform chemical reaction and purification of medicinal compounds of pharmaceutical interest.

CO 2: Analyze the percentage purity of various classes of drugs as per the monographs in pharmacopoeias.

Week	TOPICS
I. Preparation of drugs / intermediates	
1	Antipyrine
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	

10	Chlorpromazine
11	Phenobarbitone
12	Ibuprofen
13	Aspirin
14	Furosemide
15	III. Determination of Partition coefficient for any two drugs

Learning Resources/Recommended Texts/Reference books/web resources

1. A.I. Vogel, Text Book of Practical Organic Chemistry, 5th Edition. Pearson Prentice Hall.
2. F.G. Mann & B.C. Saunders, Practical Organic Chemistry, 4th Edition. Pearson Publishers.
3. Indian Pharmacopoeia
4. British Pharmacopoeia

Program	B. Pharmacy
Semester	IV
Name of the course	Physical pharmaceutics II – Practical
Course Code	BP 407P
Credits	2
Hours /week	4 hours
Pre / co-requisite/s	Nil

Course Description: The Physical Pharmacy- II laboratory course aimed to train the students on experimental techniques for the determination of Physico–chemical properties of substances. This course also deals with wet laboratory that determines order of kinetics, flow of solids & liquids. This course also provides the laboratory skills related to solubility, partition & evaluation of dispersed systems.

Course Outcomes: Upon successful completion of this course, the student should be able to

CO 1: Demonstrate the skills on determination of Physico – chemical properties.

CO2: Analyze the stability of dispersed systems by experimental techniques.

CO 3: Interpret the scientific data from graphical presentations.

Course Content

Week	Topic
1	Determination of particle size, particle size distribution using Microscopic method
2	Determination of bulk density, true density and porosity
3	Determine the angle of repose and influence of lubricant on angle of repose
4	Determination of viscosity of liquid using Ostwald’s viscometer
5	Determination sedimentation volume with effect of different suspending agent
6	Determination sedimentation volume with effect of different concentration of single suspending agent
7	Identification and evaluation of Physical stability of an emulsion.
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 reference Books

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.

Program /Year/Sem	B. Pharm
Semester	IV
Name of the course	Pharmacology – I (Practical)
Course Code	BP 408 P
Credits	2
Hours /week	4 hours (Practical)
Pre / co-requisite/s	Nil

Course Description: This course aimed to expertise the students on Basic needs of Pharmacology like handling of animals, Routes of drug administration, Collection of blood samples by various techniques. This course also describes about different preclinical screening models employed in drug discovery and development.

Course Learning Outcomes: Upon successful completion of this course, the student should be able to:

CO 1: Demonstrate the Basic needs and skills required for pharmacology laboratory.

CO2: Perform the experiments on isolated tissue and experimental animals

CO 3: Handle & maintain the laboratory animals as per CPCSEA guidelines

Practical Course: Contents

Week	Topics
1	Introduction to Experimental Pharmacology
2	Commonly used instruments in experimental pharmacology.
3	Study of laboratory animals and their handling (a. Frogs, b. Mice, c. Rats, d. Guinea pigs, e. Rabbits).
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	Effect of Psychotropic drugs on condition avoidance response
8	To study the antidepressant activity of drugs using forced swim test
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	To study anti-amnesic effect by using Y- Maze
16	Revision

Note: All laboratory techniques and animal experiments are demonstrated by simulated experiments by software's and videos

Recommended Books (Latest Editions)

1. Rang H. P., Dale M. M., Ritter J. M., Flower R. J., Rang and Dale's Pharmacology, Churchill 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,

Program	B. Pharm
Semester	IV
Name of the course	Pharmacognosy and Phytochemistry I (Practical)
Course Code	BP409P
Credits	2
Hours /week	4 hours (Practical)
Pre / co-requisite/s	Nil

Course Description: The Pharmacognosy and Phytochemistry I laboratory course is aimed to train the students regarding laboratory skills of various chemical test of the drugs mentioned in theory under lipids, carbohydrates. This course also deals with laboratory-based experiments on identification of crude drugs by physical and microscopic evaluation.

Course Learning Outcomes: Upon successful completion of this course, the student should be able to:

CO 1: Evaluate crude drugs by chemical test.

CO 2: Demonstrate knowledge on evaluation of crude drugs.

Practical Course: Contents

S. No.	Topic
5.	Analysis of crude drugs by chemical tests: (i) Tragacanth (ii) Acacia (iii) Agar (iv) Gelatin (v) starch (vi) Honey (vii) Castor oil
6.	Determination of stomatal number and index
7.	Determination of vein islet number, vein islet termination and palisade ratio
8.	Determination of size of starch grains, calcium oxalate crystals by eye piece micrometer
9.	Determination of Fiber length and width
10.	Determination of number of starch grains by Lycopodium spore method
11.	Determination of Ash value
12.	Determination of Extractive values of crude drugs
13.	Determination of moisture content of crude drugs
14.	Determination of swelling index and foaming

Recommended Books: (Latest Editions)

1. W.C.Evans, Trease and Evans Pharmacognosy, 16th edition, W.B. Saunders & 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), IstEdn, 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.

Program	B. Pharmacy
Semester	V
Name of the course	Medicinal Chemistry II– Theory
Course Code	BP 501T
Credits	4
Hours /week	3 hours (lectures) & 1hour (Tutorial)
Pre / co-requisite/s	Nil

Course description: This subject 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 Outcomes: Upon completion of the course, the student shall be able to

CO 1: Understand the chemistry of drugs with respect to their pharmacological activity

CO 2: Identify the drug metabolic pathways, adverse effect and therapeutic value of drugs

CO 3: Know the Structural Activity Relationship of different class of drugs

CO 4: Report the chemical synthesis of selected drugs

Course Content

Unit	Topics	Hours
	<i>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 (*)</i>	
I (3 Weeks)	<p>Antihistaminic agents: Histamine, receptors and their distribution in the human body.</p> <p>H₁–antagonists: Diphenhydramine hydrochloride*, Dimenhydrinate, Doxylamines succinate, Clemastine fumarate, Diphenylpyraline hydrochloride, Tripelenamine hydrochloride, Chlorcyclizine hydrochloride, Meclizine hydrochloride, Buclizine hydrochloride, Chlorpheniramine maleate, Triprolidine hydrochloride*, Phenidamine tartrate, Promethazine hydrochloride*, Trimeprazine tartrate, Cyproheptadine hydrochloride, Azatidine maleate, Astemizole, Loratadine, Cetirizine, Levocetrazine Cromolyn</p>	12

	<p>sodium</p> <p>H₂-antagonists: Cimetidine*, Famotidine, Ranitidine.</p> <p>Gastric Proton pump inhibitors: Omeprazole, Lansoprazole, Rabeprazole, Pantoprazole</p> <p>Anti-neoplastic agents:</p> <p>Alkylating agents: Meclorothamine*, Cyclophosphamide, Melphalan, Chlorambucil, Busulfan, Thiotepa</p> <p>Antimetabolites: Mercaptopurine*, Thioguanine, Fluorouracil, Floxuridine, Cytarabine, Methotrexate*, Azathioprine</p> <p>Antibiotics: Dactinomycin, Daunorubicin, Doxorubicin, Bleomycin</p> <p>Plant products: Etoposide, Vinblastin sulphate, Vincristin sulphate</p> <p>Miscellaneous: Cisplatin, Mitotane.</p>	
II (3 Weeks)	<p>Anti-anginal:</p> <p>Vasodilators: Amyl nitrite, Nitroglycerin*, Pentaerythritol tetranitrate, Isosorbidedinitrite*, Dipyridamole.</p> <p>Calcium channel blockers: Verapamil, Bepridil hydrochloride, Diltiazemhydrochloride, Nifedipine, Amlodipine, Felodipine, Nicardipine, Nimodipine.</p>	12
	<p>Diuretics:</p> <p>Carbonic anhydrase inhibitors: Acetazolamide*, Methazolamide, Dichlorphenamide.</p> <p>Thiazides: Chlorthiazide*, Hydrochlorothiazide, Hydroflumethiazide, Cyclothiazide,</p> <p>Loop diuretics: Furosemide*, Bumetanide, Ethacrynic acid.</p> <p>Potassium sparing Diuretics: Spironolactone, Triamterene, Amiloride.</p> <p>Osmotic Diuretics: Mannitol</p>	
	<p>Anti-hypertensive Agents: Timolol, Captopril, Lisinopril, Enalapril, Benazepril hydrochloride, Quinapril hydrochloride, Methyl dopatehydrochloride,* Clonidine hydrochloride, Guanethidine monosulphate, Guanabenz acetate, Sodium nitroprusside, Diazoxide,</p>	

	Minoxidil, Reserpine, Hydralazine hydrochloride.	
III (3 Weeks)	Anti-arrhythmic Drugs: Quinidine sulphate, Procainamide hydrochloride, Disopyramide phosphate*, Phenytoin sodium, Lidocaine hydrochloride, Tocainide hydrochloride, Mexiletine hydrochloride, Lorcaïnide hydrochloride, Amiodarone, Sotalol.	12
	Anti-hyperlipidemic agents: Clofibrate, Lovastatin, Cholesteramine and Cholestipol	
	Coagulant & Anticoagulants: Menadione, Acetomenadione, Warfarin*, Anisindione, clopidogrel	
	Drugs used in Congestive Heart Failure: Digoxin, Digitoxin, Nesiritide, Bosentan, Tezosentan.	
IV (3 Weeks)	Drugs acting on Endocrine system Nomenclature, Stereochemistry and metabolism of steroids Sex hormones: Testosterone, Nandralone, Progesterones, Oestriol, Oestradiol, Oestrione, Diethyl stilbestrol.	12
	Drugs for erectile dysfunction: Sildenafil, Tadalafil.	
	Oral contraceptives: Mifepristone, Norgestrel, Levonorgestrol	
	Corticosteroids: Cortisone, Hydrocortisone, Prednisolone, Betamethasone, Dexamethasone Thyroid and antithyroid drugs: L-Thyroxine, L-Thyronine, Propylthiouracil, Methimazole.	
V (3 Weeks)	Antidiabetic agents: Insulin and its preparations Sulfonyl ureas: Tolbutamide*, Chlorpropamide, Glipizide, Glimepiride. Biguanides: Metformin.	12
	Thiazolidinediones: Pioglitazone, Rosiglitazone. Meglitinides: Repaglinide, Nateglinide. Glucosidase inhibitors: Acarbose, 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, Dipiperodon, Dibucaine.*	
TOTAL		60

Learning Resources/Recommended Texts/Reference books/web resources

1. William O. Foye. Principle of medicinal chemistry, 5th Ed. New Delhi: Wolter's Kluwer health (India) Pvt Ltd.; 2008.
2. Block JH & Beale JM. Wilson & Gisvold's Textbook of Organic Medicinal and Pharmaceutical Chemistry, 12th ed. Philadelphia: Wolter's Kluwer health (India) PvtLtd.; 2011.
3. Abraham D. Burger, Medicinal Chemistry and Drug Discovery, 6th Ed. New York: John Wiley & Sons. 2007.
4. Graham L. Patrick. An Introduction to Medicinal Chemistry, 1st ed. U K: Oxford University Publishers; 2002.
5. Rama Rao Nadenla. Medicinal Chemistry: Mc Millan Publishers; 2007.
6. Hansch. Comprehensive Medicinal Chemistry, Vol 1-6 ed. Oxford: Elsevier pergmon press.

Program	B. Pharmacy
Semester	V
Name of the course	Industrial Pharmacy I Theory
Course Code	BP 502T
Credits	4
Hours /week	3hours (lectures) & 1hour (Tutorial)
Pre / co-requisite/s	Nil

Course Description: The Industrial Pharmacy I course is aimed to present fundamentals and importance of pre-formulation studies and the effect of physic-chemical properties of drug on formulations. It emphasizes various techniques in the development and evaluation of tablets, capsules, Parenteral, ophthalmics and Aerosols. The course also deals with the formulation, equipments for manufacture of pellets and the cosmetic preparations for skin, hair. It also describes about the packaging components and their specifications.

Course Learning Outcomes:

Upon successful completion of this course, the student should be able to:

C502.1: Define the different types of tablets.

C502.2: Demonstrate the various techniques used in tablet coating.

C502.3: Analyze the fundamentals in designing of Parenteral formulations.

C502.4: Propose the appropriate packaging system for the drug products.

Course Content

Unit	Topics	Hours
I	<p>Pre-formulation Studies: Introduction to pre-formulation, goals and objectives, study of physicochemical characteristics of drug substances.</p> <p>Physical properties: Physical form (crystal & amorphous), particle size, shape, flow properties, solubility profile (pKa, pH, partition coefficient), polymorphism.</p> <p>Chemical Properties: Hydrolysis, oxidation, reduction, racemization, polymerization. BCS classification of drugs & its significant application.</p>	12

<p style="text-align: center;">II</p>	<p>Tablets: Introduction, ideal characteristics of tablets, classification of tablets. Excipients, Pre-formulation considerations and 14 Formulation of tablets, granulation methods, compression and processing problems. Equipments and tablet tooling. Tablet coating: Types of coating, coating materials, formulation of coating composition, methods of coating, equipment employed and defects in coating. Quality control tests: In process and finished product tests Liquid orals: Pre-formulation, Formulation and manufacturing consideration of Syrups, elixirs, suspensions and emulsions; Filling and packaging; evaluation of liquid orals official in pharmacopoeia</p>	
<p style="text-align: center;">III</p>	<p>Capsules: Hard gelatin capsules: Introduction, Production of hard gelatin capsule shells. Size of capsules, Filling, finishing and special techniques of formulation of hard gelatin capsules, manufacturing defects. In process and final product quality control tests for capsules. 12 Soft gelatin capsules: Introduction, Nature of shell and capsule content, size of capsules, 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, equipment for manufacture of pellets</p>	
	<p>Parenteral Products: Definition, types, advantages and limitations. Pre-formulation factors and essential requirements, vehicles, additives, Formulation requirements, importance of Iso-tonicity, Production procedure, production facilities and controls, aseptic processing, 12</p>	

IV	Formulation of injections, sterile powders, large volume parenteral and lyophilized products. Containers and closures selection, filling and sealing of ampoules, vials and infusion fluids. Quality control tests of parenteral products. Ophthalmic Preparations: Introduction, formulation and pre-formulation considerations; formulation of eye drops, eye ointments and eye lotions; methods of preparation; labeling, containers, evaluation of ophthalmic preparations	
V	Pharmaceutical Aerosols: Definition, propellants, containers, valves, types of aerosol systems; formulation and manufacture of aerosols; Evaluation of aerosols; Quality control and stability studies. Packaging Materials Science: Materials used for10 packaging of pharmaceutical products, factors influencing choice of containers, legal and official requirements for containers, Stability aspects of packaging materials, quality control tests. Cosmetics: Introduction to cosmetics, Formulation and preparation of: lipsticks, shampoos, cold cream and vanishing cream, tooth pastes, hair dyes and sunscreens.	
Total		60

Learning Resources/Recommended Texts/Reference books/web resources

Text books

1. Lachman L, Lieberman HA, Kanig JL. Theory & Practice of Industrial pharmacy. 3rd ed. Philadelphia: Lea & Febieger; 1990.
2. Allen LV, Popovich NG, Ansel HC. Pharmaceutical dosage forms and drug delivery systems. 8thed. Lippincott Williams & Wilkins; 2005.
3. Aulton Pharmaceutics ME. The science of dosage form design. 2nd ed. Churchill Livingstone; 2002.
4. Mithal B.M. A text book of pharmaceutical formulations. 6thed. Delhi: vallabh prakashan; 2010.
5. Mithal BM , Saha RN. A hand book of cosmetics. 1sted. Delhi: vallabhprakashan; 2004.
6. Lippincott Williams, Wilkin Remington. The science and practice of pharmacy. 21st ed. New Delhi: Wolterskluwer Health Pvt ltd; 2006.

Program	B. Pharm
Semester	V
Name of the course	Pharmacology- II (Theory)
Course Code	BP503T
Credits	4
Hours /week	3 hours (lectures) & 1hour (Tutorial)
Pre / co-requisite/s	Nil

Scope: This course aimed to provide knowledge on mechanism of action, adverse effects, drug interactions, contraindications and therapeutic uses of drugs acting on cardiovascular system, hematopoietic system, renal system, Endocrine system. This course also describes about pharmacological actions of autacoids and their antagonists.

Course Outcomes: Upon successful completion of this course, the student should be able to:

CO 1: Recall the mechanism of drug action and its relevance in the treatment of different diseases

CO2: Explain the pharmacology of drugs used in hormonal disorders

CO3: Describe the various bioassay methods used to estimate the potency of drugs

Course Content:

Unit	Contents	Hours
I	Pharmacology of drugs acting on cardio vascular system Drugs used in congestive heart failure Anti-hypertensive drugs. Anti-anginal drugs. Anti-arrhythmic drugs. Anti-hyperlipidemic drugs	12
II	Pharmacology of drugs acting on cardio vascular system Drug used in the therapy of shock. Hematinics, coagulants and anticoagulants. Fibrinolytics and anti-platelet drugs Plasma volume expanders Pharmacology of drugs acting on urinary system Diuretics	12

	Anti-diuretics.	
III	<p>Autocoids and related drugs</p> <p>Introduction to autacoids and classification</p> <p>Histamine, 5-HT and their antagonists.</p> <p>Prostaglandins, Thromboxanes and Leukotrienes.</p> <p>Angiotensin, Bradykinin and Substance P.</p> <p>Non-steroidal anti-inflammatory agents</p> <p>Anti-gout drugs</p> <p>Antirheumatic drugs</p>	12
IV	<p>Pharmacology of drugs acting on endocrine system</p> <p>Basic concepts in endocrine pharmacology.</p> <p>Anterior Pituitary hormones- analogues and their inhibitors.</p> <p>Thyroid hormones- analogues and their inhibitors.</p> <p>Hormones regulating plasma calcium level- Parathormone, Calcitonin and Vitamin-D.</p> <p>Insulin, Oral Hypoglycemic agents and glucagon.</p> <p>ACTH and corticosteroids.</p>	12
V	<p>Pharmacology of drugs acting on endocrine system</p> <p>Androgens and Anabolic steroids.</p> <p>Estrogens, progesterone and oral contraceptives.</p> <p>Drugs acting on the uterus.</p> <p>Bioassay</p> <p>a. Principles and applications of bioassay.</p> <p>b. Types of bioassay</p> <p>c. Bioassay of insulin, ACTH, d-tubocurarine, digitalis</p>	12
	Total	60

Recommended Books (Latest Editions)

1. Rang H. P., Dale M. M., Ritter J. M., Flower R. J., Rang and Dale's Pharmacology, Churchill 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.

Program	B. Pharm
Semester	V
Name of the course	Pharmacognosy and Phytochemistry II
Course Code	BP504T
Credits	4
Hours /week	3 hours (lectures) & 1hour (Tutorial)
Pre / co-requisite/s	Nil

Course Description: The Pharmacognosy and Phytochemistry II course is aimed to impart the students the knowledge of how the secondary metabolites are produced in the crude drugs, how to isolate and identify and produce them industrially. This subject involves the study of pharmacognosy of alkaloids, glycosides, Iridoids, Other terpenoids & Naphthoquinones and industrial production, identification and analysis of important phytoconstituents. The subject involves in imparting knowledge on basic phytochemical aspects.

Course Learning Outcomes: Upon successful completion of this course, the student should be able to:

CO1: Underline the importance of biogenesis

CO2: Translates pharmacognosy of alkaloids, glycosides, Iridoids, Other terpenoids & Naphthoquinones.

CO3: Illustrate industrial production, identification and analysis of important phytoconstituents.

CO4: Locate knowledge on basic phytochemical aspects.

Course Contents

UNIT	Contents	Hours
I	Metabolic pathways in higher plants and their determination: Brief study of basic metabolic pathways and formation of different secondary metabolites through these pathways- Shikimic acid pathway, Acetate pathways. Study of utilization of radioactive isotopes in the investigation of Biogenetic studies. Biosynthesis of alkaloids, biosynthesis of glycosides.	10
II	General introduction, classification, chemistry, chemical tests, of following categories of chemical constituents. Biological source, chemical constituents, therapeutic uses of	20

	<p>crude drugs under following categories.</p> <p>Alkaloids: Vinca, Rauwolfia, Belladonna, Opium.</p> <p>Glycosides: Senna, Aloes, Bitter Almond.</p> <p>Volatile oils: Mentha, Clove, Cinnamon, Fennel, Coriander,</p> <p>Tannins: Catechu, Pterocarpus0.</p> <p>Resins: Benzoin, Guggul, Ginger, Asafoetida, Myrrh, Colophony.</p> <p>Phenylpropanoids and Flavonoids: Lignans, Tea, Ruta.</p> <p>Steroids, Cardiac Glycosides & Triterpenoids: Liquorice, Dioscorea, Digitalis.</p> <p>Iridoids, Other terpenoids & Naphthaquinones: Gentian, Artemisia, taxus, carotenoids</p>	
III	<p>Isolation, Identification and Analysis of Phytoconstituents</p> <p>a) Terpenoids: Menthol, Citral,</p> <p>b) Glycosides: Glycyrrhetic acid & Rutin</p> <p>c)Alkaloids: Atropine, Quinine, Reserpine, Caffeine</p> <p>d) Resins: Podophyllotoxin, Curcumin</p>	10
IV	<p>Biological source, chemistry, uses and estimation of the following phytoconstituents:</p> <p>Forskolin, Sennoside, Artemisinin, Diosgenin, Digoxin, Atropine, Podophyllotoxin, Caffeine, Taxol, Vincristine and Vinblastine.</p>	10
V	<p>Basics of Phytochemistry:</p> <p>Modern methods of extraction, application of latest techniques like Spectroscopy, chromatography and electrophoresis in the isolation, purification and identification of crude drugs.</p>	10
Total		60

Recommended Books: (Latest Editions)

- 1.W.C. Evans, Trease and Evans Pharmacognosy, 16th edition, W.B. Saunders & 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, NiraliPrakashan, New Delhi.
- 4.Herbal drug industry by R.D. Choudhary (1996), Ist Ed., 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 & Pharmaco biotechnology. 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

Program	B. Pharmacy
Semester	V
Subject	Pharmaceutical Jurisprudence (Theory)
Course Code	BP 505 T
Credits	04
Hours /week	3 Hours (Lectures) & 1 Hour (Tutorial)
Pre /co-requisite(s)	No

Course Description This course is designed to impart basic knowledge on important legislations related to the profession of pharmacy in India. The Drugs and Cosmetics Act, along with its amendments are the core of this course. Other acts, which are covered, include the Pharmacy Act, Narcotic Drugs and Psychotropic substances Act, Medicinal and Toilet preparation Act etc. Besides this the new drug policy, DPCO, professional ethics, Patent and design Act etc., will be discussed.

Course Outcomes Upon completion of the subject student shall be able to–

CO1: Know the significance of pharmaceutical legislations in India and role of ethics in pharmacy profession.

CO2: Understand the import, export, manufacture, and sale regulations and pertaining schedules to the acts and rules.

CO2: Know and understand the administrative bodies, authorities, and officer's roles and responsibilities.

CO3: Know the constitution, functions of central, state councils, registration procedure and importance of education regulations.

CO4: Know the new drugs pricing policies, procedures and other legislations.

CO6: Know the amendments, other laws as prescribed by the central and state Councils from time to time including international laws.

Course Content

UNIT	Contents	Hours
I	<p>Code of Pharmaceutical ethics: Definition, principles and significance of ethics, Code of Pharmaceutical ethics as adopted by Pharmacy Council of India. Pharmacist's oath.</p> <p>The Drugs and Cosmetics Act, 1940 and Rules 1945: Objectives, Definitions to the Act and Rules.</p> <p>Administration of the Act and Rules – Drugs Technical Advisory Board (DTAB), Central drugs Laboratory (CDL), Drugs Consultative Committee (DCC), Government drug analysts, licensing authorities, Controlling authorities, Drugs Inspectors.</p>	10
II	<p>The Drugs and Cosmetics Act, 1940 and Rules 1945: General Study of Schedules to the Act and Rules and detailed study of Part XII B of Schedule F, Schedules G, H, H1, K, M, M-I, M-II, M-III, N, P, Q, T, U, V, X, Y. Import of drugs and cosmetics – Types of import license, procedure and conditions for grant of import license or permit and conditions of import license. Manufacture and sale of drugs – Types of manufacturing license, procedure and 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. Sale of drugs – Types of sale license, procedure and conditions for sale license and conditions of sale license. Classes of drugs and cosmetics prohibited from import, manufacture and sale or distribution or exhibit for sale. Offences and penalties. Labeling and packing of drugs- General labeling requirements and specimen labels for drugs and cosmetics, Offences and penalties.</p>	14
III	<p>The Pharmacy Act, 1948: Objectives, Definitions, Pharmacy Council of India (PCI)– constitution and functions, Education Regulations, State and Joint state pharmacy councils – constitution and functions, Registration of Pharmacists, Offences and penalties.</p> <p>Medicinal and Toilet Preparation Act (Excise Duties), 1955:</p>	12

	<p>Objectives, Definitions, Licensing, Manufacture In bond and Outside bond, Export of alcoholic preparations, Manufacture of Ayurvedic, Homeopathic, Patent & Proprietary Preparations. Levy and collection of duties. Offences and Penalties.</p> <p>Narcotic Drugs and Psychotropic substances Act, 1985 and Rules: Objectives, Definitions, Authorities and Officers, Constitution and Functions of Narcotic and Psychotropic Consultative Committee, National Fund for Controlling the Drug Abuse. Prohibition, Control and Regulation of cultivation of Opium poppy, Cannabis plant, Coca plant and production of poppy straw, manufacture, sale and export of any narcotic drug and psychotropic substance. Offences and Penalties.</p>	
IV	<p>Study of Salient Features of Drugs and Magic Remedies Act, 1954 and Rules: Objectives, Definitions, Prohibition of certain advertisements, Classes of Exempted advertisements, Schedule to the Act. Offences and Penalties.</p> <p>Prevention of Cruelty to animals Act-1960: Objectives, Definitions, Institutional Animal Ethics Committee (IAEC), The Committee for the Purpose of Control and Supervision of Experiments on Animals (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.</p> <p>National Pharmaceutical Pricing Authority (NPPA): Introduction, National Pharmaceutical Pricing Policy (NPPP) -2012.</p>	12
V	<p>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. Schedules to DPCO, Schedule-I: National List of Essential Medicines (NLEM).</p> <p>Study of Salient Features of Medical Termination of Pregnancy Act, 1971</p> <p>Right to Information Act, 2005: Objectives, Definitions, right to</p>	12

	information and obligations of public authorities, procedure in filing RTI application and supply of information, information exempted from disclosure. Intellectual Property Rights (IPR): Introduction to intellectual property rights – Patents and designs, Copyright, Trademarks, Trade Secrets, Geographical indications, Plant variety rights etc. Medical Device and Diagnostics: Medical Device Rules, 2017.	
Total		60

Learning Resources/Recommended Texts/Reference books/web resources

1. Mithal B.M. Text Book of Forensic Pharmacy. New Delhi: Vallabh Prakashan.
2. Kokate C.K, Gokhale S.B. Text Book of Forensic Pharmacy. Hyderabad:Pharma Book Syndicate.
3. Jain N.K. Text Book of Forensic Pharmacy. New Delhi: Vallabh Prakashan.
4. Agarwal S.P, Rajesh Khanna. Pharmaceutical Jurisprudence and Ethics. NewDelhi: Birla Publications.
5. Hand book of drug law-by M.L. Mehra.
6. Drugs and Cosmetics Act/Rules by Govt. of India publications.
7. Medicinal and Toilet preparations act 1955 by Govt. of India publications.
8. Narcotic drugs and psychotropic substances act by Govt. of India publications.
9. Drugs and Magic Remedies act by Govt. of India publication.
10. B. S. Kuchekar. Forensic Pharmacy. Pune: Nirali Prakashan.
11. <https://www.indiacode.nic.in/> (It is a database of all Central enactments which are in force and their subordinate legislations made from time to time. It also contains Legislations enacted by the States and Union Territory Administrations along with their relevant subordinate legislations)

Program	B. Pharmacy
Semester	V
Name of the course	Industrial Pharmacy I (Practical)
Course Code	BP 506P
Credits	2
Hours /week	4 hours (Practical)
Pre / co-requisite/s	Nil

Course Description: The Industrial Pharmacy I laboratory course is aimed to train the students on experimental techniques for the preparation of pharmaceutical dosage forms like tablets, injections and ophthalmics. This course also deals with various quality control tests to be performed on tablets and capsules. This course also provides the laboratory skills related to formulation of cosmetic preparations like creams.

Course Learning Outcomes:

Upon successful completion of this course, the student should be able to:

- CO1 Demonstrate the skills in handling of different Equipments.
- CO2 Formulate different types of tablets, injections and ophthalmics.
- CO3 Evaluate the tests on tablets and capsules.

Week	Topics
1	Pre-formulation studies on Paracetamol/Aspirin/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	Quality 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)

Learning Resources/Recommended Texts/Reference books/web resources

Text books

1. Lachman L, Lieberman HA, Kanig JL. Theory & Practice of industrial pharmacy. 3rded. Philadelphia: Lea & Febieger; 1990.
2. Allen LV, Popovich NG, Ansel HC. Pharmaceutical dosage forms and drug delivery systems. 8th ed. Lippincott Williams & Wilkins; 2005.
3. Aulton Pharmaceutics ME. The science of dosage form design. 2nded. Churchill Livingstone; 2002.
4. Mithal B.M. A text book of pharmaceutical formulations. 6thed. Delhi: vallabh prakashan; 2010.
5. MithalBM , Saha RN. A hand book of cosmetics. Isted. Delhi: vallabh prakashan; 2004.
6. Lippincott Williams, Wilkin Remington. The science and practice of pharmacy. 21st ed. New delhi: Wolterskluwer Health pvt ltd; 2006.

Program	B. Pharm
Semester	V
Name of the course	Pharmacology – II (Practical)
Course Code	BP 507 P
Credits	2
Hours /week	4hrs (Practical)
Pre / co-requisite/s	Nil

Scope: This course aimed to provide skill for the students on various aspects of bioassay experiments. This course also provides an idea about the calculations of pA₂ value for antagonists. This course also expertise the students on drug screening methods by using intact animals.

Course Outcomes:

Upon successful completion of this course, the student should be able to:

CO 1: Demonstrate Bioassays of drugs on isolation isolated organ or tissue preparation by simulated experiments

CO2: Calculate the pA₂ value of Different antagonists by using suitable organ or tissue preparation.

CO 3: Perform the Experiments on intact animals related to screening of analgesic and anti-inflammatory agents

Practical Course: Contents

Week	Topics
1	Introduction to <i>in-vitro</i> 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
7	rectus abdominis muscle and rat ileum respectively.
8	Bioassay of histamine using guinea pig ileum by matching method.
9	Bioassay of oxytocin using rat uterine horn by interpolation method.
10	Bioassay of serotonin using rat fundus strip by three-point bioassay.

11	Bioassay of acetylcholine using rat ileum/colon by four-point bioassay.
12	Determination of PA_2 value of prazosin using rat anococcygeus muscle (by Schilds plot method).
13	
14	Determination of PD_2 value using guinea pig ileum/rat ileum/chick ileum. Effect of seasons and spasmolytics using rabbit jejunum/ rat ileum/chick ileum.
15	Anti-inflammatory activity of drugs using carrageenan induced paw-edema model. Analgesic activity of drug using central and peripheral methods

Note: All laboratory techniques and animal experiments are demonstrated by simulated experiments by software's and videos

Recommended Books (Latest Editions)

1. Rang H. P., Dale M. M., Ritter J. M., Flower R. J., Rang and Dale's Pharmacology, Churchill 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.

Program	B. Pharmacy
Semester	V
Name of the course	Pharmacognosy and Phytochemistry II (Practical)
Course Code	BP508P
Credits	2
Hours /week	4 hours (Practical)
Pre / co-requisite/s	Nil

Course Description: The Pharmacognosy and Phytochemistry II laboratory course is aimed to train the students on Morphological, histology and powder characteristics, extraction & detection of crude drugs. The subject refers to isolation & detection of active principles. This course also emphasis on analysis of crude drugs by chemical tests and chromatographic methods.

Course Learning Outcomes: Upon successful completion of this course, the student should be able to:

CO 1: Demonstrate the skills on Morphology, histology and powder characteristics & extraction & detection of crude drugs

CO 2: Illustrate isolation & detection of active principles.

CO 3. Analysis of crude drugs by chemical tests and chromatographic methods.

Practical Course: Contents

S. No.	Topic
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 Caffeine - from tea dust.
3.	Diosgenin from Dioscorea
4.	Atropine from Belladonna
5.	Sennosides from Senna
6.	Separation of sugars by Paper chromatography
7.	TLC of herbal extract
8.	Distillation of volatile oils and detection of phytoconstituents by TLC
9.	Analysis of crude drugs by chemical tests: (i) Asafoetida (ii) Benzoin (iii)

Recommended Books: (Latest Editions)

1. W.C.Evans, Trease and Evans Pharmacognosy, 16th edition, W.B. Saunders & 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 Ed., 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.

Program	B. Pharm
Year /Semester	V
Name of the course	Pharma Marketing Management
Course Code	BP509ET
Credits	4
Hours /week	3 hours (Lectures) & 1 hour (Tutorial)
Pre / co-requisite/s	Nil

Course Description: 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.

Course Learning Outcomes: Upon successful completion of this course, the student should be able to:

CO1: Understand marketing concepts and techniques.

CO2: Apply marketing management concepts in the pharmaceutical industry.

CO3: Apply pricing techniques over any proposed product.

CO4: Analyse business scenarios in an integrative way

CO5: Craft alternative strategies to address complex business-related situations as well as evaluate the pros and cons of those alternatives.

Theory Course: Contents

Unit	Topics	Hours
I (3 Weeks)	<p>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.</p> <p>Pharmaceutical market: Quantitative and qualitative aspects; size and composition of the market; demographic descriptions and socio-psychological characteristics of the consumer; market segmentation&</p>	12

	targeting. Consumer profile; Motivation and prescribing habits of the physician; patients' choice of physician and retail pharmacist. Analyzing the Market; Role of market research.	
II (3 Weeks)	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.	12
III (3 Weeks)	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.	12
IV (3 Weeks)	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.	12
V (3 Weeks)	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; Rural Marketing; Consumerism; Industrial Marketing; Global Marketing.	12
	Total	60

Learning Resources/Recommended Texts/Reference books/web resources

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 Graw Hill, 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.
9. Smarta RB. Strategic Pharma Marketing. India: A.H. Wheeler Publishing Co Ltd; 1996. ISBN-10: 8185814996, ISBN-13: 9788185814995
10. Vidyasagar G. Pharmaceutical Industrial Management. India: Pharma book syndicate; 2005. ISBN-10: 8188449121, ISBN-13: 978-8188449125
11. Subbarao C. Pharmaceutal Marketing in India – Concepts and Strategy Cases. Hyderabad: Pharma Book Syndicate; 2007. ISBN 10: 8188449253 ISBN 13: 9788188449255.
12. Khanna OP. Industrial engineering and management. New Delhi: Dhanpat Rai Publishing Company; 2010. ISBN-10: 818992835X, ISBN-13: 9788189928353.

Program	B. Pharm
Semester	V
Name of the course	Health Care and Dietary Supplements
Course Code	BP510ET
Credits	4
Hours /week	3 hours (Lectures) & 1 hour (Tutorial)
Pre / co-requisite/s	Nil

Course Description: This subject covers foundational topic that are important for understanding the need and requirements of dietary supplements among different groups in the population.

Course Learning Outcomes:

This module aims to provide an understanding of the concepts behind the theoretical applications of dietary supplements. By the end of the course, students should be able to:

CO1: Understand the need of supplements by the different group of people to maintain Healthy life.

CO2: Understand the outcome of deficiencies in dietary supplements.

CO3: Appreciate the components in dietary supplements and the application.

CO4: Appreciate the regulatory and commercial aspects of dietary supplements Including health claims.

Theory Course: Contents

UNIT	Topic	Hours
I	<p>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.</p> <p>Public health nutrition, maternal and child nutrition, nutrition and ageing, nutrition education in community.</p> <p>Source, Name of marker compounds and their chemical nature, Medicinal uses and health benefits of following used as Spirulina,</p>	15

	foods; Nutraceuticals /functional Soya bean, Ginseng, Garlic, Broccoli, Gingko, Flaxseeds.	
II	Phytochemicals as nutraceuticals: Occurrence and characteristic features (chemical nature medicinal benefits) of following Carotenoids- α and β -Carotene, Lycopene, Xanthophylls, leutin , Sulfides: Diallyl sulfides, Allyltrisulfide. Polyphenolics: Reservetrol Flavonoids- Rutin, Naringin, Quercitin, Anthocyanidins, catechins, Flavones. Prebiotics/ Probiotics: Fructo oligosaccharides, Lacto bacillum Phyto estrogens : Isoflavones, daidzein, Geebustin, lignans Tocopherols, Proteins, vitamins, minerals, cereal, vegetables and beverages as functional foods: oats, wheat bran, rice bran, sea foods, coffee, tea and the like.	15
III	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. Dietary fibres and complex carbohydrates as functional food ingredients	10
IV	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. Antioxidants: Endogenous antioxidants – enzymatic and non-enzymatic antioxidant defence, Superoxide dismutase, catalase, Glutathione peroxidase, Glutathione Vitamin C, Vitamin E, α -Lipoic acid, melatonin.	10

	Synthetic antioxidants: Butylated hydroxy Toluene, Butylated hydroxy Anisole. Functional foods for chronic disease prevention.	
V	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. Pharmacopeial Specifications for dietary supplements and nutraceuticals.	10
Total		60

Recommended Books: (Latest Editions)

1. Dietetics by Sri Lakshmi
2. Role of dietary fibres and nutraceuticals in preventing diseases by K.T Agustiand P. Faizal: BS Ppublication.
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 2ndEdn., Avery Publishing Group, NY (1997).
6. G. Gibson and C. williams Editors *2000 Functional foods* Wood head 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) Shils, ME, Olson, JA, Shike, M. 1994 *Modern Nutrition in Health and Disease*. Eighth edition. Lea and Febiger.

Program	B. Pharm
Year/Semester	V Semester
Name of the course	Entrepreneurship Development
Course Code	BP511ET
Credits	4
Hours + Tutorial/week	3 hours (Lectures) & 1 hour (Tutorial)
Pre/Co-requisite/s	Nil

Course description

This course is designed to impart knowledge and skills necessary to train the students on entrepreneurship management.

Course outcomes

On completion of this course, it is expected that students will be able to understand,

CO 1: The Role of enterprise in national and global economy

CO 2: Dynamics of motivation and concepts of entrepreneurship

CO 3: Demands and challenges of Growth Strategies and Networking

Course contents

Unit	Topic	Hours
1	Conceptual Frame Work: Concept need and process in entrepreneurship development. Role of enterprise in national and global economy. Types of enterprise – Merits and Demerits. Government policies and schemes for enterprise development. Institutional support in enterprise development and management	12
2	Entrepreneur: Entrepreneurial motivation – dynamics of motivation. Entrepreneurial competency –Concepts. Developing Entrepreneurial competencies - requirements and understanding the process of entrepreneurship development, self-awareness, interpersonal skills, creativity, assertiveness, achievement, factors affecting entrepreneur role.	12
3	Launching and Organizing an Enterprise: Environment scanning – Information, sources, schemes of assistance, problems. Enterprise selection, market assessment, enterprise feasibility study, SWOT	12

	Analysis. Resource mobilization - finance, technology, raw material, site and manpower. Costing and marketing management and quality control. Feedback, monitoring and evaluation.	
4	Growth Strategies and Networking: Performance appraisal and assessment. Profitability and control measures, demands and challenges. Need for diversification. Future Growth – Techniques of expansion and diversification, vision strategies. Concept and dynamics. Methods, Joint venture, co-ordination and feasibility study	12
5	Preparing project proposal to start on new enterprise project work – Feasibility report; Planning, resource mobilization and implementation.	12
Total		60

References

1. Akhauri, M.M.P.(1990): Entrepreneurship for Women in India, NIESBUD, New Delhi.
2. Hisrich, R.D & Brush, C.G.(1996) The Women Entrepreneurs, D.C. Health & Co., Toronto.
3. Hisrich, R.D. and Peters, M.P. (1995): Entrepreneurship – Starting, Developing and Managing a New Enterprise, Richard D., Inwin, INC, USA.
4. Meredith, G.G. etal (1982): Practice of Entrepreneurship, ILO, Geneva. Patel, V.C. (1987): Women Entrepreneurship – Developing New Entrepreneurs, Ahmedabad EDII.

Program	B. Pharmacy
Semester	VI
Name of the course	Medicinal Chemistry III– Theory
Course Code	BP 601T
Credits	4
Hours /week	3hours (lectures) & 1hour (Tutorial)
Pre / co-requisite/s	Nil

Course description: This subject 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 Outcomes: Upon completion of the course, student shall be able to

CO 1: Understand the importance of drug design and different techniques of drug design.

CO 2: Illustrate the chemistry of drugs with respect to their biological activity.

CO 3: Know the importance of SAR, metabolism, adverse effects and therapeutic value of drugs.

Course Content

Unit	Topics	Hours
<i>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 (*)</i>		
I (3 Weeks)	Antibiotics Historical background, Nomenclature, Stereochemistry, Structure activity relationship, Chemical degradation classification and important products of the following classes. β- Lactam antibiotics: Penicillin, Cephalosporins, β- Lactamase inhibitors, Monobactams	12
	Aminoglycosides: Streptomycin, Neomycin, Kanamycin	

	Tetracyclines: Tetracycline, Oxytetracycline, Chlortetracycline, Minocycline, Doxycycline	
II (3 Weeks)	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.	12
	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, Artesunate, Artemether, Atovoquone.	
III (3 Weeks)	Anti-tubercular Agents Synthetic antitubercular agents: Isoniazid*, Ethionamide, Ethambutol, Pyrazinamide, Para amino salicylic acid.* Anti-tubercular antibiotics: Rifampicin, Rifabutin, Cycloserine Streptomycin, Capreomycin sulphate.	12
	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.	

IV (3 Weeks)	<p>Antifungal agents:</p> <p>Antifungal antibiotics: Amphotericin-B, Nystatin, Natamycin, Griseofulvin.</p> <p>Synthetic Antifungal agents: Clotrimazole, Econazole, Butoconazole, Oxiconazole Tioconazole, Miconazole*, Ketoconazole, Terconazole, Itraconazole, Fluconazole, Naftifine hydrochloride, Tolnaftate*.</p>	12
	<p>Anti-protozoal Agents: Metronidazole*, Tinidazole, Ornidazole, Diloxanide, Iodoquinol, Pentamidine Isethionate, Atovaquone, Eflornithine. Anthelmintics: Diethylcarbamazine citrate*, Thiabendazole, Mebendazole*, Albendazole, Niclosamide, Oxamniquine, Praziquantal, Ivermectin.</p>	
	<p>Sulphonamides and Sulfones</p> <p>Historical development, chemistry, classification and SAR of Sulfonamides: Sulphamethizole, Sulfisoxazole, Sulphamethizine, Sulfacetamide*, Sulphapyridine, Sulfamethoxazole*, Sulphadiazine, Mefenide acetate, Sulfasalazine.</p> <p>Folate reductase inhibitors: Trimethoprim*, Cotrimoxazole.</p> <p>Sulfones: Dapsone*.</p>	
V (3 Weeks)	<p>Introduction to Drug Design</p> <p>Various approaches used in drug design.</p> <p>Physicochemical parameters used in quantitative structure activity relationship (QSAR) such as partition coefficient, Hammett's electronic parameter.</p>	12
	<p>Taft's steric parameter and Hansch analysis. Pharmacophore modeling and docking techniques.</p>	
	<p>Combinatorial Chemistry: Concept and applications of combinatorial chemistry: solid phase and solution phase synthesis.</p>	
TOTAL		60

Learning Resources/Recommended Texts/Reference books/web resources

1. William O. Foye, Textbook of Medicinal Chemistry, Lea Febiger, Philadelphia.

2. Graham. L. Patrick, an Introduction to Medicinal Chemistry, Oxford University publishers.
3. JH Block & JM Beale (Eds), Wilson & Griswold's textbook of organic Medicinal Chemistry and pharmaceutical chemistry, 11th Ed, Lipcolt, Raven, Philadelphia, 2004.
4. Rama Rao Nadendla, Medicinal Chemistry, Mc Millan Publishers.
5. Hansch, Comprehensive medicinal chemistry, Vol 1 – 6 Elsevier pergmon press, Oxford.
6. D. Abraham (Ed), Burger Medicinal chemistry and Drug discovery, Vol. 1 & 2, 6thEd, John Wiley & Sons, New York 2003.
7. M. Atherden, Bentley and Driver's Textbook of Pharmaceutical Chemistry Ed: 1. Oxford University Press, Delhi.
8. Daniel lednicer, Strategies for Organic Drug Synthesis and Design, John Wiley, N. Y. 1998.
9. D. Lednicer, Organic drug synthesis, Vol, 1 – 6, J. Wiley N.Y.

Program	B. Pharmacy
Semester	VI
Name of the course	Pharmacology- III (Theory)
Course Code	BP602 T
Credits	4
Hours /week	3hours (lectures) & 1hour (Tutorial)
Pre / co-requisite/s	Nil

Scope: This course aimed to provide knowledge on pharmacological aspects like mechanism of action, pharmacokinetics, side effects, drug interactions, contraindications and indications of drugs acting on respiratory and gastrointestinal system, infectious diseases, immuno-pharmacology and in addition, emphasis on the principles of toxicology and chrono pharmacology

Course Outcomes: Upon successful completion of this course, the student should be able to:

CO1: Illustrates the general principles of chemotherapy

CO2: Apply the knowledge of chemotherapeutic agents for the management of infectious diseases

CO3: Describe the principles of animal toxicology and human toxicology

CO4: Explain the principles of chrono pharmacology in optimization of drug therapy

Theory Course: Contents

Unit	Contents	Hours
I	<p>Pharmacology of drugs acting on Respiratory system</p> <p>Anti -asthmatic drugs</p> <p>Drugs used in the management of COPD</p> <p>Expectorants and antitussives</p> <p>Nasal decongestants</p> <p>Respiratory stimulants</p> <p>Pharmacology of drugs acting on the Gastrointestinal Tract</p> <p>Antiulcer agents.</p> <p>Drugs for constipation and diarrhea.</p> <p>Appetite stimulants and suppressants.</p> <p>Digestants and carminatives.</p> <p>Emetics and anti-emetics.</p>	12

II	<p>Chemotherapy</p> <p>a. General principles of chemotherapy.</p> <p>b. Sulfonamides and cotrimoxazole.</p> <p>c. Antibiotics: Penicillin's, cephalosporins, chloramphenicol, macrolides, quinolones and fluoroquinolones, tetracycline and aminoglycosides</p>	12
III	<p>Chemotherapy</p> <p>Antitubercular agents</p> <p>Antileprotic agents</p> <p>Anti-fungal agents</p> <p>Antiviral drugs</p> <p>Anthelmintics</p> <p>Antimalarial drugs</p> <p>Antiamoebic agents</p>	12
IV	<p>Chemotherapy</p> <p>Urinary tract infections and sexually transmitted diseases.</p> <p>Chemotherapy of malignancy.</p> <p>Immunopharmacology</p> <p>Immunostimulants</p> <p>Immunosuppressant</p> <p>Protein drugs, monoclonal antibodies, target drugs to antigen, biosimilars</p>	12
V	<p>Principles of toxicology</p> <p>Definition and basic knowledge of acute, subacute and chronic toxicity.</p> <p>Definition and basic knowledge of genotoxicity, carcinogenicity, teratogenicity and mutagenicity</p> <p>General principles of treatment of poisoning</p> <p>Clinical symptoms and management of barbiturates, morphine, organophosphorus compound and lead, mercury and arsenic poisoning.</p>	12

	Chrono pharmacology Definition of rhythm and cycles. Biological clock and their significance leading to chronotherapy.	
	Total	60

Recommended Books (Latest Editions)

1. Rang H. P., Dale M. M., Ritter J. M., Flower R. J., Rang and Dale's Pharmacology, Churchill 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.

Program	B. Pharmacy
Semester	VI
Name of the course	Herbal Drug Technology (Theory)
Course Code	BP 603 T
Credits	4
Hours /week	3hours (lectures) & 1hour (Tutorial)
Pre / co-requisite/s	Nil

Course Description: This subject gives the student the knowledge of basic understanding of herbal drug industry, the quality of raw material, guidelines for quality of herbal drugs, herbal cosmetics, natural sweeteners, Nutraceuticals etc. The subject also emphasizes on Good Manufacturing Practices (GMP), patenting and regulatory issues of herbal drugs

Course Learning Outcomes: Upon completion of this course the student should 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.

Theory Course: Contents

UNIT	Topic	Hours
I	<p>Herbs as raw materials</p> <p>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</p> <p>Biodynamic Agriculture</p> <p>Good agricultural practices in cultivation of medicinal plants including Organic farming. Pest and Pest management in medicinal plants: Bio pesticides/ Bio insecticides.</p> <p>Indian Systems of Medicine</p> <p>Preparation and standardization of Ayurvedic formulations viz Aristas and Asawas, Ghutika, Churna, Lehya and Bhasma</p>	12
II	<p>Nutraceuticals</p> <p>General aspects, Market, growth, scope and types of products</p>	12

	<p>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.</p> <p>Study of following herbs as health food: Alfalfa, Chicory, Ginger, Fenugreek, Garlic, Honey, Amla, Ginseng, Ashwagandha, Spirulina</p> <p>Herbal-Drug and Herb-Food Interactions: General introduction to interaction and classification. Study of following drugs and their possible side effects and interactions: Hypericum, kava-kava, Ginkobiloba, Ginseng, Garlic, Pepper & Ephedra.</p>	
III	<p>Herbal Cosmetics</p> <p>Sources and description of raw materials of herbal origin used via, fixed oils, waxes, gums colors, perfumes, protective agents, bleaching agents, antioxidants in products such as skin care, hair care and oral hygiene products.</p> <p>Herbal excipients: Herbal Excipients – Significance of substances of natural origin as excipients – colorants, sweeteners, binders, diluents, viscosity builders, disintegrants, flavors & perfumes.</p> <p>Herbal formulations: Conventional herbal formulations like syrups, mixtures and tablets and Novel dosage forms like Phytosomes</p>	12
IV	<p>Evaluation of Drugs WHO & ICH guidelines for the assessment of herbal drugs</p> <p>Stability testing of herbal drugs.</p> <p>Patenting and Regulatory requirements of natural products:</p> <p>Definition of the terms: Patent, IPR, Farmers right, Breeder’s right, Patenting aspects of Traditional Knowledge and Natural Products. Case study of Curcuma.</p> <p>Regulatory Issues - Regulations in India (ASU DTAB, ASU DCC), Regulation of manufacture of ASU drugs - Schedule Z of Drugs & Cosmetics Act for ASU drugs.</p>	12
V	<p>General Introduction to Herbal Industry</p> <p>Herbal drugs industry: Present scope and future prospects.</p>	12

	A brief account of plant based industries and institutions involved in work on medicinal and aromatic plants in India. Schedule 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 equipment’s, standard operating procedures, health and hygiene, documentation and records.	
Total		60

Recommended Books: (Latest Editions)

1. W.C. Evans, Trease and Evans Pharmacognosy, 16th edition, W.B. Saunders & 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), IstEdn, 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. Pharmacognosy & Phytochemistry by V.D.Rangari
10. Pharmacopoeal standards for Ayurvedic Formulation (Council of Research in Indian Medicine & Homeopathy)
11. Mukherjee, P.W. Quality Control of Herbal Drugs: An Approach to Evaluation of Botanicals. Business Horizons Publishers, New Delhi, India, 2002.
12. Pragi A, Varun A. A text book of Herbal Drug Technology
13. Satya S, Jaiganesh KP, Sudha P. Current trends in Herbal Drug Technology.

Program	B. Pharmacy
Semester	VI
Name of the course	Biopharmaceutics and Pharmacokinetics
Course Code	BP 604T
Credits	4
Hours /week	3hours (lectures) & 1hour (Tutorial)
Pre / co-requisite/s	Nil

Course Description: This subject is designed to impart knowledge and skills of Biopharmaceutics and pharmacokinetics and their applications in pharmaceutical development, design of dose and dosage regimen and in solving the problems arised.

Course outcome

At the end of the theory course, the student will be able to

- C704.1 Understand the concepts of Absorption, Distribution, Metabolism and Elimination of Drugs
- C704.2 Estimate various pharmacokinetic parameters of drugs following various compartment models with different routes of administration.
- C704.3 Understand the concepts of Design of Dosage Regimen
- C704.4 Demonstrate the understanding of Bioavailability and Bioequivalence

Course Content

Unit	Contents	Hours
I.	<p>Introduction to Biopharmaceutics</p> <p>Absorption: Mechanisms of drug absorption through GIT, factors influencing drug absorption though GIT, absorption of drug from Non per oral extra-vascular routes,</p> <p>Distribution: Tissue permeability of drugs, binding of drugs, apparent volume of drug distribution, Protein binding of drugs: plasma and tissue protein binding of drugs, factors affecting protein-drug binding. Kinetics of protein binding, Clinical significance of protein binding of drug</p>	12

II.	<p>Elimination: Drug metabolism and basic understanding metabolic pathways renal excretion of drugs, factors affecting renal excretion of drugs, renal clearance, Nonrenal routes of drug excretion of drugs</p> <p>Bioavailability and Bioequivalence: Definition and Objectives of bioavailability, absolute and relative bioavailability, measurement of bioavailability, <i>in-vitro</i> drug dissolution models, <i>in-vitro-in-vivo</i> correlations, bioequivalence studies, methods to enhance the dissolution rates and bioavailability of poorly soluble drugs</p>	12
III.	<p>Pharmacokinetics:</p> <p>Definition and introduction to Pharmacokinetics, Compartment models, Non compartment models, physiological models, One compartment open model. (a) Intravenous Injection (Bolus) (b) Intravenous infusion and (c) Extra vascular administrations.</p> <p>Pharmacokinetics parameters- KE, t_{1/2}, V_d, AUC, K_a, Cl_T and CLR- definitions methods of eliminations, understanding of their significance and application</p>	12
IV.	<p>Multi compartment models: Two compartment open model. IV bolus</p> <p>Dosage Regimens: Approaches to Design of Dosage Regimen: Kinetics of multiple dosing, steady state drug levels, calculation of loading and maintenance doses and their significance in clinical settings.</p>	12
V.	<p>Nonlinear Pharmacokinetics: a. Introduction, b. Factors causing Non-linearity. c. Michaelis-menton method of estimating parameters, Explanation with example of drugs.</p>	12
Total		60

Recommended reference Books

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 International edition, USA
4. Biopharmaceutics and Pharmacokinetics-A Treatise, By D.M. Brahmkar and Sunil B. Jaiswal, Vallabh Prakashan Pitampura, Delhi
5. Pharmacokinetics: By Milo Gibaldi Donald, R. Mercei Dekker Inc.
6. Handbook 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 Thomas, N. Tozen, Lea and Febiger, 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 Robert F Notari Marcel Dekker Inc, New York and Basel, 1987
12. Remington's Pharmaceutical Sciences, By Mack Publishing Company, Pennsylvania

Program	B. Pharmacy
Semester	VI
Name of the course	Pharmaceutical Biotechnology-Theory
Course Code	BP605T
Credits	4
Hours /week	3 hours (lectures) & 1hour (Tutorial)

Course Description: This course is dealing with the basic techniques of fermentation technology, rDNA technology, Enzyme immobilization, biotechnological based. This course will focus on the new developments in the production of biopharmaceuticals by rDNA technology and monoclonal antibodies.

Course Learning Outcomes: Upon completion of the subject student shall be able to;

CO 1: Compare the knowledge of interlinks of pharmaceutical sciences, with biotechnology by using living organisms, their products applying rDNA technology and immobilized enzymes in Pharmaceutical Industries

CO2: Expertise their skills for biotechnology concepts, tools and genetic engineering techniques.

CO3: Genetic engineering applications in relation to production of pharmaceuticals and vaccines.

CO4: Importance of Monoclonal antibodies in Industries.

CO5: Appreciate the use of microorganisms in fermentation technology.

Course Contents

Unit	Contents	Hours
I	Brief introduction to Biotechnology with reference to Pharmaceutical Sciences. Enzyme Biotechnology- Methods of enzyme immobilization and applications. Biosensors- Working and applications of biosensors in Pharmaceutical Industries. Brief introduction to Protein Engineering. Use of microbes in industry. Production of Enzymes- General consideration - Amylase, Catalase, Peroxidase, Lipase, Protease, Penicillinase. Basic principles of genetic engineering.	12
II	Study of cloning vectors, restriction endonucleases and DNA ligase. Recombinant DNA technology. Application of genetic engineering in medicine.	12

	Application of r DNA technology and genetic engineering in the production of: Interferon ii) Vaccines- hepatitis- B iii) Hormones-Insulin. Brief introduction to PCR.	
III	Types of immunity- humoral immunity, cellular immunity Structure of Immunoglobulins, Structure and Function of MHC Hypersensitivity reactions, Immune stimulation and Immune suppressions. General method of the preparation of bacterial vaccines, toxoids, viral vaccine, antitoxins, serum-immune blood derivatives and other products relative to immunity. Storage conditions and stability of official vaccines Hybridoma technology- Production, Purification and Applications. Blood products and Plasma Substitutes.	12
IV	Immuno blotting techniques- ELISA, Western blotting, Southern blotting. Genetic organization of Eukaryotes and Prokaryotes. Microbial genetics including transformation, transduction, conjugation, plasmids and transposons. Introduction to Microbial biotransformation and applications. Mutation: Types of mutation/mutants.	12
V	Fermentation methods and general requirements, study of media, equipments, sterilization methods, aeration process, stirring. Large scale production fermenter design and its various controls. Study of the production of - penicillin's, citric acid, Vitamin B12, Glutamic acid, Griseofulvin, Blood Products: Collection, Processing and Storage of whole human blood, dried human plasma, plasma Substitutes.	12
Total		60

Recommended Books (Latest edition):

1. B.R. Glick and J.J. Pasternak: Molecular Biotechnology: Principles and applications of Recombinant DNA: 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.

8. Vyas SP, DixitVK. Pharmaceutical Biotechnology, 1sted. India: CBS Publishers.

9. PrescottSC, DunnCG. Industrial Microbiology, 1sted. UK: Mc.Graww Hill.

10. Kokate, Jalalpure, Hurakadle : Pharmaceutical Biotechnology, Elsevier India.

Program	B. Pharmacy
Semester	VI
Name of the course	Biostatistics and Research Methodology
Course Code	BP606T
Credits	4
Hours /week	3 hours (Lecture)+ 1hour (Tutorial)
Pre / co-requisite/s	Nil

Course Description: This course helps the students to understand the applications of Biostatistics in Pharmacy. This subject deals with descriptive 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 and Experimental studies, SPSS, R and MINITAB statistical software's, analyzing the statistical data using Excel.

Course Learning Outcomes: Upon successful completion of this course, the student should be able to:

CO1: Define Basics concepts of Statistics

CO2: Recognize types of clinical studies, types of data distribution, data graphics and statistical applications in Pharmacy.

CO3: Formulate parametric tests and non-parametric tests.

CO4: Able to the operation of M.S. Excel, SPSS, R and MINITAB®, DoE (Design of Experiment)

Theory Course: Contents

Unit	Topics	No. of hours
I	Introduction: Statistics, Biostatistics, Frequency distribution Measures of central tendency: Mean, Median, Mode- Pharmaceutical examples Measures of dispersion: Dispersion, Range, standard deviation, Pharmaceutical problems Correlation: Definition, Karl Pearson's coefficient of correlation, Multiple correlation - Pharmaceuticals examples	13
II	Regression: Curve fitting by the method of least squares, fitting the	

	<p>lines $y = a + bx$ and $x = a + by$, Multiple regression, standard error of regression– Pharmaceutical Examples</p> <p>Probability: Definition of probability, Binomial distribution, Normal distribution, Poisson’s distribution, properties – problems</p> <p>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</p> <p>Parametric test: t-test (Sample, Pooled or Unpaired and Paired) , ANOVA, (One way and Two way), Least Significance difference</p>	13
III	<p>Non-Parametric tests: Wilcoxon Rank Sum Test, Mann-Whitney U test, Kruskal-Wallis test, Friedman Test</p> <p>Introduction to Research: Need for research, Need for design of Experiments, Experiential Design Technique, plagiarism</p> <p>Graphs: Histogram, Pie Chart, Cubic Graph, response surface plot, Counter Plot graph</p> <p>Designing the methodology: Sample size determination and Power of a study, Report writing and presentation of data, Protocol, Cohorts studies, Observational studies, Experimental studies, Designing clinical trial, various phases.</p>	13
IV	<p>Blocking and confounding system for Two-level factorials</p> <p>Regression modeling: Hypothesis testing in Simple and Multiple regression models</p> <p>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</p>	11
V	<p>Design and Analysis of experiments:</p> <p>Factorial Design: Definition, 2^2, 2^3 design.</p>	10

	Advantage of factorial design Response Surface methodology: Central composite design, Historical design, Optimization Techniques	
	Total	60

Learning Resources/Recommended Texts/Reference books/web resources

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.
5. Text book of Statistical Methods and Computer applications by Dr. Ramakrishna Prasad.
6. Fundamentals of Biostatistics by Khan and Khanum.

Program	B. Pharmacy
Semester	VI
Name of the course	Medicinal Chemistry III – Practical
Course Code	BP 607P
Credits	2
Hours /week	4 hours
Pre / co-requisite/s	Nil

Course Description: Medicinal Chemistry - III laboratory course aimed to train the students in chemical synthesis and purification process for few medicinal compounds. This course also provides the laboratory skills related to identification of impurities and percentage purity present in drug substances as per IP procedures.

Course Outcomes: Upon successful completion of this course, the student should be able to:

CO 1: Demonstrate the skills in synthesis of various medicinal compounds and intermediates.

CO 2: Perform quantitative estimations to determine the purity of drug substances.

CO 3: Know the physicochemical properties of drugs and Lipinski rule by *Insilico* drug design software.

Week	TOPICS
I. Preparation of drugs and intermediates	
1	Sulphanilamide
2	7-Hydroxy-4-methyl coumarin
3	Chlorobutanol
4	Chalcone
5	Diazoamino benzene from aniline
6	Hexamine
II. Assay of drugs	
7	Isonicotinic acid hydrazide
8	Chloroquine
9	Albendazole
10	Dapsone
11	Chlorpheniramine maleate

12	Lactic acid/Acetazolamide
13, 14	III. Preparation of medicinally important compounds or intermediates by Microwave irradiation technique
15, 16	IV. Drawing structures and reactions using Chem Draw® 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 (Lipinski's RO5)

Learning Resources/Recommended Texts/Reference books/web resources

1. Vogel A. L. Vogel's Textbook of Practical Organic Chemistry, 5th ed. Pearson Prentice Hall: Dorling. Kindersley (India) Pvt, Ltd; 2007.
2. Mann F. G. & Saunders B. C. Practical Organic Chemistry, 4th ed.: Pearson Publishers; 2007.
3. Indian pharmacopoeia 2007/2010.
4. Burger's Medicinal Chemistry, Vol I to IV.
5. Introduction to principles of drug design- Smith and Williams.

Program	B. Pharmacy
Semester	VI
Name of the course	Pharmacology – III (Lab)
Course Code	BP 608 P
Credits	2
Hours /week	4 hours (laboratory)
Pre / co-requisite/s	Nil

Scope: The pharmacology laboratory course is aimed to skilled the students to perform the various toxicity tests according to respective guidelines. And also, expertise the students on biostatistics used in experimental pharmacology.

Course Outcomes:

Upon successful completion of this course, the student should be able to:

CO 1: Estimate the serum biochemical parameters by using semi-auto analyzer

CO2: Find out the LD50 of given compounds

CO 3: Apply the various Biostatistics methods in experimental pharmacology

Practical Course: Contents

Week	Topics
1	Dose calculation in pharmacological experiments
2	Anti-allergic 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 Antidiarrheal activity of drugs
5	Study of anti-helminthic activity
6	Estimation of serum biochemical parameters by using semi- autoanalyzer
7	Study of antioxidant activity (<i>Invitro/ In vivo</i>) Study of antidiabetic activity (<i>In vitro/ In vivo</i>)
8	Test for pyrogens (rabbit method)
9	Determination of acute oral toxicity (LD50) of a drug from a given data
10	Determination of acute skin irritation / corrosion of a test substance

11	Determination of acute eye irritation / corrosion of a test substance
12	Calculation of pharmacokinetic parameters from a given data
13	Biostatistics methods in experimental pharmacology (student's t test, ANOVA).
14	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, Churchill 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.

Program	B. Pharmacy
Semester	VI
Name of the course	HERBAL DRUG TECHNOLOGY (Practical)
Course Code	BP 609 P
Credits	2
Hours /week	4 hours (Practical)
Pre / co-requisite/s	Nil

Course Description: Herbal drug technology laboratory course is aimed to train the students regarding laboratory skills by preliminary phytochemical screening of crude drugs. This course also deals with laboratory-based experiments on preparation and evaluation herbal formulation.

Course Learning Outcomes: Upon successful completion of this course, the student should be able to:

CO 1: Learn preliminary phytochemical screening of crude drugs.

CO 2: Illustrate cosmeceutical formulation and their evaluation.

CO3: Analysis herbal pharmaceutical formulations

Practical Course: Contents

Week	Topics
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 Pharmacopeial 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. W.C. Evans, Trease and Evans Pharmacognosy, 16th edition, W.B. Saunders & 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), IstEdn, 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. Pharmacognosy & Phytochemistry by V.D.Rangari
10. Pharmacopeial standards for Ayurvedic Formulation (Council of Research in Indian Medicine & Homeopathy)
11. Mukherjee, P.W. Quality Control of Herbal Drugs: An Approach to Evaluation of Botanicals. Business Horizons Publishers, New Delhi, India, 2002.

Program	B. Pharmacy
Semester	VII
Name of the course	Instrumental methods of analysis (Theory)
Course Code	BP701T
Credits	4
Hours/week	3 hours (lectures) + 1 (Tutorial)
Pre/co-requisite/s	Nil

Course Description

This subject deals with the application of instrumental methods in qualitative and quantitative 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 Learning Outcomes: Upon completion of the course the student shall be able to

CO1. Understand the interaction of matter with electromagnetic radiations and its applications in drug analysis

CO2. Understand the chromatographic separation and analysis of drugs.

CO3. Perform quantitative & qualitative analysis of drugs using various analytical instruments.

Course content:

Unit	Topics	Hours
I	<p>UV Visible spectroscopy</p> <p>Introduction to Spectroscopy, Properties of Electromagnetic Radiation, Electromagnetic spectrum and its interaction with matter. Electronic transitions, chromophores, auxochromes, spectral shifts, solvent effect on absorption spectra, Beer and Lambert's law, Derivation and deviations.</p> <p>Instrumentation - Sources of radiation, wavelength selectors, sample cells, detectors- Photo tube, Photomultiplier tube, Photo voltaic cell, Silicon Photodiode.</p> <p>Applications - Spectrophotometric titrations, Single component and multi component analysis</p> <p>Fluorimetry</p> <p>Theory, Concepts of singlet, doublet and triplet electronic states, internal and external conversions, factors affecting fluorescence, quenching, instrumentation and applications</p>	15

II	<p>IR spectroscopy Introduction, fundamental modes of vibrations in poly atomic molecules, samplehandling, factors affecting vibrations</p> <p>Instrumentation - Sources of radiation, wavelength selectors, detectors - Golay cell, Bolometer, Thermocouple, Thermister, Pyroelectric detector and applications</p> <p>NMR, Mass Spectroscopy: Basic introduction and applications</p> <p>Flame Photometry: Principle, Interferences, Instrumentation and applications</p> <p>Atomic Absorption Spectroscopy: Principle, Interferences, Instrumentation and applications</p> <p>Nepheloturbidometry- Principle, instrumentation and applications</p>	15
III	<p>Introduction to chromatography</p> <p>Adsorption and partition column chromatography- Methodology, advantages, disadvantages and applications.</p> <p>Thin layer chromatography- Introduction, Principle, Methodology, Rf values, advantages, disadvantages and applications.</p> <p>Paper chromatography- Introduction, methodology, development techniques, advantages, disadvantages and applications.</p> <p>Electrophoresis- Introduction, factors affecting electrophoretic mobility, Techniques of paper, gel, capillary electrophoresis, applications</p>	10
IV	<p>Gas chromatography - Introduction, theory, instrumentation, derivatization, temperature programming, advantages, disadvantages and applications</p> <p>High performance liquid chromatography (HPLC)- Introduction, theory, instrumentation, advantages and applications.</p>	10
V	<p>Ion exchange chromatography- Introduction, classification, ion exchange resins, properties, mechanism of ion exchange process, factors affecting ion exchange, methodology and applications</p> <p>Gel chromatography- Introduction, theory, instrumentation and applications</p> <p>Affinity chromatography- Introduction, theory, instrumentation and applications</p>	10
	Total	60

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

Program	B. Pharmacy
Semester	
Name of the course	Industrial Pharmacy II
Course Code	BP 702 T
Credits	4
Hours /week	3hours (lectures) & 1hour (Tutorial)
Pre / co-requisite/s	Nil

Course Description: The Industrial Pharmacy II course is aimed to impart knowledge on techniques of pilot plant and scale up, quality management systems. It emphasizes the discussions on regulatory requirements and considerations for filing and approval process - NDA, IND. This course also deals with technology transfer process. It also enlightens the students to know different Laws and Acts that regulate pharmaceutical industry.

Course outcome

At the end of the theory course, the student will be able to

CO1: Define basic framework of regulatory affairs.

CO2: Identify the various regulatory requirements for filing process of IND and NDA

CO3: Describe the process of technology transfer from lab scale to commercial batch

CO4: Propose the regulatory environment by implementing regulatory practices

Course Content

Unit	Contents	Hours
I	Pilot plant scale up techniques: General considerations - including significance of personnel 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.	12
II	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,	14

	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.	
III	<p>Regulatory affairs: Introduction, Historical overview of Regulatory Affairs, Regulatory authorities, Role of Regulatory affairs department, Responsibility of Regulatory Affairs Professionals</p> <p>Regulatory requirements for drug approval: Drug Development Teams, Non-Clinical Drug 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.</p>	12
IV	<p>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.</p>	12
V	<p>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.</p>	10
	Total	60

Learning Resources/Recommended Texts/Reference books/web resources

Text books

1. A Guide to Total Quality Management by Kaushik Maitra and Sedhan K. Ghosh.
2. The Pharmaceutical Regulatory Process, Second Edition Edited by Ira R. Berry and Robert
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. Guarino RA. New Drug Approval Process (Drugs and the Pharmaceutical Sciences). Marcel Dekker Inc: USA; 198
7. ISBN-13: 978-0824773823.

Program	B. Pharmacy
Semester	VII
Name of the course	Pharmaceutical Quality Assurance
Course Code	BP703T
Credits	4
Hours /week	3hours (lectures) & 1hour (Tutorial)
Pre / co-requisite/s	Nil

Course Description:

The pharmaceutical quality assurance course provides the knowledge on various aspects related to pharmaceutical manufacturing industries. It covers the concepts and guidelines of quality assurance and quality management, Total Quality Management (TQM), ICH guidelines, Quality by Design (QbD), ISO 9000 & ISO 14000, NABL Accreditation and IPR. It deals with pharmaceutical aspects related to Organization and personnel, Premises, equipments and raw materials. The course offers the information on the activities like quality control, calibration and validation, warehousing and good laboratory practice (GLP). It also provides the quality assurance activities of complaints, recalls and document maintenance in pharmaceutical industry.

Course Learning Outcomes:

Upon successful completion of this course, the student should be able to:

- CO 1: Define the principles and concepts of TQM, ICH, QbD, ISO, GMP, GLP, calibration, validation, warehousing and IPR.
- CO 2: Distinguish the calibration and validation activities of QC and QA in Pharmaceutical manufacturing industry as per the regulatory authorities.
- CO 3: Evaluate the pharmaceutical manufacturing activities related to premises, organization, personnel, warehousing, equipments, raw materials, complaints, product recalls, and document maintenance.

Theory Course: Contents

Unit	Topics	Hours
I (4 Weeks)	Quality Assurance and Quality Management concepts: Definition and concept of Quality control, Quality assurance and GMP. Total Quality Management (TQM): Definition, elements, philosophies.	16
	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 and Benefits. NABL accreditation: Principles and procedures. Intellectual property rights: General principles, Concepts.	
II (3 Weeks)	Organization and personnel: Personnel responsibilities, training, hygiene and personal records.	12
	Premises: Design, construction and plant layout, maintenance, sanitation, environmental control, 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.	
III (2 Weeks)	Quality Control: Quality control test for containers, rubber closures and secondary packing materials.	8
	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	

IV (3 Weeks)	Complaints: Complaints and evaluation of complaints, Handling of return good, recalling and waste disposal. Document maintenance in pharmaceutical industry: Batch Formula Record, Master Formula Record, SOP, Quality audit, Quality Review and Quality documentation, Reports and documents, distribution records.	12
V (3 Weeks)	Calibration and Validation: Introduction, definition and general principles of calibration and validation, importance and scope of validation, types of validation, validation master plan. Advantages of Validation. General principles of Analytical method Validation.	12
	Qualification: Introduction, definition, general principles and types.	
	Warehousing: Good warehousing practice, materials management	
TOTAL		60

Learning Resources/Recommended Texts/Reference books/web resources

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.
10. Saha CN, Bhattacharya S. Intellectual property rights: An overview and implications in pharmaceutical industry. J Adv Pharm Technol Res. 2011;2(2):88-93. doi:10.4103/2231-4040.82952

Program	B. Pharmacy
Semester	VII
Name of the course	Novel Drug Delivery Systems
Course Code	BPH704T
Credits	4
Hours /week	3hours (lectures) & 1hour (Tutorial)
Pre / co-requisite/s	Nil

Course Description: This course is designed to impart knowledge on the area of novel drug delivery systems, their formulation, evaluation, and applications. The course also allows students to extend their knowledge in various approaches for development of novel drug delivery systems and criteria for selection of drugs and polymers for the development of Novel drug delivery systems and Targeted drug delivery systems.

Course outcomes

At the end of the theory course, the student will be able to

CO1: Understand the concepts, applications and criteria for selection of drugs and polymers for the development and formulation of Novel drug delivery systems.

CO2: Apply knowledge in designing and formulation, characterization of various novel formulations as per requirements.

CO3: Assess various evaluation parameters for oral, parenteral, topical etc. drug delivery systems.

CO4 Originate novel current drug delivery technologies in development of dosage forms and differentiate them from conventional systems

Course Content

Unit	Contents	Hours
I	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 of polymers in formulation of controlled release drug delivery systems.	12

II	<p>Microencapsulation: Definition, advantages and disadvantages, microspheres/ microcapsules, microparticles, methods of microencapsulation, applications. Mucosal Drug Delivery system: Introduction, Principles of bio adhesion/ mucoadhesion, concepts, advantages and disadvantages, transmucosal permeability and formulation considerations of buccal delivery systems. Implantable Drug Delivery Systems: Introduction, advantages and disadvantages, concept of implants and osmotic pump, Design of Elementary osmotic pump, Alzet osmotic pump</p>	12
III	<p>Transdermal Drug Delivery Systems: Introduction, Permeation through skin, factors affecting permeation, permeation enhancers, basic components of TDDS, formulation approaches, Evaluation of TDDS</p> <p>Gastroretentive drug delivery systems: Introduction, advantages, disadvantages, approaches for GRDDS – Floating, high-density systems, inflatable and gastroadhesive systems and their applications, Evaluation of GRDDS. Nasopulmonary drug delivery system: Introduction to Nasal and Pulmonary routes of drug delivery, Formulation of Inhalers (dry powder and metered dose), nasal sprays, nebulizers</p>	12
IV	<p>Targeted drug Delivery: Concepts and approaches advantages and disadvantages, introduction to liposomes, niosomes, nanoparticles, monoclonal antibodies and their applications and evaluation tests</p>	12
V	<p>Ocular Drug Delivery Systems: Introduction, intra ocular barriers and methods to overcome –Preliminary study, ocular formulations and occuserts. Intrauterine Drug Delivery Systems: Introduction, advantages and disadvantages, development of intra uterine devices (IUDs) and applications.</p>	12
Total		60

Learning Resources:

Y W. Chien, Novel Drug Delivery Systems, 2nd edition, revised and expanded, Marcel Dekker, Inc., New York, 1992.

S.P.Vyas and R.K.Khar, Controlled Drug Delivery - concepts and advances VallabhPrakashan, New Delhi, First edition 2002.

N.K. Jain, Controlled and Novel Drug Delivery, CBS Publishers & Distributors New Delhi, First edition 1997 (reprint in 2001).

Saltzman WM. Drug delivery: engineering principles for drug therapy. Oxford University Press; 2001.

Wang B, Hu L, Siahaan TJ. Drug delivery: principles and applications. John Wiley & Sons; 2016 Mar 9.

Robinson, J. R., Lee V. H. L, Controlled Drug Delivery Systems, Marcel Dekker, Inc., New York, 1992.

Encyclopedia of Controlled Delivery. Edith Mathiowitz, Published by Wiley Interscience Publication, John Wiley and Sons, Inc, New York. Chichester/Weinheim.

Program	B. Pharmacy
Semester	VII
Name of the course	Instrumental Methods of Analysis (Practical)
Course Code	BP705P
Credits	2
Hours/week	4hours(lectures)
Pre/co-requisite/s	Nil

Course Outcomes: Upon completion of the course the student shall be able to

CO 1: Handle UV-Vis Spectrophotometer. **CO**

2: Analyze drugs by different techniques

Practical Course: Contents

Week	Topics
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 amino acids by circular paper chromatography
13	Separation of sugars by thin layer chromatography
14	Separation of plant pigments by column chromatography
15	Demonstration experiment on HPLC

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

Program	B. Pharm
Semester	VIII
Name of the course	Pharmacy Practice
Course Code	BP801T
Credits	4
Hours /week	3hours (lectures) & 1hour (Tutorial)
Pre / co-requisite/s	Nil

Course Description: This course is designed based on the changing scenario of pharmacy practice in India. The course gives a brief description about the organization and classification of hospitals. The course describes various skills like drug distribution, drug information, and therapeutic drug monitoring for improved patient care. The course describes the activities of community pharmacy such as drug store management and inventory control, dispensing of drugs, responding to minor ailments by providing suitable safe medication, patient counselling for improved patient care in the community set up. This course mentions the importance of clinical pharmacy concept and activities of the clinical pharmacist.

Course Learning Outcomes: Upon successful completion of this course, the student should be able to:

CO 1: Define the professional practice like drug distribution and management skills in hospital pharmacy, community pharmacy and clinical pharmacy in association with respect to various committees of the hospitals.

CO 2: Assess the drug therapy of patient through drug therapy chart review, medication history interview; recognize and manage drug related problems effectively.

CO 3: Equip unbiased drug and poison information.

CO 4: Interpret the laboratory investigations of specific diseased states.

CO 5: Provide the pharmaceutical care services

Theory Course: Contents

Unit	Topics	Hours
I	Hospital and it's organization Definition, Classification of hospital- Primary, Secondary and Tertiary hospitals, Classification based on clinical and non- clinical basis,	

	<p>Organization Structure of a Hospital, and Medical staffs involved in the hospital and their functions.</p> <p>Hospital pharmacy and its organization: Definition, functions of hospital pharmacy, Organization structure, Location, Layout and staff requirements, and Responsibilities and functions of hospital pharmacists.</p> <p>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.</p> <p>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.</p>	13
II	<p>Drug distribution system in a hospital</p> <p>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.</p> <p>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.</p> <p>Therapeutic drug monitoring: Need for Therapeutic Drug Monitoring, Factors to be considered during the Therapeutic Drug Monitoring, and Indian scenario for Therapeutic Drug Monitoring.</p> <p>Medication adherence: Causes of medication non-adherence, pharmacist role in the medication adherence, and monitoring of patient medication adherence.</p> <p>Patient medication history interview: Need for the patient medication history interview, medication interview forms.</p>	13

	<p>Community pharmacy management Financial, materials, staff, and infrastructure requirements.</p>	
III	<p>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. Drug information services: Drug and Poison information centre, Sources of drug information, Computerised services, and storage and retrieval of information. Patient counseling: Definition of patient counseling; steps involved in patient counseling, and Special cases that require the pharmacist 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. Prescribed medication order and communication skills Prescribed medication order- interpretation and legal requirements, and Communication skills- communication with prescribers and patients.</p>	13
IV	<p>Budget preparation and implementation Budget preparation and implementation 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. Over the counter (OTC) sales: Introduction and sale of over the counter, and Rational use of common over the counter medications.</p>	11
V	<p>Drug store management and inventory control Organization of drug store, types of materials stocked and storage</p>	

<p>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</p> <p>Investigational use of drugs Description, principles involved, classification, control, identification, role of hospital pharmacist, advisory committee.</p> <p>Interpretation of Clinical Laboratory Tests Blood chemistry, hematology, and urinalysis</p>	10
Total	60

Learning Resources/Recommended Texts/Reference books/web resources

1. William E Hassan. Hospital Pharmacy – 5th ed. Philadelphia: Lea and Febiger.
2. Merchant and Qadry's: Dr. J.S. Qadry. A textbook of Hospital Pharmacy 10th ed. B.S. Shah Prakashan.
3. David H Lawson, R Michael E. Richards. Clinical Pharmacy and Hospital Drug Management – 1982. Chapman and Hall.
4. Dr. H.P. Tipnis, Dr. Amrita Bajaj. Clinical Pharmacy – 1st ed. Career Publications.
5. Dr. G. Parthasarathi, Karin Nyfort-Hansen, Milap C Nahata. A textbook of Clinical Pharmacy Practice- essential concepts and skills – 2nd ed. University Press.
6. S. J. Carter. Cooper and Gunn's. Dispensing for Pharmaceutical students – 12th ed. CBS Publishers and Distributors.
7. Mary Lee. Basic skills in interpreting laboratory data – 5th ed. American Society of Health System Pharmacist®.
8. Susan Foran. Australian drug information -Procedure manual – 1996. Society of Hospital Pharmacists of Australia.
9. Parmar N.S. Health Education and Community Pharmacy- 18th ed. CBS Publishers and Distributors.

Program	B. Pharmacy
Semester	VIII
Name of the course	Social and Preventive Pharmacy
Course Code	BP802T
Credits	4
Hours /week	3 hours (Lecture)+ 1hour (Tutorial)
Pre / co-requisite/s	Nil

Course Description: 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 Learning Outcomes: Upon successful completion of this course, the student should be able to:

CO1: Acquire high consciousness/realization of current issues related to health and pharmaceutical problems within the country and worldwide.

CO2: Develop skills of critical way of thinking based on current healthcare development.

CO3: Evaluate alternative ways of solving problems related to health and pharmaceutical issues.

Theory Course: Contents

Unit	Topics	No. of hours
I (3 Weeks)	<p>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.</p> <p>Social and health education Food in relation to nutrition and health, Balanced diet, Nutritional deficiencies, Vitamin deficiencies, Malnutrition and its prevention.</p> <p>Sociology and health Socio cultural factors related to health and disease, Impact of urbanization on health and disease, Poverty and health</p>	13

	Hygiene and health Personal hygiene and health care; avoidable habits	
II (3 Weeks)	Preventive medicine General principles of prevention and control of diseases such as cholera, SARS, Ebola virus, influenza, acute respiratory infections, malaria, chicken guinea, dengue, lymphatic filariasis, pneumonia, hypertension, diabetes mellitus, cancer, drug addiction-drug substance abuse.	13
III (3 Weeks)	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.	13
IV (3 Weeks)	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.	11
V (3 Weeks)	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.	10
	Total	60

Learning Resources/Recommended Texts/Reference books/web resources

1. Prabhakara GN. Short Textbook of Preventive and Social Medicine. 2nd Edition. 2010. Jaypee Publications. ISBN: 9789380704104.
2. Roy Rabindra Nath, Saha Indranil. Textbook of Preventive and Social Medicine (Mahajan and Gupta). 4th Edition, 2013. Jaypee Publications. ISBN: 9789350901878.
3. Jain Vivek. Review of Preventive and Social Medicine (Including Biostatistics). 6th Edition. 2014. Jaypee Publications. ISBN: 9789351522331.
4. Hiremath Lalita D, Hiremath Dhananjaya A. Essentials of Community Medicine—A Practical Approach. 2nd Edition. 2012. Jaypee Publications. ISBN: 9789350250440.
5. K Park. Park Textbook of Preventive and Social Medicine. 21st Edition. 2011. Banarsidas Bhanot Publishers. ISBN-14: 9788190128285.
6. Ramesh Adepu. Community Pharmacy Practice. BSP publishers, Hyderabad.
7. Research in Social and Administrative Pharmacy, Elsevier, Ireland. (Journal).

Program	B. Pharmacy
Semester	VIII
Name of the course	Pharmaceutical Regulatory Science
Course Code	BP803ET
Credits	4
Hours /week	3hours (lectures) & 1hour (Tutorial)
Pre / co-requisite/s	Nil

Course Description: This course is designed to impart the fundamental knowledge on the regulatory requirements 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 Learning Outcomes: Upon successful completion of this course, the student should be able to:

CO1: Understand the process of drug discovery and development

CO2: Discusses the scientific, regulatory, and legal considerations for the development of generic drug products and Outlines the ANDA regulatory approval process

CO3: Identify the regulatory authorities and agencies governing the manufacture and sale of pharmaceuticals.

CO4: Understand the regulatory approval process and their registration in Indian and international markets

CO5: Understand, write and review Regulatory Documents.

Theory Course: Contents

Unit	Topics	No. of hours
I (3 Weeks)	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.	13
II	Regulatory Approval Process	

(3 Weeks)	<p>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.</p> <p>Regulatory authorities and agencies</p> <p>Overview of regulatory authorities of India, United States, European Union, Australia, Japan, Canada (Organization structure and types of applications).</p>	13
III (3 Weeks)	<p>Registration of Indian drug product in overseas market</p> <p>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.</p>	13
IV (3 Weeks)	<p>Clinical trials</p> <p>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</p>	11
V (3 Weeks)	<p>Regulatory Concepts</p> <p>Basic terminology, guidance, guidelines, regulations, Laws and Acts, Orange book, Federal Register, Code of Federal Regulatory, Purple book</p>	10
	Total	60

Learning Resources/Recommended Texts/Reference books/web resources

1. David Machin, Simon Day, Sylvan Green. Textbook of Clinical Trials. John Wiley and Sons; 2005.
2. Giovanna Di Ignazio, Di Giovanna, Haynes. Principles of Clinical Research. Illustrated edition. University of Michigan. Wrightson Biomedical Publications; 2008. ISBN 1871816459, 9781871816457.
3. Sachin Itkar, Dr. N.S. Vyawahare. Drug Regulatory Affairs. Nirali Prakashan.
4. Ira R. Berry and Robert P. Martin. The Pharmaceutical Regulatory Process. Drugs and the Pharmaceutical Sciences, 2nd ed. Vol.185. Informa Health care Publishers.
5. Richard A Guarino, MD. New Drug Approval Process: Accelerating Global Registrations. Drugs and the Pharmaceutical Sciences. 5th edition. Vol.190.
6. John Wiley & Sons. Inc. Guidebook for drug regulatory submissions / Sandy Weinberg.
7. Douglas J. Pisano, David Mantus. FDA Regulatory Affairs: a guide for prescription drugs, medical devices, and biologics.
8. Leon Shargel and Isader Kaufer. Generic Drug Product Development, Solid Oral Dosage forms. , Marcel Dekker series. Vol.143.
9. Fay A. Rozovsky and Rodney K. Adams. Clinical Trials and Human Research: A Practical Guide to Regulatory Compliance.
10. John I. Gallin and Frederick P. Ognibene. Principles and Practices of Clinical Research. 2nd ed.
11. Rick Ng. Drugs: From Discovery to Approval. 2nd ed.

Program	B. Pharmacy
Semester	VIII
Name of the course	Computer Aided Drug Design
Course Code	BP804ET
Credits	4
Hours /week	3hours (lectures) & 1hour (Tutorial)
Pre / co-requisite/s	Nil

Course description: This subject designed to provide detailed knowledge of rational drug design process and various techniques used in rational drug design process.

Course Outcomes: Upon completion of the course, the student shall be able to

CO 1: Design and discovery of lead molecules

CO 2: Estimate the role of drug design in drug discovery process

CO 3: Apply the concept of QSAR, docking, molecular modeling software and various strategies to design & develop new drug like molecules.

Course Content

Unit	Topics	Hours
I (3 Weeks)	Introduction to Drug Discovery and Development Stages of drug discovery and development	12
	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, Bioisosteric replacement. Any three case studies	
II (3 Weeks)	Quantitative Structure Activity Relationship (QSAR) SAR versus QSAR, History and development of QSAR,	12
	Types of physicochemical parameters, experimental and theoretical approaches for the determination of Physico-chemical parameters such as Partition coefficient, Hammett's substituent constant and Tafts	

	steric constant. Hansch analysis, Free Wilson analysis, 3D-QSAR approaches like COMFA and COMSIA.	
III (3 Weeks)	Molecular Modeling and virtual screening techniques Virtual Screening techniques: Drug likeness screening, Concept of pharmacophore mapping and pharmacophore based Screening,	12
	Molecular docking: Rigid docking, flexible docking, manual docking,	
	Docking based screening. <i>De novo</i> drug design.	
IV (3 Weeks)	Informatics & Methods in drug design Introduction to Bioinformatics, chemoinformatics. ADME databases, chemical, biochemical and pharmaceutical databases.	12
V (3 Weeks)	Molecular Modeling: Introduction to molecular mechanics and quantum mechanics. Energy Minimization methods and Conformational Analysis, global conformational minima determination.	12
	Revision	
TOTAL		60

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 & Gisvold'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.

Program	B. Pharmacy
Semester	VIII
Name of the course	Cell and Molecular Biology Theory
Course Code	BP805ET
Credits	4
Hours /week	3hours (lectures) & 1hour (Tutorial)

Course Description: 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 organisms such as humans, plants, and sponges.

Course Learning Outcomes: Upon successful completion of this course, the student should be able to:

CO1: Summarize cell and molecular biology history.

CO2: Summarize cellular functioning and composition.

CO3: Describe the chemical foundations of cell biology.

CO4: Summarize the DNA properties of cell biology.

CO5: Describe protein structure and function.

CO6: Describe cellular membrane structure and function.

CO7: Describe basic molecular genetics mechanisms.

CO8: Summarize the Cell Cycle.

Theory Course: Contents

Unit	Topic	Hours
I	Cell and Molecular Biology: Definitions theory and basics and Applications. Cell and Molecular Biology: History and Summation. Properties of cells and cell membrane. Prokaryotic versus Eukaryotic, Cellular Reproduction Chemical Foundations – an Introduction and Reactions (Types)	12

II	DNA and the Flow of Molecular Information DNA Functioning DNA and RNA Types of RNA Transcription and Translation.	12
III	Proteins: Defined and Amino Acids Protein Structure Regularities in Protein Pathways Cellular Processes Positive Control and significance of Protein Synthesis	12
IV	Science of Genetics Transgenics and Genomic Analysis Cell Cycle analysis Mitosis and Meiosis Cellular Activities and Checkpoints	12
V	Cell Signals: Introduction Receptors for Cell Signals Signaling Pathways: Overview Mis regulation of Signaling Pathways Protein-Kinases: Functioning.	12
Total		60

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.

Program	B. Pharmacy
Semester	VIII
Name of the course	Cosmetic Science– Theory
Course Code	BP806ET
Credits	4
Hours /week	3hours (lectures) & 1hour (Tutorial)

Course Description:

This course is designed to impart a fundamental knowledge on various types of cosmetics products, their formulation and evaluations. This course also describes the importance of herbal cosmetics.

Course Learning Outcomes: Upon completion of this course the student should be able to:

CO 1: Define and classify various types of cosmetic and dermatological products.

CO 2: Discuss the principles involved in formulation and manufacturing of various cosmetic and dermatological products.

CO 3: Demonstrate ability to develop, validate and apply different instrumental analytical techniques to analyze various cosmetic and dermatological products.

Theory Course Contents:

Unit	Topic	Hours
I	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.	14
II	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	16

	<p>cosmeceuticals.</p> <p>Antiperspant& deodorants- Actives & mechanism of action.</p> <p>Principles of formulation and building blocks of Hair care products: Conditioning shampoo, Hair conditioner, anti-dandruff shampoo. Hair oils. Chemistry and formulation of Para-phenylene diamine based hair dye.</p> <p>Principles of formulation and building blocks of oral care products: Toothpaste for bleeding gums, sensitive teeth. Teeth whitening, Mouthwash.</p>	
III	<p>Sun protection: Classification of Sunscreens and SPF.</p> <p>Role of herbs in cosmetics: Skin Care: Aloe and turmeric Hair care: Henna and amla. Oral care: Neem and clove</p> <p>Analytical cosmetics: BIS specification and analytical methods for shampoo, skin-cream and toothpaste.</p>	12
IV	<p>Principles of Cosmetic Evaluation: Principles of sebumeter, corneometer.</p> <p>Measurement of TEWL, Skin Color, Hair tensile strength, Hair combing properties Soaps, and syndet bars. Evolution and skin benefits.</p>	8
V	<p>Oily and dry skin causes leading to dry skin, skin moisturization. Basic understanding of the terms Comedogenic, dermatitis.</p> <p>Cosmetic problems associated with Hair and scalp: Dandruff, Hair fall causes</p> <p>Cosmetic problems associated with skin: blemishes, wrinkles, acne, prickly heat and body odor.</p> <p>Antiperspirants and Deodorants- Actives and mechanism of action.</p>	10
Total		60

Recommended Books: (Latest Editions)

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 cosmeticology by Sanju Nanda &Roop K. Khar, Tata Publishers.

Program	B. Pharmacy
Semester	VIII
Name of the course	Experimental Pharmacology
Course Code	BP807ET
Credits	4
Hours /week	3hours (lectures) & 1hour (Tutorial)
Pre / co-requisite/s	Nil

Course Description: This subject is designed to impart the basic knowledge of preclinical studies in experimental animals including design, conduct and interpretations of results.

Course Learning Outcomes: Upon successful completion of this course, the student should be able to:

CO1: Appreciate the applications of various commonly used laboratory animals.

CO2: Appreciate and demonstrate the various screening methods used in preclinical research

CO3: Appreciate and demonstrate the importance of biostatistics and research methodology

CO4: Design and execute a research hypothesis independently

Theory Course: Contents

UNIT	Topic	Hours
I	<p>Laboratory Animals:</p> <p>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.</p>	15
II	<p>Preclinical screening models</p> <p>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.</p> <p>b. Study of screening animal models for</p> <p>Diuretics, nootropics, anti-Parkinson's, antiasthmatics,</p> <p>c. Preclinical screening models: for CNS activity- analgesic, antipyretic, anti-inflammatory, general anaesthetics, sedative and</p>	15

	hypnotics, antipsychotic, antidepressant, antiepileptic, antiparkinsonism, alzheimer's disease.	
III	Preclinical screening models: for ANS activity, sympathomimetics, sympatholytics, parasympathomimetics, parasympatholytics, skeletal muscle relaxants, drugs acting on eye, local anaesthetics.	10
IV	Preclinical screening models: for CVS activity- antihypertensives, diuretics, antiarrhythmic, antidyslipidemic, anti aggregatory, coagulants, and anticoagulants. Preclinical screening models for other important drugs like antiulcer, antidiabetic, anticancer and antiasthmatics.	10
V	Research methodology and Bio-statistics Selection of 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.	10
	Total	60

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

Programme	B. Pharm
Semester	VIII
Name of the course	Advanced Instrumentation Techniques-Theory
Course Code	BP808ET
Credits	4
Hours /week	3hours (lectures) & 1hour (Tutorial)
Pre / co-requisite/s	Nil

Scope: This subject deals with the application of instrumental methods in qualitative and quantitative 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 Outcomes: Upon completion of the course the student shall be able to

CO 1: Understand the advanced instruments used and its applications in drug analysis

CO 2: Perform the chromatographic separation and analysis of drugs.

CO 3: Perform the calibration of various analytical instruments

Course Content:

Unit	Topics	Hours
I (4 Weeks)	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	16
	Mass Spectrometry: Principles, Fragmentation, Ionization techniques, Electron impact, chemical ionization, MALDI, FAB.	
	Analyzers-Time of flight and Quadrupole, instrumentation, applications.	
II (3 Weeks)	Thermal Methods of Analysis: Principles, instrumentation and applications of Thermogravimetric Analysis (TGA), Differential Thermal Analysis (DTA), Differential Scanning Calorimetry (DSC)	12

	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.	
III (3 Weeks)	Calibration and validation -as per ICH and USFDA guidelines	12
	Calibration of following Instruments Electronic balance, UV-Visible spectrophotometer, IR spectrophotometer,	
	Calibration of following Instruments Fluorimeter, Flame Photometer, HPLC and GC	
IV (2 Weeks)	Radio immune assay: Importance, various components, Principle, different methods, Limitation and Applications of Radio immuno assay	8
	Extraction techniques: General principle and procedure involved in the solid phase extraction and liquid-liquid extraction.	
V (3 Weeks)	Hyphenated techniques-LC-MS/MS	12
	GC-MS/MS,	
	HPTLC-MS.	
TOTAL		60

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.

Program	B. Pharm
Semester	VIII
Name of the course	Quality Control and Standardization of Herbals
Course Code	BP809ET
Credits	4
Hours /week	3 Hours (Lectures) + 1 (Tutorial)
Pre / co-requisite/s	Nil

Course Description: In this subject the student learns about the various methods and guidelines for evaluation and standardization of herbs and herbal drugs. The subject also provides an opportunity for the student to learn cGMP, GAP and GLP in traditional system of medicines.

Course Learning Outcomes:

Upon completion of the subject student shall be able to;

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

Theory Course: Contents

Unit	Topic	Hours
I	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.	10
II	Quality assurance in herbal drug industry of cGMP, GAP, GMP and GLP in traditional system of medicine. WHO Guidelines on current good manufacturing Practices (cGMP) for Herbal Medicines WHO Guidelines on GACP for Medicinal Plants.	12
III	EU and ICH guidelines for quality control of herbal drugs. Research Guidelines for Evaluating the Safety and Efficacy of Herbal Medicines.	12

IV	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.	12
V	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.	12
Total		60

Recommended Books: (Latest Editions)

1. W.C. Evans, Trease and Evans Pharmacognosy, 16th edition, W.B. Saunders & Co., London, 2009.
2. Text book of Pharmacognosy by C.K. Kokate, Purohit, Gokhlae (2007), 37th Edition, Nirali Prakashan, New Delhi.
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. EMEA. Guidelines on Quality of Herbal Medicinal Products/Traditional Medicinal Products,
5. Mukherjee, P.W. Quality Control of Herbal Drugs: An Approach to Evaluation of Botanicals. Business Horizons Publishers, New Delhi, India, 2002.
6. 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.
7. WHO Quality Control Methods for Medicinal Plant Materials, World Health Organization, Geneva, 1998.
8. 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 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.

Program	B. Pharm
Semester	VIII
Name of the course	Project Work
Course Code	BP810PW
Credits	6
Hours /week	12 Hours

