MANIPAL
ACADEMY of HIGHER EDUCATION
(Deemed to be University under Section 3 of the UGC Act, 1956)

Academic Program Regulations - 2017

[Framed under Regulation 6, 7 & 8 of the Bachelor of Pharmacy (BPharm) course regulations 2014 of Pharmacy Council of India]

Program Title: BPharm (Bachelor of Pharmacy), CBCS (Choice Based Credit System)

Manipal College of Pharmaceutical Sciences
Manipal Academy of Higher Education
Manipal-576 104, Karnataka, India

MANIPAL
ACADEMY of HIGHER EDUCATION
(Institution of Eminence Deemed to be University)

July 1, 2023

Academic Program Regulations – 2017 : BPharm, CBCS – Approval

The Bachelor of Pharmacy (BPharm) program, CBCS of Manipal Academy of Higher Educaiton being offered at Manipal College of Pharmaceutical Sciences under the title "Academic Program Regulations - 2017: BPham CBCS" has been duly approved by the Academic Council of Manipal Academy of Higher Education.

REGISTRAR

MANIPAL ACADEMY OF HIGHER EDUCATION * INSTITUTION OF EMINENCE DEEMED TO BE UNIVERSITY * MANIPAL - 576 104 *

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NOTIFICATION

New Delhi, the 10th December, 2014

The Bachelor of Pharmacy (B.Pham.) Course Regulations, 2014

No. 14-154/ 2010- PCI.—In exercise of the powers conferred by Section 10 and 18 of the Pharmacy Act, 1948 (8 of 1948), the Pharmacy Council of India, with the approval of the Central Government hereby makes the following regulations; namely–

CHAPTER- I: REGULATIONS

1. Short title and commencement

These regulations shall be called as "The Regulations for the Bachelor of Pharmacy (BPharm) Degree Program- Choice Based Credit System (CBCS) of the Pharmacy Council of India, New Delhi". They shall come into effect from the academic year 2017-18.

The regulations framed are subject to modifications from time to time by the authorities of Manipal Academy of Higher Education (MAHE).

2. Minimum qualification for admission

2.1. First year BPharm:

Candidate shall have passed 10+2 examination conducted by the respective state/central government authorities recognized as equivalent to 10+2 examination by the Association of Indian Universities (AIU) with English as one of the subjects and Physics, Chemistry, Mathematics (P.C.M) and or Biology (P.C.B/ P.C.M.B) as optional subjects individually. Any other qualification approved by the Pharmacy Council of India as equivalent to any of the above examinations.

2.2. BPharm lateral entry (to third semester):

A pass in DPharm 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 BPharm shall extend over a period of eight semesters (four academic years) for regular 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 Pharmacy Council of India, New Delhi.

4. Medium of instruction and examination

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 July/August to November/December and the even semesters shall be conducted from the month of December/January to May/June in an academic year.

6. Attendance and progress

A candidate is required to put in at least 80% attendance in individual courses considering theory and practical separately. The candidate shall complete the prescribed course satisfactorily to be eligible to appear for the respective examinations.

7. Program/Course credit structure

As per the philosophy of Credit Based Semester System, certain quantum of academic work viz. theory classes, tutorial hours, practical classes, etc. are measured in terms of credits. On satisfactory completion of the courses, a candidate earns credits. The amount of credit associated with a course is dependent upon the number of hours of instruction per week in that course. Similarly, the credit associated with any of the other academic, co/extra-curricular activities is dependent upon the quantum of work expected to be put in by the student for each of these activities per week/per activity.

7.1. Credit assignment

7.1.1. Theory and laboratory courses

Courses are broadly classified as Theory and Practical. Theory courses consist of lecture (L) and /or tutorial (T) hours, and Practical (P) courses consist of hours spent in the laboratory. Credits (C) for a course is dependent on the number of hours of instruction per week in that course, and is obtained by using a multiplier of one (1) for lecture and tutorial hours, and a multiplier of half (½) 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.

7.2. Minimum credit requirements

The minimum credit points required for award of the BPharm degree for different categories are as follows;

Category	Credit points required for award of BPharm degree			
	From the courses of **University examination***	From the courses of **Non-University examination**	From Extra-curricular activities	**Total**
Physics, Chemistry, Mathematics and Biology (P.C.M.B)	206	07	01	**214**
Physics, Chemistry and Biology (P.C.B)	206	09	01	**216**
Physics, Chemistry and Mathematics (P.C.M)	206	10	01	**217**
Lateral entry	157	07	01	165+52 (credit points transferred from DPharm program) = **217**
* are only taken for the calculation of SGPA/CGPA				

These credits are divided into Theory courses, Tutorials, Practical, Practice School and Project over the duration of eight semesters. The credits are distributed semester-wise as shown in Table-IX. Courses generally progress in sequences, building competencies and their positioning indicates certain academic maturity on the part of the learners. Learners are expected to follow the semester-wise schedule of courses given in the syllabus.

The lateral entry students shall get 52 credit points transferred from their DPharm 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.

8. Academic work

A regular record of attendance both in Theory and Practical shall be maintained by the department/teaching staff of respective courses.

9. Course work of study

The course work of study for BPharm shall include semester wise theory and 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/wk**			**Credit points (C)**
		Lecture (L)	**Tutorial (T)**	**Practical (P)**	
PHA-BP101T	Human Anatomy and Physiology-I (Theory)	3	1	--	4
PQA-BP102T	Pharmaceutical Analysis I (Theory)	3	1	--	4
PCE-BP103T	Pharmaceutics I (Theory)	3	1	--	4
PCH-BP104T	Pharmaceutical Inorganic Chemistry (Theory)	3	1	--	4
PRM-BP105T	Communication Skills (Theory)	2	--	--	2
PCO-BP106RBT/ PCE-BP106RMT	Remedial Biology/ Remedial Mathematics (Theory)*	2	--	--	2
PHA-BP107P	Human Anatomy and Physiology I (Practical)	--	--	4	2
PQA-BP108P	Pharmaceutical Analysis I (Practical)	--	--	4	2
PCE-BP109P	Pharmaceutics I (Practical)	--	--	4	2
PCH-BP110P	Pharmaceutical Inorganic Chemistry (Practical)	--	--	4	2
PRM-BP111P	Communication Skills (Practical)	--	--	2	1
PCO-BP112RBP	Remedial Biology (Practical)*	--	--	2	1
	Total	**14/16[$, #]**	**4**	**16/18[$]/20[#]**	**27/29[$]/30[#]**

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

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

***Non University Examination (NUE). Internal assessment only.

Table-II: Course of study for semester II					
Course Code	**Name of the course**	**No of hours/wk**			**Credit points (C)**
		Lecture (L)	**Tutorial (T)**	**Practical (P)**	
PHA-BP201T	Human Anatomy and Physiology II (Theory)	3	1	--	4
PCH-BP202T	Pharmaceutical Organic Chemistry I (Theory)	3	1	--	4
PBT-BP203T	Biochemistry (Theory)	3	1	--	4
PPR-BP204T	Pathophysiology (Theory)	3	1	--	4
PCE-BP205T	Computer Applications in Pharmacy (Theory)*	2	1	--	3
PRM-BP206T	Environmental Sciences (Theory)	2	1	--	3
PHA-BP207P	Human Anatomy and Physiology II (Practical)	--	--	4	2
PCH-BP208P	Pharmaceutical Organic Chemistry I (Practical)	--	--	4	2
PBT-BP209P	Biochemistry (Practical)	--	--	4	2
PCE-BP210P	Computer Applications in Pharmacy (Practical)*	--	--	2	1
	Total	**16**	**6**	**14**	**29**
*Non University Examination (NUE). Internal assessment only.					

Table-III: Course of study for semester III – Regular students					
Course code	**Name of the course**	**No of hours/wk**			**Credit points (C)**
		Lecture (L)	**Tutorial (T)**	**Practical (P)**	
PCH-BP301T	Pharmaceutical Organic Chemistry II (Theory)	3	1	--	4
PCE-BP302T	Physical Pharmaceutics I (Theory)	3	1	--	4
PBT-BP303T	Pharmaceutical Microbiology (Theory)	3	1	--	4
PCE-BP304T	Pharmaceutical Engineering (Theory)	3	1	--	4
PCH-BP305P	Pharmaceutical Organic Chemistry II (Practical)	--	--	4	2
PCE-BP306P	Physical Pharmaceutics I (Practical)	--	--	4	2
PBT-BP307P	Pharmaceutical Microbiology (Practical)	--	--	4	2
PCE-BP308P	Pharmaceutical Engineering (Practical)	--	--	4	2
	Total	**12**	**4**	**16**	**24**

Table-IIIA: Course of study for semester III - Lateral entry students					
Course code	**Name of the course**	**No of hours/wk**			**Credit points (C)**
		Lecture (L)	**Tutorial (T)**	**Practical (P)**	
PCH-BP301T	Pharmaceutical Organic Chemistry II (Theory)	3	1	--	4
PCE-BP302T	Physical Pharmaceutics I (Theory)	3	1	--	4
PBT-BP303T	Pharmaceutical Microbiology (Theory)	3	1	--	4
PCE-BP304T	Pharmaceutical Engineering (Theory)	3	1	--	4
PRM-BP105T	Communication Skills (Theory)	2	--	--	2
PCE-BP205T	Computer Applications in Pharmacy (Theory)*	2	1	--	3
PCH-BP305P	Pharmaceutical Organic Chemistry II (Practical)	--	--	4	2
PCE-BP306P	Physical Pharmaceutics I (Practical)	--	--	4	2
PBT-BP307P	Pharmaceutical Microbiology (Practical)	--	--	4	2
PCE-BP308P	Pharmaceutical Engineering (Practical)	--	--	4	2
PRM-BP111P	Communication Skills (Practical)	--	--	2	1
PCE-BP210P	Computer Applications in Pharmacy (Practical)*	--	--	2	1
	Total	**16**	**5**	**20**	**31**
*Non University Examination (NUE). Internal assessment only.					

Table-IV: Course of study for semester IV					
Course code	**Name of the course**	**No of hours/wk**			**Credit points (C)**
		Lecture (L)	**Tutorial (T)**	**Practical (P)**	
PCH-BP401T	Pharmaceutical Organic Chemistry III (Theory)	3	1	--	4
PCH-BP402T	Medicinal Chemistry I (Theory)	3	1	--	4
PCE-BP403T	Physical Pharmaceutics II (Theory)	3	1	--	4
PHA-BP404T	Pharmacology I (Theory)	3	1	--	4
PCO-BP405T	Pharmacognosy and Phytochemistry I (Theory)	3	1	--	4
PCH-BP406P	Medicinal Chemistry I (Practical)	--	--	4	2
PCE-BP407P	Physical Pharmaceutics II (Practical)	--	--	4	2
PHA-BP408P	Pharmacology I (Practical)	--	--	4	2
PCO-BP409P	Pharmacognosy and Phytochemistry I (Practical)	--	--	4	2
Total		**15**	**5**	**16**	**28**

Table-V: Course of study for semester V					
Course code	**Name of the course**	**No of hours/wk**			**Credit points (C)**
		Lecture (L)	**Tutorial (T)**	**Practical (P)**	
PCH-BP501T	Medicinal Chemistry II (Theory)	3	1	--	4
PCE-BP502T	Industrial Pharmacy I (Theory)	3	1	--	4
PHA-BP503T	Pharmacology II (Theory)	3	1	--	4
PCO-BP504T	Pharmacognosy and Phytochemistry II (Theory)	3	1	--	4
PRM-BP505T	Pharmaceutical Jurisprudence (Theory)	3	1	--	4
PCE-BP506P	Industrial Pharmacy I (Practical)	--	--	4	2
PHA-BP507P	Pharmacology II (Practical)	--	--	4	2
PCO-BP508P	Pharmacognosy and Phytochemistry II (Practical)	--	--	4	2
Total		**15**	**5**	**12**	**26**

Table-VI: Course of study for semester VI					
Course code	**Name of the course**	**No of hours/wk**			**Credit points (C)**
		Lecture (L)	**Tutorial (T)**	**Practical (P)**	
PCH-BP601T	Medicinal Chemistry III (Theory)	3	1	--	4
PHA-BP602T	Pharmacology III (Theory)	3	1	--	4
PCO-BP603T	Herbal Drug Technology (Theory)	3	1	--	4
PCE-BP604T	Biopharmaceutics and Pharmacokinetics (Theory)	3	1	--	4
PBT-BP605T	Pharmaceutical Biotechnology (Theory)	3	1	--	4
PQA-BP606T	Pharmaceutical Quality Assurance (Theory)	3	1	--	4
PCH-BP607P	Medicinal Chemistry III (Practical)	--	--	4	2
PHA-BP608P	Pharmacology III (Practical)	--	--	4	2
PCO-BP609P	Herbal Drug Technology (Practical)	--	--	4	2
	Total	**18**	**6**	**12**	**30**

Table-VII: Course of study for semester VII					
Course code	**Name of the course**	**No of hours/wk**			**Credit points (C)**
		Lecture (L)	**Tutorial (T)**	**Practical (P)**	
PQA-BP701T	Instrumental Methods of Analysis (Theory)	3	1	--	4
PCE-BP702T	Industrial Pharmacy II (Theory)	3	1	--	4
PPR-BP703T	Pharmacy Practice (Theory)	3	1	--	4
PCE-BP704T	Novel Drug Delivery Systems (Theory)	3	1	--	4
PRM-BP705T	Consumer Affairs*	3	--	--	3
PQA-BP706P	Instrumental Methods of Analysis (Practical)	--	--	4	2
BP707PS	Practice School	--	--	12	6
	Total	**15**	**4**	**16**	**27**
*Non University Examination (NUE). Internal assessment only					

Table-VIII: Course of study for semester VIII					
Course code	**Name of the course**	**No of hours/wk**			**Credit points (C)**
		Lecture (L)	**Tutorial (T)**	**Practical (P)**	
PHA-BP801T	Biostatistics and Research Methodology (Theory)	3	1	--	4
PPR-BP802T	Social and Preventive Pharmacy (Theory)	3	1	--	4
Group A					
PRM-BP803ET	Pharma Marketing Management (Theory)	3	1	--	4
PQA-BP804ET	Pharmaceutical Regulatory Science (Theory)				
PPR-BP805ET	Pharmacovigilance (Theory)				
PCO-BP806ET	Quality Control and Standardization of Herbals (Theory)				
PCE-BP812ET	Dietary Supplements and Nutraceuticals (Theory)				
Group B					
PCH-BP807ET	Computer Aided Drug Design (Theory)	3	1	--	4
PBT-BP808ET	Cell and Molecular Biology (Theory)				
PCE-BP809ET	Cosmetic Science (Theory)				
PHA-BP810ET	Pharmacological Screening Methods (Theory)				
PQA-BP811ET	Advanced Instrumentation Techniques (Theory)				
BP813PW	Project Work	--	--	12	6
	Total	**12**	**4**	**12**	**22**

Table-IX: Semester wise credits distribution		
Semester	**Credit points for regular admission**	**Credit points for lateral entry**
I	**27/29[$]/30[#]**	52 credits transferred from DPharm program
II	29	
III	24	31
IV	28	28
V	26	26
VI	30	30
VII	27	27
VIII	22	22
Extracurricular/ Cocurricular activities	01*	01*
Credit points for university examinations	**214/216[$]/217[#]**	**217**

*The credit points assigned for extracurricular and or co-curricular activities shall be given by the Principals of the colleges and the same shall be submitted to the University. The criteria to acquire this credit point shall be defined by the colleges from time to time. This credit will also be given for students who obtain B or C certificates in NCC as per MAHE Policy.

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

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

10. Program committee

1. The BPharm 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 shall be the chairperson; One teacher from each department handling BPharm courses; and four student representatives of the program (one from each academic year), nominated by the Head of the institution.

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 thrice in a semester preferably at the end of each sessional exam (Internal Assessment) and before the end semester exam.

11. Examinations/Assessments

The scheme for internal assessment and end semester examinations are given in Table-XIII.

11.1. Internal assessment: Continuous mode

The marks allocated for continuous mode of internal assessment shall be awarded as per the scheme given below (Table-X).

Table-X: Scheme for awarding internal assessment: Continuous mode		
Theory		
Criteria	**Continuous mode maximum marks**	
	10	**5**
Attendance (for guidelines, Refer Table-XI)	4	2
Academic activities (Average of any 3 activities e.g. quiz, assignment, open book test, field work, group discussion and seminar)	3	1.5
Student – Teacher interaction	3	1.5
Total	**10**	**5**
Practical		
Attendance (for guidelines, Refer Table-XI)	2	
Based on practical records, regular viva voce, etc.	3	
Total	**5**	

Table-XI: Guidelines for the allotment of marks for attendance		
Percentage of attendance	**Theory**	**Practical**
95 – 100	4	2
90 – 94	3	1.5
85 – 89	2	1
80 – 84	1	0.5
Less than 80	0	0

11.1.1. Sessional exams

Two sessional exams shall be conducted for each theory and one sessional exam for practical course as per the schedule fixed by the college(s). However: an extra sessional examination may be conducted in case the student has any genuine health reasons. The Principal, MCOPS will decide the retest to be conducted based on the health reasons. The scheme of question paper for theory and practical sessional examinations is given below. The average marks of two sessional exams shall be computed for internal assessment as per the requirements given in Table-XIII.

Sessional exam shall be conducted for 45 marks for theory and shall be computed for 15 marks. Similarly, sessional exam for practical shall be conducted for 40 marks and shall be computed for 10 marks.

Question paper pattern for theory sessional examinations
For subjects having university examination

I	Multiple Choice Questions (MCQs)	10Q ×1M =10 marks
II	Long Answers	1Q × 10M =10 marks
III	Short Answers	5Q × 5M = 25 marks
		Total = 45 marks

For subjects having non university examination

I	Short Answers	4Q × 5M = 20 marks
		Total = 20 marks

Question paper pattern for practical sessional examinations

I	Synopsis	10 marks
	Experiments	25 marks
III	Viva-voce	5 marks
		Total = 40 marks

11.2. End semester examinations

End semester examinations are conducted for eligible students twice at the end of the semester, namely, the main examination for regular students and the make-up/supplementary examinations for the failed students only before the commencement of the next semester (Table XII). In case a failed student could not clear the course in the make-up/supplementary examination, the student would have his/her next examination along with the regular students only in the main examination.

Table XII: Tentative schedule of end semester examinations

Semester	Main Examination	Make-up/Supplementary Exams
I, III, V and VII	November/December	December/January
II, IV, VI and XIII	May/June	July/August

The end semester examinations for each theory and practical course through semesters I to VIII shall be conducted by the university except for the subjects with asterix symbol (*) in Table I, II and VII for which examinations shall be conducted by the subject experts at college level and the marks/grades shall be submitted to the university.

Question paper pattern for end semester theory examinations

For 75 marks paper

I	Multiple Choice Questions (MCQs)	20Q ×1M = 20 marks
II	Long Answers	2Q × 10M = 20 marks
III	Short Answers	7Q × 5M = 35 marks
		Total = 75 marks

For 50 marks paper

I	Long Answers	2Q × 10M = 20 marks
II	Short Answers	6Q × 5M = 30 marks
		Total = 50 marks

For 35 marks paper

I	Long Answers	1Q × 10M = 10 marks
II	Short Answers	5Q × 5M = 25 marks
		Total = 35 marks

Question paper pattern for end semester practical examinations

I	Synopsis	5 marks
II	Experiments	25 marks
III	Viva-voce	5 marks
		Total = 35 marks

Table-XIII: 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**	
			Marks	**Duration**				
PHA-BP101T	Human Anatomy and Physiology I (Theory)	10	15	1hr	25	75	3hrs	100
PQA-BP102T	Pharmaceutical Analysis I (Theory)	10	15	1hr	25	75	3hrs	100
PCE-BP103T	Pharmaceutics I (Theory)	10	15	1hr	25	75	3hrs	100
PCH-BP104T	Pharmaceutical Inorganic Chemistry (Theory)	10	15	1hr	25	75	3hrs	100
PRM-BP105T	Communication skills (Theory)	5	10	1hr	15	35	1.5hrs	50
PCO-BP106RBT/ PCE-BP106RMT	Remedial Biology/ Mathematics (Theory)*	10	20+20	1hr each	50	--	--	--
PHA-BP107P	Human Anatomy and Physiology (Practical)	5	10	4hrs	15	35	4hrs	50
PQA-BP108P	Pharmaceutical Analysis I (Practical)	5	10	4hrs	15	35	4hrs	50
PCE-BP109P	Pharmaceutics I (Practical)	5	10	4hrs	15	35	4hrs	50
PCH-BP110P	Pharmaceutical Inorganic Chemistry (Practical)	5	10	4hrs	15	35	4hrs	50
PRM-BP111P	Communication Skills (Practical)	5	5	2hrs	10	15	2hrs	25
PCO-BP112RBP	Remedial Biology (Practical)*	5	20	2hrs	25	--	--	--
Total		**75/ 80$/ 85#**	**115/ 155$/ 175#**	--	**185/ 235$/ 260#**	**490**	**--**	**675**

#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**.**

*Non University Examination (NUE). Internal assessment only.

Semester II								
Course code	**Name of the course**	**Internal assessment**				**End semester exams**		**Total marks**
		Continuous mode	**Sessional exams**		**Total**	**Marks**	**Duration**	
			Marks	**Duration**				
PHA-BP201T	Human Anatomy and Physiology II (Theory)	10	15	1hr	25	75	3hrs	100
PCH-BP202T	Pharmaceutical Organic Chemistry I (Theory)	10	15	1hr	25	75	3hrs	100
PBT-BP203T	Biochemistry (Theory)	10	15	1hr	25	75	3hrs	100
PPR-BP204T	Pathophysiology (Theory)	10	15	1hr	25	75	3hrs	100
PCE-BP205T	Computer Applications in Pharmacy (Theory)*	10	20+20	1hr each	50	--	--	--
PRM-BP206T	Environmental Sciences (Theory)	10	15	1hr	25	50	2hrs	75
PHA-BP207P	Human Anatomy and Physiology II (Practical)	5	10	4hrs	15	35	4hrs	50
PCH-BP208P	Pharmaceutical Organic Chemistry I (Practical)	5	10	4hrs	15	35	4hrs	50
PBT-BP209P	Biochemistry (Practical)	5	10	4hrs	15	35	4hrs	50
PCE-BP210P	Computer Applications in Pharmacy (Practical)*	5	20	2hrs	25	--	--	--
Total		**80**	**165**	**--**	**245**	**455**	**--**	**625**
*Non University Examination (NUE). Internal assessment only.								

Semester III - Regular admission								
Course code	**Name of the course**	**Internal assessment**				**End semester exams**		**Total marks**
		Continuous mode	**Sessional exams**		**Total**	**Marks**	**Duration**	
			Marks	**Duration**				
PCH-BP301T	Pharmaceutical Organic Chemistry II (Theory)	10	15	1hr	25	75	3hrs	100
PCE-BP302T	Physical Pharmaceutics I (Theory)	10	15	1hr	25	75	3hrs	100
PBT-BP303T	Pharmaceutical Microbiology (Theory)	10	15	1hr	25	75	3hrs	100
PCE-BP304T	Pharmaceutical Engineering (Theory)	10	15	1hr	25	75	3hrs	100
PCH-BP305P	Pharmaceutical Organic Chemistry II (Practical)	5	10	4hrs	15	35	4hrs	50
PCE-BP306P	Physical Pharmaceutics I (Practical)	5	10	4hrs	15	35	4hrs	50
PBT-BP307P	Pharmaceutical Microbiology (Practical)	5	10	4hrs	15	35	4hrs	50
PCE-BP308P	Pharmaceutical Engineering (Practical)	5	10	4hrs	15	35	4hrs	50
Total		**60**	**100**	**--**	**160**	**440**	**--**	**600**

Semester IIIA - Lateral entry								
Course code	**Name of the course**	**Internal assessment**				**End semester exams**		**Total marks**
		Continuous mode	**Sessional exams**		**Total**	**Marks**	**Duration**	
			Marks	**Duration**				
PCH-BP301T	Pharmaceutical Organic Chemistry II (Theory)	10	15	1hr	25	75	3hrs	100
PCE-BP302T	Physical Pharmaceutics I (Theory)	10	15	1hr	25	75	3hrs	100
PBT-BP303T	Pharmaceutical Microbiology (Theory)	10	15	1hr	25	75	3hrs	100
PCE-BP304T	Pharmaceutical Engineering (Theory)	10	15	1hr	25	75	3hrs	100
PRM-BP105T	Communication skills (Theory)	5	10	1hr	15	35	1.5hrs	50
PCE-BP205T	Computer Applications in Pharmacy (Theory)*	10	20+20	1hr each	50	--	--	--
PCH-BP305P	Pharmaceutical Organic Chemistry II (Practical)	5	10	4hrs	15	35	4hrs	50
PCE-BP306P	Physical Pharmaceutics I (Practical)	5	10	4hrs	15	35	4hrs	50
PBT-BP307P	Pharmaceutical Microbiology (Practical)	5	10	4hrs	15	35	4hrs	50
PCE-BP308P	Pharmaceutical Engineering (Practical)	5	10	4hrs	15	35	4hrs	50
PRM-BP111P	Communication Skills (Practical)	5	5	2hrs	10	15	2hrs	25
PCE-BP210P	Computer Applications in Pharmacy (Practical)*	5	20	2hrs	25	--	--	--
Total		**85**	**175**	**--**	**260**	**490**	**--**	**675**
*Non University Examination (NUE). Internal assessment only.								

Semester IV								
Course code	**Name of the course**	**Internal assessment**				**End semester exams**		**Total marks**
		Continuous mode	**Sessional exams**		**Total**	**Marks**	**Duration**	
			Marks	**Duration**				
PCH-BP401T	Pharmaceutical Organic Chemistry III (Theory)	10	15	1hr	25	75	3hrs	100
PCH-BP402T	Medicinal Chemistry I (Theory)	10	15	1hr	25	75	3hrs	100
PCE-BP403T	Physical Pharmaceutics II (Theory)	10	15	1hr	25	75	3hrs	100
PHA-BP404T	Pharmacology I (Theory)	10	15	1hr	25	75	3hrs	100
PCO-BP405T	Pharmacognosy and Phytochemistry I (Theory)	10	15	1hr	25	75	3hrs	100
PCH-BP406P	Medicinal Chemistry I (Practical)	5	10	4hrs	15	35	4hrs	50
PCE-BP407P	Physical Pharmaceutics II (Practical)	5	10	4hrs	15	35	4hrs	50
PHA-BP408P	Pharmacology I (Practical)	5	10	4hrs	15	35	4hrs	50
PCO-BP409P	Pharmacognosy and Phytochemistry I (Practical)	5	10	4hrs	15	35	4hrs	50
Total		**70**	**115**	**--**	**185**	**515**	**--**	**700**

Semester V								
Course code	**Name of the course**	**Internal assessment**				**End semester exams**		**Total marks**
		Continuous mode	**Sessional exams**		**Total**	**Marks**	**Duration**	
			Marks	**Duration**				
PCH-BP501T	Medicinal Chemistry II (Theory)	10	15	1hr	25	75	3hrs	100
PCE-BP502T	Industrial Pharmacy I (Theory)	10	15	1hr	25	75	3hrs	100
PHA-BP503T	Pharmacology II (Theory)	10	15	1hr	25	75	3hrs	100
PCO-BP504T	Pharmacognosy and Phytochemistry II (Theory)	10	15	1hr	25	75	3hrs	100
PRM-BP505T	Pharmaceutical Jurisprudence (Theory)	10	15	1hr	25	75	3hrs	100
PCE-BP506P	Industrial Pharmacy I (Practical)	5	10	4hrs	15	35	4hrs	50
PHA-BP507P	Pharmacology II (Practical)	5	10	4hrs	15	35	4hrs	50
PCO-BP508P	Pharmacognosy and Phytochemistry II (Practical)	5	10	4hrs	15	35	4hrs	50
Total		**65**	**105**	**--**	**170**	**480**	**--**	**650**

Semester VI								
Course code	**Name of the course**	**Internal assessment**				**End semester exams**		**Total Marks**
		Continuous mode	**Sessional exams**		**Total**	**Marks**	**Duration**	
			Marks	**Duration**				
PCH-BP601T	Medicinal Chemistry III (Theory)	10	15	1hr	25	75	3hrs	100
PHA-BP602T	Pharmacology III (Theory)	10	15	1hr	25	75	3hrs	100
PCO-BP603T	Herbal Drug Technology (Theory)	10	15	1hr	25	75	3hrs	100
PCE-BP604T	Biopharmaceutics and Pharmacokinetics (Theory)	10	15	1hr	25	75	3hrs	100
PBT-BP605T	Pharmaceutical Biotechnology (Theory)	10	15	1hr	25	75	3hrs	100
PQA-BP606T	Pharmaceutical Quality Assurance (Theory)	10	15	1hr	25	75	3hrs	100
PCH-BP607P	Medicinal Chemistry III (Practical)	5	10	4hrs	15	35	4hrs	50
PHA-BP608P	Pharmacology III (Practical)	5	10	4hrs	15	35	4hrs	50
PCO-BP609P	Herbal Drug Technology (Practical)	5	10	4hrs	15	35	4hrs	50
Total		**75**	**120**	**--**	**195**	**555**	**--**	**750**

Semester VII								
Course code	**Name of the course**	**Internal assessment**				**End semester exams**		**Total Marks**
		Continuous mode	**Sessional exams**		**Total**	Marks	**Duration**	
			Marks	**Duration**				
PQA-BP701T	Instrumental Methods of Analysis (Theory)	10	15	1hr	25	75	3hrs	100
PCE-BP702T	Industrial Pharmacy (Theory)	10	15	1hr	25	75	3hrs	100
PPR-BP703T	Pharmacy Practice (Theory)	10	15	1hr	25	75	3hrs	100
PCE-BP704T	Novel Drug Delivery Systems (Theory)	10	15	1hr	25	75	3hrs	100
PRM-BP705T	Consumer Affairs* (Theory)	10	20+20	1hr	50	--	--	50
PQA-BP706P	Instrumental Methods of Analysis (Practical)	5	10	4hrs	15	35	4hrs	50
BP707PS	Practice School	25	-	-	25	125	5hrs	150
Total		80	110	**--**	**190**	**460**	**--**	**650**
*Non University Examination (NUE). Internal assessment only.								

Semester VIII								
Course code	**Name of the course**	**Internal assessment**				**End semester exams**		**Total marks**
		Continuous mode	**Sessional exams**		**Total**	**Marks**	**Duration**	
			Marks	**Duration**				
PHA-BP801T	Biostatistics and Research Methodology (Theory)	10	15	1hr	25	75	3hrs	100
PPR-BP802T	Social and Preventive Pharmacy (Theory)	10	15	1hr	25	75	3hrs	100
Group A		10	15	1	25	75	3	100
PRM-BP803ET	Pharma Marketing Management (Theory)							
PQA-BP804ET	Pharmaceutical Regulatory Science (Theory)							
PPR-BP805ET	Pharmacovigilance (Theory)							
PCO-BP806ET	Quality Control and Standardization of Herbals (Theory)							
PCE-BP812ET	Dietary Supplements and Nutraceuticals (Theory)							
Group B								
PCH-BP807ET	Computer Aided Drug Design (Theory)							
PBT-BP808ET	Cell and Molecular Biology (Theory)							
PCE-BP809ET	Cosmetic Science (Theory)							
PHA-BP810ET	Pharmacological Screening Methods (Theory)							
PQA-BP811ET	Advanced Instrumentation Techniques (Theory)							
BP813PW	Project Work	--	--	--	--	150	4 hrs	150
	Total	**40**	**60**	**--**	**100**	**450**	**--**	**550**

12. Promotion and award of grades

12.1. Minimum for a pass in a course :

The minimum for a pass in a course shall be 50% of the maximum marks (IA + End Semester Examination marks put together) allotted for a course. However, it is mandatory for a student to score a minimum 35% of the maximum marks of a course in the End Semester examination per se if he/she has to be considered for the pass grades. Failing which, he/she will be declared failed in the course concerned. Hence, a student shall be declared PASS, if the student secures E-Grade and above, in the course concerned, on 10-Point-Relative-Letter Grading-Scheme.

12.2. Award of performance grades

The marks obtained in the end semester and internal assessment in a course are added together and a 10-Point-Relative-Letter Grading-Scheme is used to allot an appropriate grade to the student's performance in that course.

12.3. The 10-Point-Relative-Letter Grading-Scheme

Final evaluation of the performance of a student in each course (theory and lab separately) will be carried out on a 10- Relative Point-Letter Grading-Scheme corresponding to the marks obtained in that course. Eventually each letter grade of the course is converted into a specific grade point associated with the letter grade as given in the Table XIV for SGPA calculations

Table-XIV: 10-Point-Relative-Letter Grading-Scheme

Letter Grade	Grade Point	Performance
A+	10	Outstanding
A	9	Excellent
B	8	Good
C	7	Fair
D	6	Average
E	5	Pass
F/I/DT/ab	0	Fail
F: Fails, I: Incomplete, DT: Detained, ab: Absent		

Note the following:

1. Internal assessment marks and end semester examination marks put together are taken into account for the 10-Point-Relative-Letter Grading-Scheme in each course separately.
2. Appropriate letter grades, from E to A+, are awarded, in each theory and lab courses, to only such candidate who has passed the course in first attempt. However, grades E to C are only awarded to a student who makes multiple attempts to pass a course; except in case of I-grade.
3. A student who is eligible and registers for the end semester examination but fails to appear in the end semester examination due to valid reasons will get a grade 'I', indicating incomplete. However, it needs prior approval of the HOI and the Registrar Evaluation, MAHE.

4. A candidate who is eligible and registers for the end semester examination but fails to appear in the end semester examination gets a grade 'ab', indicating failure.
5. The grade DT is given to a candidate who fails to put in the minimum required attendance for appearing the end semester examination for a course.
6. A student, who appears for the end semester examination could not secure ‘E” or above grade in the 10-point-relative-grading scheme in a course is granted ‘F’ grade indicating failure in a course (subject) concerned.
7. A student who earns a grade ‘E’ or above in a course is declared to have successfully completed the course and earns the credits assigned to that particular course. A course successfully completed cannot be repeated for the purpose of improving the grade.

13. Carry forward of marks

In case, a student fails to secure E-grade in any theory or practical courses, 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 is entitled for a maximum grade of ‘C’ only, irrespective of the student’s top order performances.

However, the candidates with DT-grade will also be allowed to take this examination provided they meet the eligibility criteria laid for the candidates to appear in the end semester examinations of the courses of the programs.

Important to note: A student who once failed (F-grade) or DT (Detained) grade in any course, a maximum of C-grade will only be awarded in subsequent end semester examinations, irrespective of the student’s high performances in that particular course. However, those who miss regular examinations due to valid reasons (I-grade) will be allowed to retain whatever the grades they secure in the make-up/supplementary examinations. In case a candidate with DT-grade re-registers for the course to repeat the entire education process in the subsequent academic year, after paying the required course fee, the DT status in that particular course is removed and he/she is allowed to retain the grades that he/she secures in the end semester examination.

After the results are declared, grade cards will be issued to each student, which will contain the list of courses for that semester and the grades obtained by the student.

14. Improvement of internal assessment

A student shall have the opportunity to improve his/her performance only once in the sessional exam component of the internal assessment.

The re-conduct of the sessional exam shall be completed before the commencement of next end semester theory examinations.

15. Re-examination of end semester examinations

Re-examination of end semester examination shall be conducted as per the schedule given in Table-XV. The exact dates of examinations shall be notified from time to time.

Table XV: Tentative schedule of end semester examinations		
Semester	**Main Examination**	**Make-up/Supplementary Exams**
I, III, V and VII	November/December	December/January
II, IV, VI and XIII	May/June	July/August

16. Academic progression

No student shall be admitted to any examination unless he/she fulfills the norms given in section 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 section 26.

Any student who has been 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

17.1. 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-XIV.

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.

Table-XIV. 10-Point-Relative-Letter Grading-Scheme

Letter Grade	Grade Point	Performance
A+	10	Outstanding
A	9	Excellent
B	8	Good
C	7	Fair
D	6	Average
E	5	Pass
F/I/DT/ab	0	Fail

18. The Semester Grade Point Average (SGPA)

Note: For the SGPA/ CGPA calculation, the credit points of the courses that are having university examinations are only considered.

However, a candidate has to earn the credit points of non-university examination and extracurricular activities along with the credit points of the courses of the university examination to qualify for the award of degree (Refer to Section 7.2 and Table)

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:

$$SGPA = \frac{C1G1 + C2G2 + C3G3 + C4G4 + C5G5}{C1 + C2 + C3 + C4 + C5}$$

The SGPA is calculated to two decimal points. It should be noted that, the SGPA for any semester shall take into consideration the 'F' and 'ab' grade awarded in that semester. For example, if a learner has a 'F' or 'ab' grade in course 4, the SGPA shall then be computed as:

$$SGPA = \frac{C1G1 + C2G2 + C3G3 + C4 * ZERO + C5G5}{C1 + C2 + C3 + C4 + C5}$$

19. Cumulative Grade Point Average (CGPA)

The CGPA is calculated with the SGPA of all the VIII semesters to two decimal points and is indicated in final grade report card/final transcript showing the grades of all VIII semesters and their courses. The CGPA shall reflect the failed status in case of F grade(s), till the course(s) is/are passed. When the course(s) is/are passed by obtaining a pass grade on subsequent examination(s) the CGPA shall only reflect the new grade and not the fail grades earned earlier. The CGPA is calculated as:

$$CGPA = \frac{C1S1 + C2S2 + C3S3 + C4S4 + C5S5 + C5S6 + C7S7 + C8S8}{C1 + C2 + C3 + C4 + C5 + C6 + C7 + C8}$$

where C1, C2, C3,.... is the total number of credits for semester I,II,III,…. and S1,S2, S3,....is the SGPA of semester I, II, III, ….

19.1. Conversion of GPA/CGPA into percentage

The performance of students who are pursuing pharmacy programs in Manipal College of Pharmaceutical Sciences, MAHE, Manipal is awarded on a 10-Point-Relative-Letter Grading-Scheme.

In this system, the top band (top 10%) of students who score highest marks are placed at A+ which is equivalent to 10 grade point (maximum). Thus, 10 GPA or CGPA is equivalent to 100%. Accordingly, 1 GPA or CGPA is equivalent to 10%.

Based on this, the following formula is applied to convert GPA or CGPA to an appropriate percentage:

Percentage secured by the candidate = GPA or CGPA × 10

20. Declaration of class

The class shall be awarded on the basis of CGPA as follows:

First Class with Distinction	CGPA of 7.50 and above
First Class	CGPA of 6.00 to 7.49
Second Class	CGPA of 5.00 to 5.99

21. 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/modules 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.

22. Industrial training

Every candidate shall be required to work for at least 150 hours spread over four weeks in a Pharmaceutical Industry/Hospital after either Semester V or Semester VI. 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, the candidate shall submit satisfactory

report of such work and a certificate duly signed by the authority of training organization to the head of the institute.

23. 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 subject 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 Discussion	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.

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 BPharm program shall not be eligible for award of ranks. Moreover, the candidates should have completed the BPharm program in minimum prescribed number of years (four years) for the award of ranks.

25. Award of degree

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

26. 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.

27. Re-admission after break of study

Candidate who seeks re-admission to the program after break of study has to get the approval from the university by paying a condonation fee.

No condonation is allowed for the candidate who has more than 2 years of break up period and he/she has to rejoin the program by paying the required fees.

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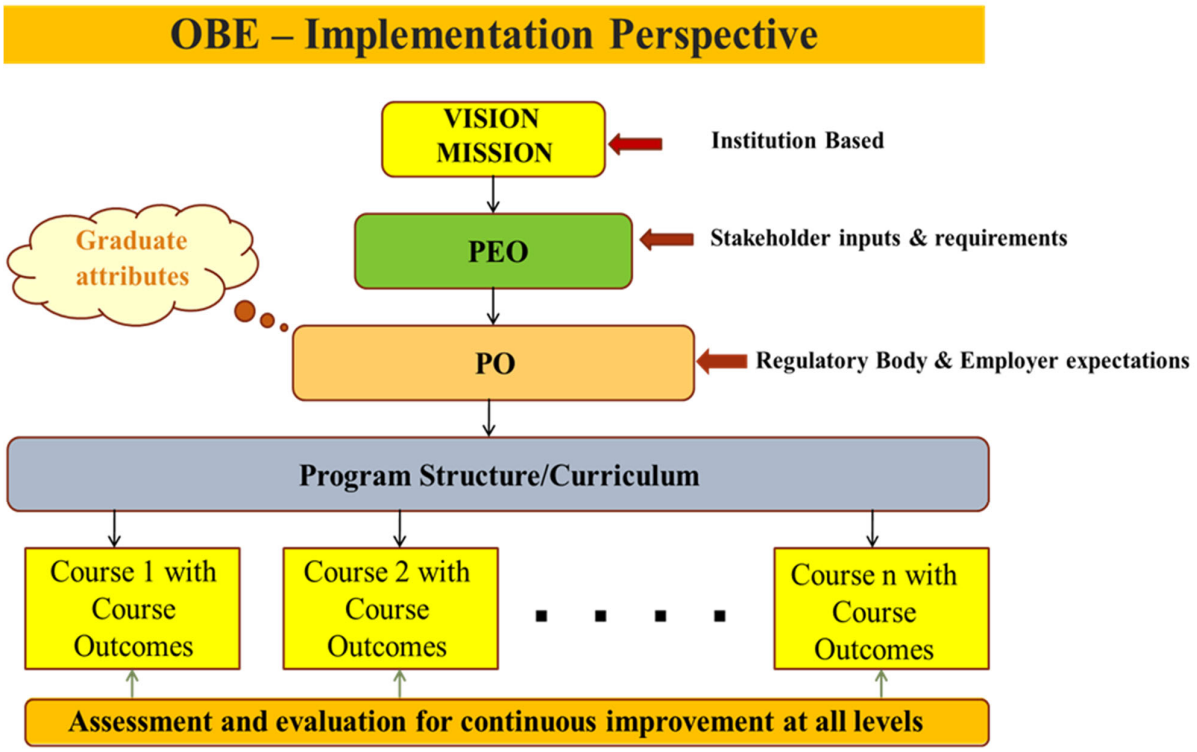
OUTCOME BASED EDUCATION (OBE) FRAMEWORK

Outcome Based Education (OBE) Framework: Process



Vision:

“Excellence in Pharmaceutical Education and Research”

Mission:

“Marching with the Times”

Quality Policy

- **MCOPS is committed towards providing value-based pharmaceutical education to meet industry, hospital and community needs through continuous improvement of infrastructure and facility for learning, practice and research.**

- **MCOPS shall provide an environment conducive to the development of staff and students.**

BPharm Program Educational Objectives

Our institution endeavours to nurture an attitude conducive to self-learning and lifelong learning that would;

- Not only provide comprehensive pharmaceutical education leading to B. Pharm. Degree, but also integrate professional knowledge and skills with research competencies.

- Cultivate an inclination for higher learning, entrepreneurial abilities and research.

- Empower and sensitize pharmacists to serve the societal needs of health care system.

- Provide experiential hands-on training with the help of state of the art infrastructure and motivated, competent teaching faculty.

BPharm Program Outcomes (POs)

The graduate student at the end of the BPharm program will be able to face the challenges of the pharmacy profession in Industry, Practice, Academia and Research as described below:

PO Number	Graduate Attributes (GA)	Program Outcomes
PO1	Pharmacy Knowledge	Demonstrate the ability to apply the acquired knowledge into providing preliminary solutions in specific areas such as synthesis, formulation, and quality assurance involved in the process of pharmaceutical manufacture.
PO2	Problem analysis	Demonstrate knowledge and skills – • To translate into problem solving abilities related to the day-to-day professional needs of the pharmaceutical industry, regulatory bodies and community pharmacy. • To interpret regulatory norms of the country and the skills to apply such knowledge in various processes such as drug discovery and development, clinical trials, manufacture, import and export, distribution, marketing, and sale of medicines. • With the ability to present a personal view founded on observing, understanding, documenting compiling, analyzing, organizing data and information; eventually converting such information into knowledge with judgement and sensitivity in the healthcare domain, especially about pharmaceutical products, and practices.
PO3	Planning Abilities	Understand the importance of applying pharmacodynamic and pharmacokinetic principles in formulation development and product development.
PO4	Modern tool usage	Demonstrate standards of digital literacy befitting a discerning end user, especially in identifying and evaluating appropriate software tools that would support professional needs in manufacture, patient care, hospital administration etc.

PO Number	Graduate Attributes (GA)	Program Outcomes
PO5	Pharmacist and society	Create awareness in society about the effective and safe use of medicines and cultivate a sense of compliant partnering spirit in professional duties; especially in aligning with diverse health professionals and communities.
PO6	Environment and sustainability	Cultivate a sense of commitment to minimizing hazards ranging from improper clinical use of drugs to their Industrial scale manufacture. To minimize environmental hazards of manufacturing practices, wasteful expenditure of energy, pollution from effluents and emissions.
PO7	Ethics	Cultivate a sense of - fair play, sensitivity to professional ethical codes of conduct, social values, and respect for democratic institutions. - gender-neutral attitudes and practices; respect for all races, nations, religions, cultures, languages, and traditions.
PO8	Leadership Skills	Demonstrate the capacity - to engage superiors, colleagues, and subordinates in problem-based learning approaches - to sensitize them to the potential conflicts of interest in healthcare systems and its implementation.
PO9	Communication	Enable effective communication skills in professional and personal domains: to speak, read, comprehend, interpret and write logically and effectively with focus.
PO10	Professional Identity	Cultivate a temperament that would enable individuals to set and work towards self-driven performance-goals, entrepreneurial ventures and overall leadership.
PO11	Lifelong learning	Demonstrate the potential to tackle future challenges through lifelong learning.

CHAPTER – II

- **Course Work**
- **COs POs Mapping**
- **Course Outcomes (Cos)**
- **Course Content and Assessment Plan**
- **Syllabus in detail**

BPharm

SEMESTER I : COURSE WORK

Course of study for Semester I					
Course code	**Name of the course**	**No of hours/wk**			**Credit points (C)**
		Lecture (L)	**Tutorial (T)**	**Practical (P)**	
PHA-BP101T	Human Anatomy and Physiology-I (Theory)	3	1	--	4
PQA-BP102T	Pharmaceutical Analysis I (Theory)	3	1	--	4
PCE-BP103T	Pharmaceutics I (Theory)	3	1	--	4
PCH-BP104T	Pharmaceutical Inorganic Chemistry (Theory)	3	1	--	4
PRM-BP105T	Communication Skills (Theory)	2	--	--	2
PCO-BP106RBT/ PCE-BP106RMT	Remedial Biology/ Remedial Mathematics (Theory)*	2	--	--	2
PHA-BP107P	Human Anatomy and Physiology I (Practical)	--	--	4	2
PQA-BP108P	Pharmaceutical Analysis I (Practical)	--	--	4	2
PCE-BP109P	Pharmaceutics I (Practical)	--	--	4	2
PCH-BP110P	Pharmaceutical Inorganic Chemistry (Practical)	--	--	4	2
PRM-BP111P	Communication Skills (Practical)	--	--	2	1
PCO-BP112RBP	Remedial Biology (Practical)*	--	--	2	1
	Total	**14/16[$, #]**	**4**	**16/18[$]/20[#]**	**27/29[$]/30[#]**

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

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

*Non University Examination (NUE). Internal assessment only.

BPharm I Semester - COs POs Mapping

Sl. No.	Course Code	Course Name	Credits	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
1	PHA- BP101T	Human Anatomy and Physiology (Theory)	4	CO1 CO2 CO3	CO1 CO2 CO3		CO1 CO2 CO3	CO1 CO2 CO3	CO1 CO2 CO3	CO1 CO2 CO3				CO1 CO2 CO3
2	PQA- BP102T	Pharmaceutical Analysis I (Theory)	4	CO1 CO2	CO2	CO1 CO2			CO1 CO2					
3	PCE- BP103T	Pharmaceutics I (Theory)	4	CO1 CO2 CO3 CO5	CO2 CO3 CO4 CO5				CO2 CO3 CO4 CO5	CO2 CO3 CO4 CO5				CO1 CO2 CO4
4	PCH- BP104T	Pharmaceutical Inorganic Chemistry (Theory)	4	CO1 CO2	CO1 CO2			CO1 CO2	CO1 CO2	CO1 CO2		CO1 CO2		CO1 CO2
5	PRM- BP105T	Communication Skills (Theory)	2	CO1	CO1 CO4	CO1 CO3		CO1 CO2 CO3 CO4 CO5			CO1 CO2 CO3 CO4 CO5	CO1 CO2 CO3 CO4 CO5	CO1 CO2 CO3 CO5	CO1 CO2 CO3 CO4 CO5
6	PHA- BP107P	Human Anatomy and Physiology I (Practical)	2	CO1 CO2	CO1 CO2		CO1 CO2	CO1 CO2	CO1 CO2	CO1 CO2				CO1 CO2
7	PQA- BP108P	Pharmaceutical Analysis I (Practical)	2	CO1 CO2 CO3	CO1 CO2 CO3	CO2 CO3			CO1 CO2 CO3					
8	PCE- BP109P	Pharmaceutics I (Practical)	2	CO1 CO2	CO1 CO2	CO1 CO2					CO1 CO2			
9	PCH- BP110P	Pharmaceutical Inorganic Chemistry (Practical)	2	CO1 CO2	CO1 CO2			CO1 CO2						
10	PRM- BP111P	Communication Skills (Practical)	1	CO1	CO1			CO1			CO1	CO1		CO1

BPharm - Semester I

COURSE CODE	PHA-BP101T
COURSE TITLE	HUMAN ANATOMY AND PHYSIOLOGY-I (Theory)

SCOPE/SYNOPSIS	OBJECTIVES/ COs
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 the homeostatic mechanisms. The subject provides the basic knowledge required to understand the various disciplines of pharmacy.	Upon completion of this course the student shall be able to: 1. Explain the gross morphology, structure and functions of various organs of the human body 2. Describe the various homeostatic mechanisms and their imbalances 3. Appreciate coordinated working pattern of different organs of each system

Course Content and Assessment Plan

SL No.	Course Content	Syllabus (Chapters or Units with hours)	Marks of assessment	Distribution of marks of assessment		
				Sessional exam (*30% of marks of assessment)*		End Sem exam (*70% of marks of assessment)*
				S1	S2	
1	Student will understand the basic definitions and elementary tissues based on its structure and functions	Unit I (10hrs)	22	8		14
2	Student will comprehend the anatomy and physiology of skeletal system, including bones, joints and skin	Unit II (10hrs)	22	7		15
3	Student will appreciate structure and functions of blood, its related components and lymphatic system	Unit III (10hrs)	22		8	14
4	Student will appreciate the anatomical and functional aspects of cardiovascular system	Unit IV (8hrs)	22		7	15
5	Student will understand the various structural and functional aspects of gastro-intestinal system. Roles of ATP and creatinine phosphate will be comprehended in ‘energetics’	Unit V (7hrs)	17		--	17
		Total marks of assessment	105	15	15	75

PHA-BP101T: HUMAN ANATOMY AND PHYSIOLOGY I (Theory)

Course Content **45hrs**

Unit I **10hrs**

- **Introduction to human body**

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

- **Cellular level of organization**

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

- **Tissue level of organization**

Classification of tissues, structure, location and functions of epithelial, muscular and nervous and connective tissues.

Unit II **10hrs**

- **Integumentary system**

Structure and functions of skin

- **Skeletal system**

Divisions of skeletal system, types of bone, salient features and functions of bones of axial and appendicular skeletal system

- **Joints**

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

- **Muscular system**

Organization of skeletal muscle, physiology of muscle contraction, neuromuscular junction

Unit III **10hrs**

- **Body fluids and blood**
- 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.
- **Lymphatic system**

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

Unit IV **8hrs**

- **Cardiovascular system**

Heart – anatomy of heart, elements of conduction system of heart, electrocardiogram, cardiac cycle, heart rate, stroke volume, cardiac output and its regulation. Structure and functions of artery, vein and capillaries. Blood circulation, pulse, blood pressure and its regulation, and disorders of heart.

Unit V **7hrs**

- **Digestive system**

Anatomy of GI Tract with special reference to anatomy and functions of stomach (acid production, regulation of acid production, pepsin role in protein digestion), small intestine and large intestine. Anatomy and functions of salivary glands, pancreas and liver, movements of GIT, digestion and absorption of nutrients and disorders of GIT.

- **Energetics:** Formation and role of ATP, Creatinine Phosphate and BMR.

BPharm - Semester I

COURSE CODE	PHA-BP107P
COURSE TITLE	HUMAN ANATOMY AND PHYSIOLOGY-I (Practical)

SCOPE/SYNOPSIS	OBJECTIVES/ COs
Practical physiology is complimentary to the theoretical discussions in physiology. Practical classes allow the verification of physiological processes discussed in theory classes through experiments on living tissue, intact animals or normal human beings. This is helpful for developing an insight on the subject**.**	Upon completion of this course the student shall be able to: 1. Identify the various tissues and organs of different systems of human body 2. Perform various experiments related to haematology

List of Experiments:

1. Study of compound microscope.
2. Microscopic study of tissues (epithelial, connective, muscular and nervous tissue)
3. Microscopic study of skin, bone, heart, salivary gland, liver, pancreas, and intestine.
4. Study of soft organs eye, heart, stomach, liver, pancreas, small intestine and large intestine
5. Identification of axial bones
6. Identification of appendicular bones
7. Introduction to haemocytometry
8. Enumeration of white blood cell (WBC) count
9. Enumeration of total red blood corpuscles (RBC) count
10. Determination of bleeding time and clotting time
11. Estimation of hemoglobin content
12. Determination of blood group.
13. Determination of erythrocyte sedimentation rate (ESR).
14. Determination of heart rate, pulse rate and blood pressure.
15. Determination of body mass index.

Recommended Books (Latest Editions)

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

References Books (Latest Editions)

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

BPharm - Semester I

COURSE CODE	PQA-BP102T
COURSE TITLE	PHARMACEUTICAL ANALYSIS (Theory)

SCOPE/SYNOPSIS	OBJECTIVES/ COs
This course deals with the fundamentals of analytical chemistry and principles of volumetric and gravimetric analysis of drugs to develop analytical skills.	Upon completion of this course, the student shall be able to Understand: 1. The basic concepts f Pharmaceutical Analysis 2. The principles & applications of Neutralization titrations. 3. The principles & applications of Precipitation, Complexometry and Gravimetric analysis. 4. The principles & applications of Redox titrations.

Course Content and Assessment Plan

SL No	Course Content	Syllabus (Chapters or Units with hours)	Marks of assessment	Distribution of marks of assessment		
				Sessional exam (*30% of marks of assessment)*		End Sem exam (*70% of marks of assessment)*
				S1	S2	
1	Student will understand the fundamentals of Pharma-ceutical analysis, errors in analysis, concentration expression terms, and standard solutions.	Unit I (10hrs)	24	8		16
2	Student will acquire the theoretical and practical skills to perform neutralization titrations and non-aqueous titrations	Unit II (10hrs)	24	7		17
3	Student will acquire the theoretical and practical skills to perform precipitation titrations, complexometric titrations, diazotization titrations and gravimetric analysis	Unit III (14hrs)	32		8	24
4	Student will acquire the theoretical and practical skills to perform redox titration	Unit IV (11hrs)	25		7	18
		Total marks of assessment	105	15	15	75

PQA-BP102T: PHARMACEUTICAL ANALYSIS (Theory)

Course Content **45hrs**

UNIT-I **10hrs**

(a) Pharmaceutical Analysis-Definition and scope

i) Different techniques of analysis
ii) Methods of expressing concentration
iii) Primary and secondary standards.
iv) Preparation and standardization of various molar and normal solutions- Oxalic acid, Sodium hydroxide, Hydrochloric acid, Sodium thiosulphate, Sulphuric acid, Potassium permanganate and Ceric ammonium sulphate.

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

UNIT-II **10hrs**

- **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
- **Non aqueous titration**: Solvents, acidimetry and alkalimetry titration and estimation of Sodium benzoate and Ephedrine HCl

UNIT-III **14hrs**

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

UNIT-IV **11hrs**

Redox titrations

a) Concepts of oxidation and reduction
b) Types of redox titrations (Principles and applications)
Cerimetry, Iodimetry, Iodometry, Bromatometry, Dichrometry, Titration with Potassium iodate

BPharm - Semester I

COURSE CODE	PQA-BP108P
COURSE TITLE	PHARMACEUTICAL ANALYSIS (Practical)

SCOPE/SYNOPSIS	OBJECTIVES/ COs
This practical course reinforces the basic principles of conventional volumetric and gravimetric analysis. Students get hands-on experience in preparing standard solutions and assaying selected compounds official in the Pharmacopoeia	Upon completion of this course, the student shall be able to: 1. Understand basic lab operations and documentation 2. Learn the preparation and standardization of primary and secondary standard solutions 3. Learn the assay and differential analysis of selected compounds official in the Pharmacopoeia

List of Experiments

I **Preparation and standardization of**

1) Sodium hydroxide
2) Sulphuric acid
3) Sodium thiosulfate
4) Potassium permanganate
5) Ceric ammonium sulphate

II **Assay of the following compounds along with standardization of the Titrant**

1) Ammonium chloride by acid base titration
2) Ferrous sulphate by Cerimetry
3) Copper sulphate by Iodometry
4) Calcium gluconate by complexometry
5) Hydrogen peroxide by Permanganometry
6) Sodium benzoate by non-aqueous titration
7) Sodium Chloride by precipitation titration
8) Mixture of strong acid and weak acid
9) Sodium hydroxide in presence of sodium carbonate
10) Calcium in presence of magnesium

Recommended Books (Latest Editions)

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

BPharm - Semester I

COURSE CODE	PCE-BP103T
COURSE TITLE	PHARMACEUTICS-I (Theory)

SCOPE/SYNOPSIS	OBJECTIVES/COs
This course is designed to impart fundamental knowledge on formulation of various pharmaceutical dosage forms.	Upon completion of this course the student shall be able to: 1. Know the historical background, basics of pharmaceutical dosage forms, prescription and posology. 2. Understand the pharmaceutical calculations and, theoretical principles of liquid dosage forms and powders 3. Understand the preparation and evaluation monophasic and biphasic liquid dosage forms. 4. Formulate and evaluate suppositories and identify and prevent pharmaceutical incompatibilities. 5. Understand the formulation and evaluation of semisolid dosage forms.

Course Content and Assessment Plan

SL No.	Course Content	Syllabus (Chapters or Units with hours)	Marks of assessment	Distribution of marks of assessment		
				Sessional exam (*30% of marks of assessment)*		End Sem exam (*70% of marks of assessment)*
				S1	S2	
1	Student will gain knowledge of historical background and development of the profession of pharmacy, basics of pharmaceutical dosage forms, prescription and posology.	Unit I (10hrs)	22	6		16
2	Student will be able to execute pharmaceutical calculations, formulate powder and liquid dosage forms.	Unit II (10hrs)	22	6		16
3	Student will be able to formulate and evaluate monophasic and biphasic liquid dosage forms, learn how to overcome formulation stability issues.	Unit III (9hrs)	22	3	3	16
4	Student will be able to formulate and evaluate suppositories; comprehend pharmaceutical incompatibilities and ways to overcome them.	Unit IV (9hrs)	22		7	15
5	Student will be able to formulate and evaluate pharmaceutical semisolids.	Unit V (7hrs)	17		5	12
		Total marks of assessment	105	15	15	75

PCE-BP103T: PHARMACEUTICS I (Theory)

Course Content **45hrs**

UNIT – I **10hrs**

- **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, Pharmacopoeias: Introduction to IP, BP, USP and Extra Pharmacopoeia.
- **Dosage forms:** Introduction to dosage forms, Classification and Definitions
- **Prescription:** Definition, Parts of prescription; Handling of prescription and Errors in prescription.
- **Posology:** Definition, Factors affecting posology; Pediatric dose calculations based on age, body weight and body surface area.

UNIT – II **10hrs**

- **Pharmaceutical calculations**: Weights and measures – Imperial & Metric system; Calculations involving percentage solutions; Alligation, Proof spirit and Isotonic solutions based on freezing point and molecular weight.
- **Powders:** Definition, classification, Advantages and disadvantages; Simple & compound powders – official preparations; Dusting powders; Efflorescent and Hygroscopic powders; Eutectic mixtures; Geometric dilutions.
- **Liquid dosage forms:** Advantages and disadvantages of liquid dosage forms; Excipients used in formulation of liquid dosage forms; Solubility enhancement techniques

UNIT – III **9hrs**

- **Monophasic liquids:** Definitions and preparations of Gargles, Mouthwashes, Throat Paint, Eardrops, Nasal drops, Enemas, Syrups, Elixirs, Liniments and Lotions.
- **Biphasic liquids:**
    - **Suspensions:** Definition, Advantages and Disadvantages; Classifications; Preparation of suspensions; Flocculated and Deflocculated suspension; Stability problems and methods to overcome.

- **Emulsions:** Definition, Classification; Emulsifying agents; Test for the identification of type of Emulsion; Methods of preparation; Stability problems and methods to overcome.

UNIT – IV **9hrs**

- **Suppositories**: Definition, Types; Advantages and disadvantages; Types of bases; Methods of preparation; Displacement value & its calculations; Evaluation of suppositories.
- **Pharmaceutical incompatibilities**: Definition, classification; Physical, Chemical and Therapeutic incompatibilities with examples.

UNIV – V **7hrs**

- **Semisolid dosage forms:** Definitions, Classification, Mechanisms and factors influencing dermal penetration of drugs; Preparation of ointments, pastes, creams and gels; Excipients used in semisolid dosage forms; Evaluation of semisolid dosages forms.

BPharm - Semester I

COURSE CODE	PCE-BP109P
COURSE TITLE	PHARMACEUTICS-I (Practical)

SCOPE/SYNOPSIS	OBJECTIVES/COs
Pharmaceutics-I (Practical) deals with the laboratory-scale formulation of conventional solid, liquid and semisolid pharmaceutical dosage forms. Students will learn the ways and means of preparation of various dosage forms through this course.	Upon completion of this course the student shall be able to: 1 Formulate monophasic and biphasic liquid dosage forms, powders, granules, suppositories and semisolid dosage forms using various methods, on laboratory-scale 2 Perform calculations with respect to working formula and dose of product, prepare product labels and appreciate their significance

List of experiments:

1. **Syrups**
   a) Syrup IP'66
   b) Compound syrup of Ferrous Phosphate BPC'68
2. **Elixirs**
   a) Piperazine citrate elixir
   b) Paracetamol pediatric elixir
3. **Linctus**
   a) Terpin Hydrate Linctus IP'66
   b) Iodine Throat Paint (Mandles Paint)
4. **Solutions**
   a) Strong solution of ammonium acetate
   b) Cresol with soap solution
   c) Lugol's solution
5. **Suspensions**
   a) Calamine lotion
   b) Magnesium Hydroxide mixture
   c) Aluminum Hydroxide gel
6. **Emulsions**
   a) Turpentine Liniment
   b) Liquid paraffin emulsion

7. **Powders and Granules**
    a) ORS powder (WHO)
    b) Effervescent granules
    c) Dusting powder
    d) Divided powders
8. **Suppositories**
    a) Glycero gelatin suppository
    b) Coca butter suppository
    c) Zinc Oxide suppository

8. Semisolids

    a) Sulphur ointment
    b) Non staining-iodine ointment with methyl salicylate
    c) Carbopol gel

9. Gargles and Mouthwashes

    a) Iodine gargle
    b) Chlorhexidine mouthwash

Recommended Books (Latest Editions)

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

BPharm - Semester I

COURSE CODE	PCH-BP104T
COURSE TITLE	PHARMACEUTICAL INORGANIC CHEMISTRY (Theory)

SCOPE/SYNOPSIS	OBJECTIVES/COs
This subject deals with the monographs of inorganic drugs and pharmaceuticals.	Upon completion of course student shall be able to: 1. Know the sources of impurities and methods to determine the impurities in inorganic drugs and pharmaceuticals 2. Understand the medicinal and pharmaceutical importance of inorganic compounds including radiopharmaceuticals. 3. Learn the method of preparation and assay of inorganic compounds official in Indian Pharmacopoeia.

Course Content and Assessment Plan

SL No.	Course Content	Syllabus (Chapters or Units with hours)	Marks of assessment	Distribution of marks of assessment		
				Sessional exam (*30% of marks of assessment)*		End Sem exam (*70% of marks of assessment)*
				S1	S2	
1	Student will know the history of Pharmacopoeia, sources and types of impurities, principle involved in the limit tests	Unit I (10hrs)	23	8		15
2	Student will learn the general aspects of buffers, dental products, importance of buffers in pharmaceutical systems, calculations related to preparation of buffers, physiological role of electrolytes, physiological acid base balance, electrolyte replacement therapy, methods of preparation, assay, medicinal uses of electrolytes and dental products.	Unit II (10hrs)	23	7		16
3	Student will learn the classification, methods of preparation, assay, medicinal uses of gastrointestinal agents	Unit III (10hrs)	23		8	15
4	Student will learn the methods of preparation, assay, medicinal uses of inorganic compounds used as expectorants, emetics, haematinics, poison and antidotes, astringents.	Unit IV (8hrs)	19		-	19
5	Student will understand the basics of radioactivity, radioisotopes, storage conditions, precautions and pharmaceutical application of radioactive substances.	Unit V (7hrs)	17		7	10
		Total marks of assessment	105	15	15	75

PCH-BP104T: PHARMACEUTICAL INORGANIC CHEMISTRY (Theory)

Course Content **45hrs**

UNIT I **10hrs**

- **Impurities in pharmaceutical substances:** History of Pharmacopoeia, Sources and types of impurities, principle involved in the limit test for Chloride, Sulphate, Iron, Arsenic, Lead and Heavy metals, modified limit test for Chloride and Sulphate.
- **General methods of preparation**, assay for the compounds superscripted with asterisk **(*),** properties and medicinal uses of inorganic compounds belonging to the following classes

UNIT II **10hrs**

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

UNIT III **10hrs**

- **Gastrointestinal agents**

  Acidifiers: Ammonium chloride* and Dil. HCl

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

  Cathartics: Magnesium sulphate, Sodium orthophosphate, Kaolin and Bentonite

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

UNIT IV **8hrs**

- **Miscellaneous compounds**

  Expectorants: Potassium iodide, Ammonium chloride*.

  Emetics: Copper sulphate*, Sodium potassium tartrate

  Haematinics: Ferrous sulphate*, Ferrous gluconate

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

  Astringents: Zinc Sulphate, Potash Alum

UNIT V **7hrs**

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

BPharm- Semester I

COURSE CODE	PCH-BP110P
COURSE TITLE	PHARMACEUTICAL INORGANIC CHEMISTRY (Practical)

SCOPE/SYNOPSIS	OBJECTIVES/COs
During the manufacturing process, several impurities tend to crop-up into Active Pharmaceutical Ingredients(APIs) and Formulations. Pharmaceutical Inorganic Chemistry Practical deals with the science of analyzing the inorganic compounds and impurities as per the methods recommended by Pharmacopoeia. Besides, it also deals with the preparation of a few inorganic compounds. .	Upon completion of course student shall be able to: 1. Perform Limit tests and Identification tests to assess the purity of the inorganic compounds official in pharmacopoeia, APIs per se or in dosage forms 2. Prepare a few Inorganic Pharmaceutical Substances and carry out Pharmacopoeial tests

List of experiments

I. **Limit tests for following ions**

Limit test for Chlorides and Sulphates

Modified limit test for Chlorides and Sulphates

Limit test for Iron

Limit test for Heavy metals

Limit test for Lead

Limit test for Arsenic

II. **Identification test**

Magnesium hydroxide

Ferrous sulphate

Sodium bicarbonate

Calcium gluconate

Copper sulphate

III. **Test for purity**

Swelling power of Bentonite

Acid Neutralizing capacity of aluminum hydroxide gel

Determination of potassium iodate and iodine in potassium Iodide

IV. **Preparation of inorganic pharmaceuticals**

Boric acid

Potash alum

Ferrous sulphate

Recommended Books (Latest Editions)

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

BPharm - Semester I

COURSE CODE	PRM-BP105T
COURSE TITLE	COMMUNCIATION SKILLS (Theory)

SCOPE/SYNOPSIS	OBJECTIVES/ COs
This course will prepare the young pharmacy student to interact effectively with doctors, nurses, dentists, physiotherapist and other healthcare 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.	Upon completion of this course the student shall be able to: 1. Understand the behavioral needs for a pharmacist to function effectively in the areas of pharmaceutical operation 2. Communicate effectively (Verbal and Non-Verbal) 3. Effectively manage the team as a team player 4. Develop interview skills 5. Develop leadership qualities and essentials

Course Content and Assessment Plan

SL No.	Course Contents	Syllabus (Chapters or Units with hours)	Marks of assessment	% of marks of assessment		
				Sessional exam (*30% of marks of assessment)*		End Sem exam (*70% of marks of assessment)*
				S1	S2	
1	Student will learn the importance of communication process and barriers to Communication and its communication perspectives	Unit I (6hrs)	15	7	-	8
2	Students shall be able to understand verbal, physical communication and communication matrix	Unit II (6hrs)	15	1	6	8
3	Student will gain knowledge about listening skills and effective written communication	Unit III (6hrs)	15	-	7	8
4	Student will learn about different interview skills and get acquainted with presentation and its delivery	Unit IV (5hrs)	12	6	-	6
5	Student will be able to effectively participate in Group Discussion	Unit V (3hrs)	8	1	2	5
		Total marks of assessment	65	15	15	35

PRM-BP105T: COMMUNICATION SKILLS (Theory)

Course Content **26hrs**

UNIT – I **6hrs**

- **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

UNIT – II **6hrs**

- **Elements of Communication:** Introduction, Face to Face Communication - Tone of Voice, Body Language (Non-verbal communication), Verbal Communication, Physical Communication.
- **Communication Styles:** Introduction, The Communication Styles Matrix with example for each - Direct Communication Style, Spirited Communication Style, Systematic Communication Style, Considerate Communication Style

UNIT – III **6hrs**

- **Basic Listening Skills:** Introduction, Self-Awareness, Active Listening, Becoming an Active Listener, 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 Lines, Put the Main Point First, Know Your Audience, Organization of the Message

UNIT – IV **5hrs**

- **Interview Skills:** Purpose of an interview, Do's and Don'ts of an interview
- **Giving Presentations:** Dealing with fears, planning your presentation, structuring your presentation, delivering your presentation, techniques of delivery

UNIT – V **3hrs**

- **Group Discussion:** Introduction, Communication skills in group discussion, Do's and Don'ts of group discussion

BPharm - Semester I

COURSE CODE	PRM-BP111P
COURSE TITLE	COMMUNCIATION SKILLS (Practical)

SCOPE/SYNOPSIS	OBJECTIVES/ COs
Communication Skills are important facets of a successful Pharmacy Professional. Communication skills practical course is designed to make the students to learn, improve and practice the tools to communicate effectively with peers and others.	Upon completion of this course the student shall be able to: Demonstrate his/her communication skills – Both spoken and written

Experiments:

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

Basic communication covering the following topics

Meeting People

Asking Questions Making Friends

What did you do?

Do's and Don'ts

Pronunciations covering the following topics

Pronunciation (Consonant Sounds)

Pronunciation and Nouns

Pronunciation (Vowel Sounds)

Advanced Learning

Listening Comprehension / Direct and Indirect Speech

Figures of Speech

Effective Communication

Writing Skills

Effective Writing

Interview Handling Skills

E-Mail etiquette

Presentation Skills

Recommended Books: (Latest Edition)

1. Basic communication skills for Technology, Andreja. J. Ruther Ford, 2nd Edition, Pearson Education, 2011.
2. Communication skills, Sanjay Kumar, Pushpalata, 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. Personality development and soft skills, Barun K Mitra, 1st Edition, Oxford Press, 2011.
9. Soft skill for everyone, Butter Field, 1st Edition, Cengage Learning India Pvt. Ltd, 2011.
10. Soft skills and professional communication, Francis Peters SJ, 1stEdition, Mc Graw Hill Education, 2011.
11. Effective communication, John Adair, 4th Edition, Pan Mac Millan, 2009.
12. Bringing out the best in people, Aubrey Daniels, 2nd Edition, Mc Graw Hill, 1999.

BPharm- Semester I

COURSE CODE	PCO-BP106RBT
COURSE TITLE	REMEDIAL BIOLOGY (Theory)

SCOPE/SYNOPSIS	OBJECTIVES/ COs
This course helps to learn and understand the components of living world, structure and functional system of plant and animal kingdom	Upon completion of this course the student shall be able to: 1. Know the classification and salient features of five kingdoms of life 2. Understand the basic components of anatomy & physiology of plant 3. Know and understand the basic components of anatomy & physiology of animal with special reference to human

Course Content **26hrs**

UNIT I **6hrs**

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.

UNIT II **6hrs**

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

UNIT III **6hrs**

Excretory products and their elimination

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

Neural control and coordination

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

Chemical coordination and regulation

- Endocrine glands and their secretions
- Functions of hormones secreted by endocrine glands

Human reproduction

- Parts of female reproductive system
- Parts of male reproductive system
- Spermatogenesis and Oogenesis
- Menstrual cycle

UNIT IV **4hrs**

Plants and mineral nutrition:

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

Photosynthesis

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

UNIT V **4hrs**

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.

Text Books

a. Text book of Biology by S. B. Gokhale
b. A Text book of Biology by Dr. Thulajappa and Dr. Seetaram.

Reference Books

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

BPharm - Semester I

COURSE CODE	PCO-BP112RBP
COURSE TITLE	REMEDIAL BIOLOGY (Practical)

SCOPE/SYNOPSIS	OBJECTIVES/ COs
To learn and understand the components of living world, structure and functional system of plant and animal kingdom	Upon completion of this course the student shall be able to: 1. Gain the knowledge of handling microscope for studying histological characters 2. Understand different parts of the medicinal plants 3. Understand the basics of anatomy and physiology

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

Reference Books

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

BPharm- Semester I

COURSE CODE	PCE-BP106RMT
COURSE TITLE	REMEDIAL MATHEMATICS (Theory)

SCOPE/SYNOPSIS	OBJECTIVES/ COs
This is an introductory course in mathematics. This subject deals with the introduction to Partial fraction, Logarithm, matrices and Determinant, Analytical geometry, Calculus, differential equation and Laplace transform.	Upon completion of this course the student shall be able to: 1. Know the fundamentals of mathematics and their application in Pharmacy 2. Solve the different types of problems by applying theory

REMEDIAL MATHEMATICS (Theory)

Course Content **26hrs**

UNIT – I **5hrs**

- **Partial fraction**

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

- **Logarithms**

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

- **Function***:*

Real Valued function, Classification of real valued functions.

- **Limits and continuity** :

Introduction, Limit of a function, Definition of limit of a function (ϵ =δ definition),

$$\lim_{x\to a}\frac{x^n - a^n}{x-a} = na^{n-1},\quad \lim_{\theta\to 0}\frac{sin\theta}{\theta} = 1$$

UNIT –II **5hrs**

- **Matrices and Determinant:**

Introduction matrices, Types of matrices, Operation on matrices, Transpose of a matrix, Matrix Multiplication, Determinants, Properties of determinants , Product of determinants, Minors and co-Factors, Adjoint or adjugate of a square matrix , Singular and non-singular matrices, Inverse of a matrix, Solution of system of linear of equations using matrix method, Cramer's rule, Characteristic equation and roots of a square matrix, Cayley–Hamilton theorem, Application of Matrices in solving Pharmacokinetic equations.

UNIT – III **5hrs**

- **Calculus**

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

UNIT – IV **5hrs**

- **Analytical Geometry**

Introduction: Signs of the Coordinates, Distance formula,

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

Integration:

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

UNIT-V **6hrs**

- **Differential Equations**: Some basic definitions, Order and degree, Equations in separable form, Homogeneous equations, Linear Differential equations, Exact equations, **Application in solving Pharmacokinetic equations**

- **Laplace Transform** : Introduction, Definition, Properties of Laplace transform, Laplace Transforms of elementary functions, Inverse Laplace transforms, Laplace transform of derivatives, Application to solve Linear differential equations, Application in solving Chemical kinetics and Pharmacokinetics equations.

Recommended Books (Latest Edition)

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

BPharm

SEMESTER II : COURSE WORK

Course of study for Semester II					
Course Code	**Name of the course**	**No of hours/wk**			**Credit points (C)**
		Lecture (L)	**Tutorial (T)**	**Practical (P)**	
PHA-BP201T	Human Anatomy and Physiology II (Theory)	3	1	--	4
PCH-BP202T	Pharmaceutical Organic Chemistry I (Theory)	3	1	--	4
PBT-BP203T	Biochemistry (Theory)	3	1	--	4
PPR-BP204T	Pathophysiology (Theory)	3	1	--	4
PCE-BP205T	Computer Applications in Pharmacy (Theory)*	2	1	--	3
PRM-BP206T	Environmental Sciences (Theory)	2	1	--	3
PHA-BP207P	Human Anatomy and Physiology II (Practical)	--	--	4	2
PCH-BP208P	Pharmaceutical Organic Chemistry I (Practical)	--	--	4	2
PBT-BP209P	Biochemistry (Practical)	--	--	4	2
PCE-BP210P	Computer Applications in Pharmacy (Practical)*	--	--	2	1
	Total	**16**	**6**	**14**	**29**
*Non University Examination (NUE). Internal assessment only.					

BPharm II Semester - COs POs Mapping														
Sl. No.	**Course Code**	**Course Name**	**Credits**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
11	PHA- BP201T	Human Anatomy and Physiology II (Theory)	4	CO1 CO2 CO3 CO4	CO1 CO2 CO3 CO4	CO1 CO2 CO3 CO4	CO2 CO3 CO4	CO1 CO2 CO3 CO4	CO1 CO2 CO3 CO4	CO1 CO2 CO3 CO4				CO1 CO2 CO3 CO4
12	PCH- BP202T	Pharmaceutical Organic Chemistry I (Theory)	4	CO1 CO2 CO3 CO4	CO1 CO2 CO3 CO4					CO1 CO2 CO3 CO4		CO2 CO3 CO4		
13	PBT- BP203T	Biochemistry (Theory)	4	CO1 CO2 CO3	CO1 CO2 CO3	CO1 CO2 CO3				CO1 CO2 CO3	CO1 CO2 CO3	CO2 CO3		CO1 CO2 CO3
14	PPR- BP204T	Pathophysiology (Theory)	4	CO1 CO2 CO3 CO4 CO5	CO1 CO2 CO3 CO4 CO5									
15	PCE- BP205T	Computer Applications in Pharmacy (Theory)	3		CO1 CO2 CO3		CO1 CO2 CO3							
16	PRM- BP206T	Environmental Sciences (Theory)	3	CO1 CO4 CO5 CO6				CO1 CO2 CO3 CO4 CO5 CO6		CO1 CO2 CO3 CO4 CO5 CO6	CO1 CO2 CO3 CO4			CO3 CO4 CO5 CO6
17	PHA- BP207P	Human Anatomy and Physiology II (Practical)	2	CO1 CO2	CO1 CO2		CO1 CO2	CO1 CO2	CO1 CO2	CO1 CO2				CO1 CO2
18	PCH- BP208P	Pharmaceutical Organic Chemistry I (Practical)	2	CO1 CO2	CO1 CO2				CO1 CO2					CO1 CO2
19	PBT- BP209P	Biochemistry (Practical)	2	CO1 CO2 CO3 CO4	CO1 CO2 CO3 CO4						CO1 CO2 CO3			CO1 CO2 CO3
20	PCE- BP210P	Computer Applications in Pharmacy (Practical)	1	CO1 CO2	CO1 CO2	CO1 CO2	CO1 CO2					CO1 CO2		

BPharm - Semester II

COURSE CODE	PHA-BP201T
COURSE TITLE	HUMAN ANATOMY AND PHYSIOLOGY-I (Theory)

SCOPE/SYNOPSIS	OBJECTIVES/COs
This subject is designed to impart fundamental knowledge on the structure and functions of the various systems of the human body. It also helps in understanding both homeostatic mechanisms. The subject provides the basic knowledge required to understand the various disciplines of pharmacy	Upon completion of this course, the student shall be able to: 1. Explain the gross morphology, structure and functions of various organs of the human body. 2. Describe the various homeostatic mechanisms and their imbalances. 3. Appreciate coordinated working pattern of different organs of each system. 4. Appreciate the interlinked mechanisms in the maintenance of normal functioning (homeostasis) of human body.

Course Content and Assessment Plan

SL No.	Course Content	Syllabus (Chapters or Units with hours)	Marks of assessment	Distribution of marks of assessment		
				Sessional exam (*30% of marks of assessment)*		End Sem exam (*70% of marks of assessment)*
				S1	S2	
1	Student will understand the organization, structure and functions of nervous system	Unit I (10hrs)	22	8		14
2	Student will understand the structure and functions of peripheral nervous system and special senses	Unit II (10hrs)	22	7		15
3	Student will appreciate the various anatomical and physiological concepts of respiratory and urinary systems	Unit III (10hrs)	22		8	14
4	Student will understand the mechanism of hormone action, structure and functions of various endocrine glands and associated disorders	Unit IV (8hrs)	22		7	15
5	Student will comprehend the anatomy and physiology of male and female reproductive systems, also understand genetic pattern of inheritance	Unit V (7hrs)	17		--	17
		Total marks of assessment	105	15	15	75

PHA-BP201T: HUMAN ANATOMY AND PHYSIOLOGY II (Theory)

Course Content **45hrs**

Unit I **10hrs**

- **Nervous system**

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

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

Unit II **10hrs**

- **Peripheral nervous system**:

Classification of peripheral nervous system: Structure and functions of sympathetic and parasympathetic nervous system.

Origin and functions of spinal and cranial nerves.

- **Special senses**

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

Unit III **10hrs**

- **Respiratory system**

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

- **Urinary system**

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

Unit IV **8hrs**

- **Endocrine system**

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.

Unit V **7hrs**

- **Reproductive system**

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

- **Introduction to genetics**

DNA, chromosomes, genes and protein synthesis, Introduction to human genetics and pattern of inheritance.

BPharm - Semester II

COURSE CODE	PHA-BP207P
COURSE TITLE	HUMAN ANATOMY AND PHYSIOLOGY-I (Practical)

SCOPE/SYNOPSIS	OBJECTIVES/COs
Practical physiology is complimentary to the theoretical discussions in physiology. Practical classes allow the verification of physiological processes discussed in theory classes through experiments on living tissue, intact animals or normal human beings. This is helpful for developing an insight on the subject**.**	Upon completion of this course, the student shall be able to: 1. Identify the various tissues and organs of different systems of human body 2. Perform the various experiments related to special senses, nervous system, respiratory and reproductive systems

List of experiments:

1 Microscopic study of spinal cord, trachea, lung alveoli, cortex of kidney, thyroid gland, pancreas, testis, and ovaries.

2 Study of soft organs: Brain, spinal cord, lungs, kidney, testis, uterus and ovary.

3 To study the special senses using specimen, models, etc.,

4 To study the nervous system using specimen, models, etc.,

5 To study the endocrine system using specimen, models, etc.

6 To demonstrate the general neurological examination

7 To demonstrate the function of olfactory nerve and to examine the types of taste.

8 To demonstrate the visual acuity

9 To demonstrate the reflex activity

10 Recording of body temperature

11 To demonstrate positive and negative feedback mechanism.

12 Determination of tidal volume and vital capacity

13 Study of digestive, respiratory, cardiovascular systems, urinary and reproductive systems with the help of models, charts and specimens

14 Study of family planning devices

15 Pregnancy test

16 Demonstration of total blood count by cell analyzer

Recommended Books (Latest Editions)

1 Essentials of Medical Physiology by K. Sembulingam and P. Sembulingam. Jaypee brothers medical publishers, New Delhi.

2 Anatomy and Physiology in Health and Illness by Kathleen J.W. Wilson, Churchill Livingstone, New York

3 Physiological basis of Medical Practice-Best and Tailor. Williams & Wilkins Co, Riverview, MI USA

4 Text book of Medical Physiology- Arthur C. Guyton and John E. Hall. Miamisburg, OH, U.S.A.

5 Principles of Anatomy and Physiology by Tortora Grabowski. Palmetto, GA, U.S.A.

6 Textbook of Human Histology by Inderbir Singh, Jaypee brothers medical publishers, New Delhi.

7 Textbook of Practical Physiology by C.L. Ghai, Jaypee brothers medical publishers, New Delhi.

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

Reference Books:

1 Physiological basis of Medical Practice-Best and Tailor. Williams & Wilkins Co, Riverview, MI USA

2 Text book of Medical Physiology- Arthur C, Guyton and John. E. Hall. Miamisburg, OH, U.S.A.

3 Human Physiology (vol 1 and 2) by Dr. C.C. Chatterjee, Academic Publishers Kolkata

BPharm- Semester II

COURSE CODE	PCH-BP202T
COURSE TITLE	PHARMACEUTICAL ORGANIC CHEMISTRY-I (Theory)

SCOPE/SYNOPSIS	OBJECTIVES/COs
This subject deals with classification and nomenclature of simple organic compounds, structural isomerism, intermediates formed in reactions, important physical properties, reactions and methods of preparation of these compounds. The syllabus also emphasizes on mechanisms and orientation of reactions.	Upon completion of the course, the student shall be able to: 1. Write the structure, name and the type of isomerism of the organic compounds 2. Write the reaction and explain the reaction mechanism. 3. Account for reactivity/stability of compounds 4. Identify/confirm the identification of organic compound

Course Content and Assessment Plan

SL No.	Course Content	Syllabus (Chapters or Units with hours)	Marks of assessment	Distribution of marks of assessment		
				Sessional exam (*30% of marks of assessment)*		End Sem exam (*70% of marks of assessment)*
				S1	S2	
1	Student will know classification, nomenclature and isomerism of organic Compounds	Unit I (7hrs)	17	6		11
2	Student will learn the general aspects, reactions including mechanism, stability of Alkanes, Alkenes and Conjugated dienes.	Unit II (10hrs)	23	9		14
3	Student will learn the general aspects, reactions including mechanism, stability, uses of Alkyl halides and Alcohols.	Unit III (10hrs)	23		8	15
4	Student will learn the general aspects, reactions including mechanism, stability, uses of carbonyl compounds.	Unit IV (10hrs)	23		7	16
5	Student will learn the general aspects, reactions including mechanism, stability, tests uses of Carboxylic acids, Amines	Unit V (8hrs)	19		-	19
		Total marks of assessment	105	15	15	75

PCH-BP202T: PHARMACEUTICAL ORGANIC CHEMISTRY I (Theory)

Course Content **45hrs**

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

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

UNIT-I **7hrs**

- **Classification, nomenclature and isomerism**

Classification of Organic Compounds

Common and IUPAC systems of nomenclature of organic compounds (up to 10 Carbons open chain and carbocyclic compounds)

Structural isomerisms in organic compounds

UNIT-II **10hrs**

- **Alkanes*, Alkenes* and Conjugated dienes***

SP^3 hybridization in alkanes, Halogenation of alkanes, uses of paraffins.

Stabilities of alkenes, SP^2 hybridization in alkenes

E_1 and E_2 reactions – kinetics, order of reactivity of alkyl halides, rearrangement of carbocations, Saytzeffs orientation and evidences. E_1 versus E_2 reactions, Factors affecting E_1 and E_2 reactions. Ozonolysis, electrophilic addition reactions of alkenes, Markownikoff's orientation, free radical addition reactions of alkenes, Anti Markownikoff's orientation.

Stability of conjugated dienes, Diel-Alder, electrophilic addition, free radical addition reactions of conjugated dienes, allylic rearrangement

UNIT-III **10hrs**

- **Alkyl halides***

SN_1 and SN_2 reactions - kinetics, order of reactivity of alkyl halides, stereochemistry and rearrangement of carbocations.

SN_1 versus SN_2 reactions, Factors affecting SN_1 and SN_2 reactions

Structure and uses of ethylchloride, chloroform, trichloroethylene, tetrachloroethylene, dichloromethane, tetrachloromethane and iodoform.

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

UNIT-IV **10hrs**

- **Carbonyl compounds* (Aldehydes and ketones)**

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

UNIT-V **8hrs**

- **Carboxylic acids***

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

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

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

BPharm - Semester II

COURSE CODE	PCH-BP208P
COURSE TITLE	PHARMACEUTICAL ORGANIC CHEMISTRY-I (Practical)

SCOPE/SYNOPSIS	OBJECTIVES/COs
Pharmaceutical Organic Chemistry Practical is designed to train the student to analyze an organic compound systematically and qualitatively. Besides, the students will also learn about construction of molecular models.	Upon completion of the course, the student shall be able to: 1. Analyze a minimum of 5 unknown organic molecules 2. Prepare a few solid derivatives from organic substances

List of Experiments:

1. Systematic qualitative analysis of unknown organic compounds like

a. Preliminary test: Color, odour, aliphatic/aromatic compounds, saturation and unsaturation, etc.

b. Detection of elements like Nitrogen, Sulphur and Halogen by Lassaigne's test

c. Solubility test

d. Functional group test like Phenols, Amides/ Urea, Carbohydrates, Amines, Carboxylic acids, Aldehydes and Ketones, Alcohols, Esters, Aromatic and Halogenated Hydrocarbons, Nitro compounds and Anilides.

e. Melting point/Boiling point of organic compounds

f. Identification of the unknown compound from the literature using melting point/ boiling point.

g. Preparation of the derivatives and confirmation of the unknown compound by melting point/ boiling point.

Minimum 5 unknown organic compounds to be analyzed systematically.

2. Preparation of suitable solid derivatives from organic compounds

3. Construction of molecular models

Recommended Books (Latest Editions)

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

BPharm - Semester II

COURSE CODE	**PBT-BP203T**
COURSE TITLE	**BIOCHEMISTRY (Theory)**

SCOPE/SYNOPSIS	OBJECTIVES/COs
Biochemistry deals with complete understanding of the molecular levels of the chemical process associated with living cells. The scope of the subject is to provide biochemical facts and principles to understand metabolism of nutrient biomolecules in physiological and pathological conditions. It also emphasizes on genetic organization of mammalian genome, hetero and autocatalytic functions of DNA.	Upon completion of this course the student shall be able to: 1. Understand the catalytic role of enzymes, importance of enzyme inhibitors in design of new drugs, therapeutic and diagnostic applications of enzymes 2. Understand the metabolism of nutrient biomolecules in physiological and pathological conditions 3. Understand the genetic organization of mammalian genome and functions of DNA in the synthesis of RNAs and proteins

Course Content and Assessment Plan

SL No	Course Contents	Syllabus (Chapters or Units with hours)	Marks of assessment	Distribution of marks of assessment		
				Sessional exam (*30% of marks of assessment)*		End Sem exam (*70% of marks of assessment)*
				S1	S2	
1	Student will understand Biochemical organization of cell and different types of macromolecules, their structure and function	Unit I (08hrs)	13	3	2	8
2	Student will understand various metabolic pathways	Unit II (10hrs)	24	7		17
		Unit III (10hrs)	25		6	19
3	Student will understand genetic organization of mammalian genome and functions of DNA in the synthesis of RNAs and proteins.	Unit IV (10hrs)	24		7	17
4	Student will understand Enzymes, their nomenclature, kinetics, functions and applications	Unit V (7hrs)	19	5		14
		Total marks of assessment	105	15	15	75

PBT-BP203T: BIOCHEMISTRY (Theory)

Course Content **45hrs**

UNIT I **8hrs**

- **Biomolecules**

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

- **Bioenergetics**

  Concept of free energy, endergonic and exergonic reactions, relationship between free energy, enthalpy, entropy and redox potential.

  Energy rich compounds and their classification, biological significance of ATP and cyclic AMP.

UNIT II **10hrs**

- **Carbohydrate metabolism**

  Glycolysis - Pathway, energetics and significance

  Citric acid cycle - Pathway, energetics and significance

  HMP shunt and its significance

  Glucose-6-Phosphate dehydrogenase (G6PD) deficiency

  Glycogen metabolism pathways and glycogen storage diseases (GSD)

  Gluconeogenesis- Pathway and its significance

  Hormonal regulation of blood glucose level and Diabetes Mellitus

- **Biological oxidation**

  Electron transport chain (ETC) and its mechanism

  Oxidative phosphorylation & its mechanism and substrate level phosphorylation

  Inhibitors of ETC and Uncouplers

UNIT III **10hrs**

- **Lipid metabolism**

β-Oxidation of saturated fatty acid (Palmitic acid)

Formation and utilization of ketone bodies, ketoacidosis

De novo synthesis of fatty acids (Palmitic acid)

Biological significance of cholesterol and conversion of cholesterol into bile acids, steroid hormone and vitamin D

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

- **Amino acid metabolism**

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

Catabolism of phenylalanine and tyrosine and their metabolic disorders (Phenylketonuria, Albinism, alkaptonuria, tyrosinemia)

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

Catabolism of heme, hyperbilirubinemia and jaundice

UNIT IV **10hrs**

- **Nucleic acid metabolism and genetic information transfer**

Biosynthesis of purine and pyrimidine nucleotides

Catabolism of purine nucleotides, Hyperuricemia and Gout disease

Organization of mammalian genome

Structure of DNA & RNA and their functions

DNA replication (semi conservative model)

Transcription or RNA synthesis

Genetic code, Translation or Protein synthesis and inhibitors

UNIT V **7hrs**

- **Enzymes**

  Introduction, properties, nomenclature and IUB classification of enzymes

  Enzyme kinetics (Michaelis Menten plot, Line Weaver Burke plot)

  Enzyme inhibitors with examples

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

  Therapeutic and diagnostic applications of enzymes and isoenzymes

  Coenzymes –Structure and biochemical functions

BPharm - Semester II

PBT-BP209P: BIOCHEMISTRY (Practical)

4hrs/wk

COURSE CODE	**PBT-BP209P**
COURSE TITLE	**BIOCHEMISTRY (Practical)**
SCOPE/SYNOPSIS	**OBJECTIVES/COs**
Biochemistry Practical course makes the students to understand the importance of different biochemical tests and their clinical applications.	Upon completion of this course the student should be able to: 1. Perform qualitative analysis of various biochemical parameters present in blood and urine and to interpret the clinical relevance based on observation 2. Perform quantitative analysis of various biochemical parameters present in blood and urine and to interpret the clinical conditions based on the results 3. Be well versed with the operational principle and procedure of various techniques such as Electrophoresis, Chromatography etc 4. Carry out experiments to study the factors affecting enzyme activity

List of Experiments:

1. Qualitative analysis of carbohydrates (Glucose, Fructose, Lactose, Maltose, Sucrose and Starch)
2. Identification tests for Proteins (Albumin and Casein)
3. Quantitative analysis of reducing sugars (DNSA method) and Proteins (Biuret method)
4. Qualitative analysis of urine for abnormal constituents
5. Determination of urine creatinine
6. Determination of blood sugar
7. Determination of serum total cholesterol
8. Preparation of buffer solution and measurement of pH
9. Study of enzymatic hydrolysis of starch
10. Determination of salivary amylase activity
11. Study of the effect of temperature on salivary amylase activity.
12. Study of the effect of substrate concentration on salivary amylase activity.

Recommended Books (Latest Editions)

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

BPharm - Semester II

COURSE CODE	**PPR-BP204T**
COURSE TITLE	**PATHOPHYSIOLGY (Theory)**

SCOPE/ SYNOPSIS	OBJECTIVES/COs
This course is designed to impart a fundamental knowledge on the etiopathogenesis, clinical characteristics and complications of the disease. It also provides the baseline knowledge required to understand the pharmacological application and practice of medicine.	Upon completion of this course the student shall be able to: 1. Understand the principles of Cell injury and basic mechanism involved in Inflammation 2. Understand the clinical characteristics and complications of Cardiovascular system, Respiratory system and Renal System 3. Understand the etiopathogenesis, clinical characteristics and complications of Hematological disease, Disease associated with Endocrine system, Nervous system and GI system 4. Understand the etiopathogenesis, clinical characteristics and complications of Cancer, Disease associated with Joints and Bones, ALD and Hepatitis 5. Understand the etiopathogenesis, clinical characteristics and complications of infectious disease

Course Content and Assessment Plan

Sl No.	Course Content	Syllabus (Chapters or Units with hours)	Marks of assessment	Distribution of marks of assessment		
				Sessional exam (*30% of marks of assessment)*		End Sem exam (*70% of marks of assessment)*
				S1	S2	
1	Student will understand the principles of Cell injury and basic mechanism involved in Inflammation	Unit I (10hrs)	24	8		16
2	Understanding the clinical characteristics and complications of Cardiovascular system, Respiratory system and Renal System	Unit II (10hrs)	24	7		17
3	Student will understand the etiopathogenesis, clinical characteristics and complications of hematological disease, disease associated with endocrine system, nervous system and GI system	Unit III (10hrs)	24		8	16
4	Student will understand the etiopathogenesis, clinical characteristics and complications of cancer, disease associated with joints and bones, ALD and hepatitis	Unit IV (8hrs)	17		7	10

5	Student will understand the etiopathogenesis, clinical characteristics and complications of infectious disease	Unit V (7hrs)	16		--	16
Total marks of assessment			105	15	15	75

PPR-BP204T: PATHOPHYSIOLOGY (Theory)

Course Content **45hrs**

Unit I **10hrs**

- **Basic principles of Cell injury and Adaptation:**

Introduction, definitions, homeostasis, components and types of feedback systems, causes of cellular injury**,** pathogenesis (cell membrane damage, mitochondrial damage, ribosome damage, nuclear damage)**,** morphology of cell injury– adaptive changes (atrophy, hypertrophy, hyperplasia, metaplasia, dysplasia)**,** cell swelling, intra cellular accumulation, calcification, enzyme leakage and cell death acidosis & alkalosis, electrolyte imbalance.

- **Basic mechanism involved in the process of inflammation and repair:**

Introduction, clinical signs of inflammation, different types of inflammation, mechanism of inflammation – alteration in vascular permeability and blood flow, migration of WBC's, mediators of inflammation, basic principles of skin wound healing.

Unit II **10hrs**

Cardiovascular System:

- Hypertension, congestive heart failure, ischemic heart disease (angina, myocardial infarction and atherosclerosis)
- **Respiratory system:** Asthma, chronic obstructive airways disease.
- **Renal system:** Acute and chronic renal failure.

Unit III **10hrs**

- **Hematological Diseases:**

  Iron deficiency, megaloblastic anemia (Vit B12 and folic acid), sickle cell anemia, thalassemia, hereditary acquired anemia, hemophilia.

- **Endocrine system:** Diabetes, thyroid diseases. osteoporosis

- **Nervous system:** Epilepsy, parkinson's disease, stroke and psychiatric disorders like depression, schizophrenia and alzheimer's disease.
- **Gastrointestinal system:** Peptic ulcer, inflammatory bowel diseases, jaundice, hepatitis (A, B, C, D, E) alcoholic liver disease.

Unit IV **8hrs**

- **Disease of bones and joints:** Rheumatoid arthritis, osteoporosis and gout
- **Cancer:** Classification, etiology and pathogenesis of cancer

Unit V **7hrs**

- **Infectious diseases:** Meningitis, typhoid, leprosy, tuberculosis, urinary tract infections
- **Sexually transmitted diseases:** AIDS, syphilis, gonorrhea

Recommended Books (Latest Editions)

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

9. V. Kumar, R. S. Cotran and S. L. Robbins; Basic Pathology; 6th edition; Philadelphia; WB Saunders Company; 1997.

10 Roger Walker, Clive Edwards; Clinical Pharmacy and Therapeutics; 3rd edition; London; Churchill Livingstone publication; 2003.

Recommended Journals

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

BPharm - Semester II

COURSE CODE	**PCE-BP205T**
COURSE TITLE	**COMPUTER APPLICATIONS IN PHARMACY (Theory)**

SCOPE/SYNOPSIS	OBJECTIVES/COs
This subject deals with the introduction to databases, database management system, computer application in clinical studies and use of databases.	Upon completion of this course, the student shall be able to: 1. Know the various types of applications of computers in pharmacy 2. Know the various types of databases 3. Know the various types of applications of databases in pharmacy

Course Content and Assessment Plan

SL No.	Course Content	Syllabus (Chapters or Units with hours)	Marks of assessment	Distribution of marks of assessment	
				S1	S2
1	Student will gain knowledge of various number systems - binary, decimal, octal, hexadecimal, conversion of numbers from one system to another. Will learn information gathering, requirement and feasibility analysis, data flow diagrams, process specifications, input/output design, process life cycle, planning and managing the project	Unit I (6hrs)	8	8	
2	Student will learn HTML, XML, CSS and programming languages. Learn the basics of web server and server products, databases MYSQL, MS ACCESS, pharmacy drug databases	Unit II (6hrs)	8	8	
3	Student will understand the various applications of computers in pharmacy like drug storage drug information storage and retrieval, hospital and clinical and others	Unit III (6hrs)	8	4	4
4	Student will comprehend the objective of bioinformatics, bioinformatics databases, concept of bioinformatics, impact of bioinformatics in vaccine discovery	Unit IV (6hrs)	8		8
5	Student will understand the use of computers in data analysis during preclinical development	Unit V (6hrs)	8		8
		Total marks of assessment	40	20	20

PCE-BP205T: COMPUTER APPLICATIONS IN PHARMACY (Theory)

Course Content **30hrs**

UNIT – I **6hrs**

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, binary subtraction – One's complement, Two's complement method, binary multiplication, binary division

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

UNIT- II **6hrs**

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

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

UNIT – III **6hrs**

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

UNIT – IV **6hrs**

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

UNIT-V **6hrs**

Computers as data analysis in Preclinical development:

Chromatographic dada analysis (CDS), Laboratory Information management System (LIMS) and Text Information Management System (TIMS)

BPharm - Semester II

PCE-BP210P: COMPUTER APPLICATIONS IN PHARMACY (Practical)

2hrs/wk

COURSE CODE	**PCE-BP210P**
COURSE TITLE	**COMPUTER APPLICATIONS IN PHARMACY (Practical)**

SCOPE/SYNOPSIS	**OBJECTIVES/COs**
Computers are an indispensable part of the pharmaceutical profession and are extensively used in hospital pharmacy, clinical pharmacy as well as pharmaceutical research. Computers are valuable in handling patient profile and data, maintenance of records, and drug information storage and retrieval. Data management and computer aided drug design plays a critical role in carrying out pharmaceutical research. Hence, Computer applications in Pharmacy Practical will allow the students to use various online tools to create, organize and retrieve patient data.	Upon completion of this course the student should be able to: 1. Understand and use various applications of MS Office to design and organize patient database 2. Learn to design forms and retrieve data using various applications of MS Office

List of Experiments:

1. Design a questionnaire using a word processing package to gather information about a particular disease.
2. Create a HTML web page to show personal information.
3 Retrieve the information of a drug and its adverse effects using online tools
4 Creating mailing labels Using Label Wizard , generating label in MS WORD
5 Create a database in MS Access to store the patient information with the required Fields Using access
6. Design a form in MS Access to view, add, delete and modify the patient record in the database
7. Generating report and printing the report from patient database
8. Creating invoice table using – MS Access
9. Drug information storage and retrieval using MS Access
10. Creating and working with queries in MS Access

11. Exporting Tables, Queries, Forms and Reports to web pages
12. Exporting Tables, Queries, Forms and Reports to XML pages

Recommended books (Latest edition):

1. Computer Application in Pharmacy – William E.Fassett –Lea and Febiger, 600 South Washington Square, USA, (215) 922-1330.
2. Computer Application in Pharmaceutical Research and Development –Sean Ekins – Wiley-Interscience, A John Willey and Sons, INC., Publication, USA
3. Bioinformatics (Concept, Skills and Applications) – S.C.Rastogi-CBS Publishers and Distributors, 4596/1- A, 11 Darya Gani, New Delhi – 110 002(INDIA)
4. Microsoft office Access - 2003, Application Development Using VBA, SQL Server, DAP and Infopath – Cary N.Prague – Wiley Dreamtech India (P) Ltd., 4435/7, Ansari Road, Daryagani, New Delhi - 110002

BPharm - Semester II

COURSE CODE	PRM-BP206T
COURSE TITLE	ENVIRONMENTAL SCIENCE (Theory)

SCOPE/SYNOPSIS	OBJECTIVES/COs
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.	Upon completion of this course the student shall be able to: 1. Create awareness about the environmental problems among learners 2. Impart basic knowledge about the environment and its allied problems 3. Develop the attitude of concern for the environment 4. Motivate learner to participate in environment protection and improvement 5. Acquire skills to help the concern individuals in identifying and following the environment problems 6. Strive to attain harmony with nature

Course Content and Assessment Plan

SL No.	Course Content	Syllabus (Chapters or Units with hours)	Marks of assessment	Distribution of marks of assessment		
				Sessional exam (*30% of marks of assessment)*		End Sem exam (*70% of marks of assessment)*
				S1	S2	
1	Students will be able to appreciate multidisciplinary nature of environment studies and reflect upon mindful use of Natural Resources	Unit I (10hrs)	26	10	-	16
2	Students will be able to understand ecosystems, biodiversity and its conservation aspects.	Unit II (10hrs)	26	5	5	16
3	Students will display learned behavior in reducing Environmental Pollution, observe causes and effects, and implement control measures to protect environment and human population	Unit III (10hrs)	28	-	10	18
		Total marks of assessment	80	15	15	50

PRM-BP206T: ENVIRONMENTAL SCIENCES (Theory)

Course Content **30hrs**

Unit-I **10hrs**

The Multidisciplinary nature of environmental studies

- Definition, Scope and Importance
- Need for public awareness

Natural Resources

- Renewable and non-renewable resources
- Natural resources and associated problems
  a) Forest resources b) Water resources c) Mineral resources d) Food resources e) Energy resources f) Land resources
- Role of an individual in conservation of natural resources.
- Equitable use of resources for sustainable lifestyle.

Unit-II **10hrs**

Ecosystems

- Concept of an ecosystem.
- Structure and function of an ecosystem.
- Producers, consumers and decomposers
- Energy flow in ecosystem
- Ecological succession
- Introduction, types, characteristic features, structure and function of the ecosystems: Forest ecosystem; Grassland ecosystem; Desert ecosystem; Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

Biodiversity and its conservation

Unit- III **10hrs**

Environmental Pollution

- Causes, effects and control measures of: a) Air pollution b) Water pollution c) Soil pollution d) Noise pollution e) Marine pollution
- Solid Waste Management
- Role of individual in prevention of pollution

Social issues and the environment

Human Population and the environment

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.
5. Clark R.S., Marine Pollution, Clanderson Press Oxford.
6. Cunningham W.P., Cooper T.H., Gorhani E., & Hepworth M.T., 2001, Environmental Encyclopedia, Jaico Publ. House, Mumbai.
7. De A.K., Environmental Chemistry, Wiley Eastern Ltd.
8. Down to Earth, Centre for Science and Environment.

BPharm

SEMESTER III : COURSE WORK

Course of study for semester III – Regular students					
Course code	**Name of the course**	**No of hours/wk**			**Credit points (C)**
		Lecture (L)	**Tutorial (T)**	**Practical (P)**	
PCH-BP301T	Pharmaceutical Organic Chemistry II (Theory)	3	1	--	4
PCE-BP302T	Physical Pharmaceutics I (Theory)	3	1	--	4
PBT-BP303T	Pharmaceutical Microbiology (Theory)	3	1	--	4
PCE-BP304T	Pharmaceutical Engineering (Theory)	3	1	--	4
PCH-BP305P	Pharmaceutical Organic Chemistry II (Practical)	--	--	4	2
PCE-BP306P	Physical Pharmaceutics I (Practical)	--	--	4	2
PBT-BP307P	Pharmaceutical Microbiology (Practical)	--	--	4	2
PCE-BP308P	Pharmaceutical Engineering (Practical)	--	--	4	2
	Total	**12**	**4**	**16**	**24**

Course of study for semester III - Lateral entry students					
Course code	**Name of the course**	**No of hours/wk**			**Credit points (C)**
		Lecture (L)	**Tutorial (T)**	**Practical (P)**	
PCH-BP301T	Pharmaceutical Organic Chemistry II (Theory)	3	1	--	4
PCE-BP302T	Physical Pharmaceutics I (Theory)	3	1	--	4
PBT-BP303T	Pharmaceutical Microbiology (Theory)	3	1	--	4
PCE-BP304T	Pharmaceutical Engineering (Theory)	3	1	--	4
PRM-BP105T	Communication Skills (Theory)	2	--	--	2
PCE-BP205T	Computer Applications in Pharmacy (Theory)*	2	1	--	3
PCH-BP305P	Pharmaceutical Organic Chemistry II (Practical)	--	--	4	2
PCE-BP306P	Physical Pharmaceutics I (Practical)	--	--	4	2
PBT-BP307P	Pharmaceutical Microbiology (Practical)	--	--	4	2
PCE-BP308P	Pharmaceutical Engineering (Practical)	--	--	4	2
PRM-BP111P	Communication Skills (Practical)	--	--	2	1
PCE-BP210P	Computer Applications in Pharmacy (Practical)*	--	--	2	1
	Total	**16**	**5**	**20**	**31**

*Non University Examination (NUE). Internal assessment only.

BPharm III Semester - COs POs Mapping														
Sl. No.	**Course Code**	**Course Name**	**Credits**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
21	PCH- BP301T	Pharmaceutical Organic Chemistry II (Theory)	4	CO1 CO2 CO3	CO1 CO2 CO3	CO2 CO3			CO1 CO2 CO3					
22	PCE- BP302T	Physical Pharmaceutics I (Theory)	4	CO1 CO2 CO3	CO1 CO2 CO3	CO1 CO2 CO3								
23	PBT- BP303T	Pharmaceutical Microbiology (Theory)	4	CO1 CO2 CO3 CO4 CO5 CO6	CO1 CO2 CO3 CO4 CO5 CO6				CO1 CO2 CO3 CO4 CO5 CO6	CO1 CO2 CO3 CO4 CO5 CO6		CO1 CO2 CO3 CO4 CO5 CO6		CO1 CO2 CO3 CO4 CO5 CO6
24	PCE- BP304T	Pharmaceutical Engineering (Theory)	4	CO1 CO2 CO3	CO2 CO3 CO4 CO5				CO4 CO5		CO3 CO4 CO5	CO1 CO3		
25	PCH- BP305P	Pharmaceutical Organic Chemistry II (Practical)	2	CO1 CO2	CO1 CO2	CO1								CO2
26	PCE- BP306P	Physical Pharmaceutics I (Practical)	2	CO1 CO2	CO1 CO2	CO1 CO2			CO1 CO2		CO1 CO2			CO1 CO2
27	PBT- BP307P	Pharmaceutical Microbiology (Practical)	2	CO1 CO2 CO3 CO4	CO1 CO2 CO3 CO4				CO1 CO2 CO3 CO4	CO1 CO2 CO3 CO4	CO1 CO2 CO3 CO4	CO1 CO2 CO3 CO4	CO1 CO2 CO3 CO4	CO1 CO2 CO3 CO4
28	PCE- BP308P	Pharmaceutical Engineering (Practical)	2	CO1 CO2	CO1 CO2	CO1 CO2					CO2	CO1		

BPharm - Semester III

COURSE CODE	**PCH-BP301T**
COURSE TITLE	**PHARMACEUTICAL ORGANIC CHEMISTRY-II (Theory)**

SCOPE/SYNOPSIS	OBJECTIVES/COs
This course is designed to impart a fundamental knowledge on the general methods of preparation and reactions of some organic compounds including oils and fats, mechanism and orientation of selected types of reactions.	Upon completion of this course the student will be able to: 1. Understand the basics of aromatic chemistry. 2. Know the chemistry of oils and fats & the analytical constants. 3. Understand the chemistry and uses of polynuclear hydrocarbons and cycloalkanes.

Course content and Assessment Plan

SL No.	Course Content	Syllabus (Chapters or Units with hours)	Marks of assessment	Distribution of marks of assessment		
				Sessional exam (*30% of marks of assessment)*		End Sem exam (*70% of marks of assessment)*
				S1	S2	
1	Students will learn about the structure, properties, reactivity of benzene and its derivatives in addition to structure and uses of aromatic compounds.	Unit I (10hrs)	23	8		15
2	Students will learn about the structural features that alter the acidity phenol and aromatic acids, identification tests and uses of phenols and carboxylic acids Students will learn about the structural features that alter the basicity of aromatic amines and its derivatives, identification tests and uses of amines.	Unit II (10hrs)	23	3	4	16
3	Learn the reaction and analytical constants of oils and fats	Unit III (10hrs)	23		8	15
4	Understand the synthesis and reactions of polynuclear hydrocarbons	Unit IV (8hrs)	19	4	-	15
5	Understand the reactions of cyclopropane and cyclobutane. Understand the stability of cycloalkanes	Unit V (7hrs)	17		3	14
Total marks of assessment			105	15	15	75

PCH-BP301T: PHARMACEUTICAL ORGANIC CHEMISTRY II (Theory)

Course Content **45hrs**

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

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

UNIT I **10hrs**

- **Benzene and its derivatives**

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

B. Reactions of benzene - nitration, sulphonation, halogenation- reactivity, Friedel crafts alkylation- reactivity, limitations, Friedel crafts acylation.

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

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

UNIT II **10hrs**

- **Phenols*** - Acidity of phenols, effect of substituents on acidity, qualitative tests, Structure and uses of phenol, cresols, resorcinol, naphthol
- **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.

UNIT III **10hrs**

- **Fats and Oils**

a. Fatty acids – reactions.

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.

UNIT IV **8hrs**

- **Polynuclear hydrocarbons:**

a. Synthesis, reactions

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

UNIT V **7hrs**

- **Cycloalkanes***

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

BPharm - Semester III

PCH-BP305P: PHARMACEUTICAL ORGANIC CHEMISTRY II (Practical)

4hrs/wk

COURSE CODE	**PCH-BP305P**
COURSE TITLE	**PHARMACEUTICAL ORGANIC CHEMISTRY II (Practical)**

SCOPE/SYNOPSIS	**OBJECTIVES/COs**
Pharmaceutical Organic Chemistry II Practical course deals with the analysis of oils of interest used in the Pharmaceutical Industry, besides, it also deals with the preparation of various organic compounds, which are the key intermediates in the manufacturing of the APIs	Upon completion of this course the student should be able to: 1. Analyse oils of pharmaceutical interest 2. Prepare, purify, and characterize organic compounds

I Experiments involving laboratory techniques

- Recrystallization
- Steam distillation

II **Determination of following oil values (including standardization of reagents)**

- Acid value
- Saponification value
- Iodine value

III **Preparation of compounds**

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

- Benzoic acid/ Salicylic acid from alkyl benzoate/ alkyl salicylate by hydrolysis reaction.
- 1-Phenyl azo-2-napthol from Aniline by diazotization and coupling reactions.
- Benzil from Benzoin by oxidation reaction.
- Dibenzalacetone from Benzaldehyde by Claisen Schmidt reaction
- Cinnammic acid from Benzaldehyde by Perkin reaction
- *P*-Iodo benzoic acid from *P*-amino benzoic acid

Recommended Books (Latest Editions)

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

BPharm - Semester III

COURSE CODE	PCE-BP302T
COURSE TITLE	PHYSICAL PHARMACEUTICS I (Theory)

SCOPE/SYNOPSIS	OBJECTIVES/COs
This course deals with the various physical and physicochemical properties, and the principles' 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.	Upon completion of this course the student shall be able to: 1. Understand various physicochemical properties of drug molecules in designing the dosage forms 2. Know the principles of states of matter and their pharmaceutical applications 3. Demonstrate the use of physicochemical properties in the formulation development and evaluation of dosage forms

Course Content and Assessment Plan

Sl No.	Course Content	Syllabus (Chapters or Units with hours)	Marks of assessment	Distribution of marks of assessment		
				Sessional exam (*30% of marks of assessment)*		End Sem exam (*70% of marks of assessment)*
				S1	S2	
1	Student will know the principles, factors influencing drug solubility and there by its absorption in body.	Unit I (10hrs)	24	8		16
2	Student will learn about the different states of matter and various physicochemical properties of drug molecule.	Unit II (10hrs)	24	7		17
3	Student will learn about the surface, interfacial properties of drug molecules.	Unit III (8hrs)	20		7	13
4	Student will understand and learn about complexation principles of drug molecule and thereby enhancement of solubility, stability and distribution of drug in body.	Unit IV (8hrs)	20		8	12
5	Student will understand the importance of buffers and isotonic solutions in formulations.	Unit V (7hrs)	17		--	17
		Total marks of assessment	105	15	15	75

PCE-BP302T: PHYSICAL PHARMACEUTICS I (Theory)

Course Content **45hrs**

UNIT-I **10hrs**

Solubility of drugs: Solubility expressions, mechanisms of solute solvent interactions, ideal solubility parameters, solvation & association, quantitative approach to the factors influencing solubility of drugs, diffusion principles in biological systems. Solubility of gas in liquids, solubility of liquids in liquids, (Binary solutions, ideal solutions) Raoult's law, real solutions. Partially miscible liquids, Critical solution temperature and applications. Distribution law its limitations and applications

UNIT-II **10hrs**

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

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

UNIT-III **8hrs**

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

UNIT-IV **8hrs**

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

UNIT-V **7hrs**

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.

BPharm - Semester III

PCE-BP306P: PHYSICAL PHARMACEUTICS I (Practical)

4hrs/wk

COURSE CODE	**PCE-BP306P**
COURSE TITLE	**PHYSICAL PHARMACEUTICS I (Practical)**

SCOPE/SYNOPSIS	**OBJECTIVES/COs**
Information on the Physicochemical Properties of drugs is very essential in the development of a formulation for a drug. Hence, the course deals with different tests to be performed to assess the physicochemical properties of drugs.	Upon completion of this course the student should be able to: 1. Carryout various tests to determine the physicochemical properties of drugs 2. Understand the significance of physicochemical properties of drugs in the formulation development and evaluation

List of experiments

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

Recommended Books: (Latest Editions)

1. Physical Pharmacy by Alfred Martin
2. Experimental Pharmaceutics by Eugene, Parott.
3. Tutorial Pharmacy by Cooper and Gunn.
4. Howard C Ansel and M. J Stoklosa Pharmaceutical Calculations, Lea & Febiger, Philadelphia.
5. Physical Pharmaceutics by Ramasamy C and Manavalan R.
6. Laboratory Manual of Physical Pharmaceutics, C.V.S. Subrahmanyam, J. Thimma Setty
7. Physical Pharmaceutics by C.V.S. Subrahmanyam
8. Essentials of Physical Pharmacy by C.V.S. Subrahmanyam
9. Test book of Physical Pharmacy, by Gaurav Jain & Roop K. Khar.

BPharm - Semester III

COURSE CODE	**PBT-BP303T**
COURSE TITLE	**PHARMACEUTICAL MICROBIOLOGY (Theory)**

SCOPE/SYNOPSIS	OBJECTIVES/COs
Study of all categories of microorganisms, especially for the production of alcohol, antibiotics, Vaccines, Vitamins etc.	Upon completion of this course the student shall be able to: 1. Perform aseptic practices in microbiology laboratory along with the ability to use essential equipment in microbiological laboratories 2. Practice various methods of identification, cultivation and preservation of various microorganisms. 3. Appreciate the importance of sterilization in pharmaceutical industry, its implementation and validation. 4. To manage contamination and to use different chemicals in the control of contamination. 5. Carryout microbiological standardization and evaluation of pharmaceuticals. 6. Understand cell culture technology and its applications in pharmaceutical industries.

Course Content and Assessment Plan

SL No.	Course Content	Syllabus (Chapters or Units with hours)	Marks of assessment	Distribution of marks of assessment		
				Sessional exam (*30% of marks of assessment)*		End Sem exam (*70% of marks of assessment)*
				S1	S2	
1	Student will know the history of microbiology and learn about the scope and importance of this science in pharmacy. Student will understand the morphology and fine structure of bacteria. Will learn the aspects bacterial growth, nutrition and techniques of quantification, isolation and preservation of cultures. Student will know the different microscopic techniques and their applications.	Unit I (10hrs)	24	7		17

2	Student will learn to identify bacteria using staining techniques and biochemical methods, Understand the Principles, equipment and methods of various sterilization techniques.	Unit II (10hrs)	23	6		17
3	Student will study the morphology, classification, method of reproduction and laboratory cultivation of viruses and fungi. Student will understand about chemical control of microorganisms using antiseptics and disinfectants, learn the methods of sterility testing of pharmaceutical products.	Unit III (10hrs)	24		7	17
4	Student will understand and learn the basics of aseptic practices and to design the aseptic area, methods of preventing contamination and importance of clean rooms. Fundamentals of analytical microbiology.	Unit IV (8hrs)	18	2	3	13
5	Student will understand the microbial spoilage and its assessment along with methods of preservation of pharmaceutical products. Student will learn the basics of cell culture technology and its applications in Pharmaceutical industries.	Unit V (7hrs)	16		5	11
Total marks of assessment			105	15	15	75

PBT-BP303T: PHARMACEUTICAL MICROBIOLOGY (Theory)

Course Content **45hrs**

Unit I **10hrs**

Introduction, history of microbiology, its branches, scope and its importance.

Introduction to prokaryotes and eukaryotes.

Study of ultra-structure and morphological classification of bacteria, nutritional requirements, raw materials used for culture media and physical parameters for growth, growth curve, methods of isolation and preservation of pure cultures, cultivation of anaerobes, quantitative measurement of bacterial growth (total and viable count).

Study of different types of microscopy such as bright field, dark field, phase contrast and electron microscopy.

Unit II **10hrs**

Identification of bacteria using staining techniques: simple, Gram's and acid fast staining. Biochemical tests with emphasis on IMViC test.

Study of principle, procedure, merits, demerits and applications of physical, chemical gaseous and radiation methods. Mechanical methods of sterilization and the equipment used.

Evaluation of the efficiency of sterilization methods by sterilization indicators.

Unit III **10hrs**

Study of morphology, classification, reproduction/replication and cultivation of fungi and viruses.

Classification and mode of action of disinfectants.

Factors influencing the actions of disinfectants and antiseptics. Evaluation of bacteriostatic and bactericidal activity of disinfectants.

Sterility testing of solids, liquids, ophthalmic and other sterile products as per IP, BP and USP.

Unit IV **8hrs**

Designing of aseptic area, laminar flow equipment, study of different sources of contamination in an aseptic area and the methods of prevention. Classification of clean rooms.

Principles and methods of different microbiological assay. Methods for standardization of antibiotics, vitamins and amino acids.

Unit V **7hrs**

Types of spoilage, factors affecting the microbial spoilage of pharmaceutical products, sources and types of microbial contaminants, assessment of microbial contamination and spoilage.

Preservation of pharmaceutical products using antimicrobial agents and evaluation of microbial stability of formulations.

Growth of animal cells in culture, general procedure for culturing of cells, primary, secondary and transformed cell cultures. Application of cell cultures in pharmaceutical industry and research.

BPharm - Semester III

PBT-BP307P: PHARMACEUTICAL MICROBIOLOGY (Practical)

4hrs/wk

COURSE CODE	**PBT-BP307P**
COURSE TITLE	**PHARMACEUTICAL MICROBIOLOGY (Practical)**

SCOPE/SYNOPSIS	**OBJECTIVES/COs**
Sterility testing is an important component of the injectables. Hence, Pharmaceutical Microbiology Practical course is designed to make the students to learn the ways and means of culturing, staining and identification methods of microorganisms – tools to evaluate the sterility testing of a Pharmaceutical product.	Upon completion of this course the student should be able to: 1. Practice aseptic techniques and work in microbiology laboratory 2. Culture, stain, and identify the microorganisms 3. Perform the microbiological assays of antibiotics 4. Do sterility testing for Pharmaceutical products

List of Experiments:

1. Introduction and study of different equipment and processes such as incubator, B.O.D. incubator, aseptic hood, laminar flow hood, autoclave, hot air oven, deep freezer, refrigerator and microscopes used in experimental microbiology.
2. Sterilization of glassware, preparation and sterilization of media.
3. Sub culturing of bacteria and fungi and inoculation techniques.
4. Staining methods: simple, Gram's staining and acid fast staining.
5. Isolation of pure culture of micro-organisms by streak plate technique and other techniques.
6. Microbiological assay of antibiotics by agar diffusion and tube dilution methods.
7. Motility determination by hanging drop method.
8. Sterility testing of pharmaceuticals.
9. Bacteriological analysis of water
10. Biochemical tests.

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 and Kreig: Microbiology, Tata McGraw Hill edn.
4. Malcolm Harris, Balliere Tindall and Cox: Pharmaceutical Microbiology.
5. Rose: Industrial Microbiology, Academic Press, New York
6. Probisher, Hinsdill et al: Fundamentals of Microbiology, W. B. Saunders Company USA
7. Cooper and Gunn's: Tutorial Pharmacy, CBS Publisher and Distribution.
8. Peppler and Perlman: Microbial Technology, Academic Press
9. I.P., B.P., U.S.P. Latest editions.
10. Ananthanarayan: Text Book of Microbiology, Orient-Longman, Chennai
11. Edward: Fundamentals of Microbiology, Benjamin-Cummings Publishing Company, USA
12. N.K.Jain: Pharmaceutical Microbiology, Vallabh Prakashan, Delhi.

COURSE CODE	**PCE-BP304T**
COURSE TITLE	**PHARMACEUTICAL ENGINEERING (Theory)**

SCOPE/SYNOPSIS	OBJECTIVES/COs
This course is designed to impart a fundamental knowledge on the art and science of various unit operations used in pharmaceutical industry.	Upon completion of the course student shall be able to: 1. Know various unit operations used in Pharmaceutical industries 2. Understand the material handling techniques 3. Perform various processes involved in pharmaceutical manufacturing process 4. Appreciate and comprehend significance of plant lay out design for optimum use of resources 5. Appreciate the various preventive methods used for corrosion control in Pharmaceutical industries

Course Content and Assessment Plan

Sl No.	Course Content	Syllabus (Chapters or Units with hours)	Marks of assessment	Distribution of marks of assessment		
				Sessional exam (*30% of marks of assessment)*		End Sem exam (*70% of marks of assessment)*
				S1	S2	
1	Student will learn flow of fluids and equipment used to measure flow of fluids, understand mechanisms and mills used for size reduction, understand mechanism and equipment used for size separation	Unit I (10hrs)	24	7		17
2	Student will learn modes of heat transfer and equipment used, know evaporation, its applications and study of evaporators, learn the basic principles and methodology of distillation process	Unit II (10hrs)	24	8		16
3	Student will understand theory of drying and dryers used in pharmaceutical industries, learn the mechanisms of mixing and various blenders used in pharmaceutical manufacturing	Unit III (8hrs)	20		6	14
4	Student will learn the theories of filtration and different filters used for filtration, learn centrifugation and different types of centrifuges used in pharmaceutical industry	Unit IV (8hrs)	20		4	16

5	Student will understand the significance of pharmaceutical plant construction, corrosion and its prevention	Unit V (7hrs)	17		5	12
Total marks of assessment			105	15	15	75

PCE-BP304T: PHARMACEUTICAL ENGINEERING (Theory)

Course Content **45hrs**

UNIT-I **10hrs**

- **Flow of fluids:** Types of manometers, Reynolds number and its significance, Bernoulli's theorem and its applications, Energy losses, Orifice meter, Venturimeter, Pitot tube and Rotameter.
- **Size Reduction:** Objectives, Mechanisms & Laws governing size reduction, factors affecting size reduction, principles, construction, working, uses, merits and demerits of Hammer mill, ball mill & colloid mill.
- **Size Separation:** Objectives, applications & mechanism of size separation, official standards of powders, sieves, size separation Principles, construction, working, uses, merits and demerits of Sieve shaker, cyclone separator, Air separator and Bag filter.

UNIT-II **10hrs**

- **Heat Transfer:** Objectives, applications & Heat transfer mechanisms. Fourier's law, Heat transfer by conduction, convection & radiation. Heat interchangers & heat exchangers.
- **Evaporation:** Objectives, applications and factors influencing evaporation, differences between evaporation and other heat process. principles, construction, working, uses, merits and demerits of Steam jacketed kettle, horizontal tube evaporator, climbing film evaporator, forced circulation evaporator, multiple effect evaporator& Economy of multiple effect evaporator.
- **Distillation:** Basic Principles and methodology of simple distillation, fractional distillation, distillation under reduced pressure and steam distillation.

UNIT- III **9hrs**

- **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, spray dryer, fluidized bed dryer, vacuum dryer, freeze dryer.
- **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.

UNIT-IV **9hrs**

- **Filtration:** Objectives, applications, Theories & Factors influencing filtration, filter aids, filter medias. Principle, Construction, Working, Uses, Merits and demerits of plate & frame filter, filter leaf, rotary drum filter, Meta filter & Cartridge filter, membrane filters and Seidtz filter.
- **Centrifugation:** Objectives, principle & applications of Centrifugation, principles, construction, working, uses, merits and demerits of Perforated basket centrifuge, Non-perforated basket centrifuge, semi continuous centrifuge & super centrifuge.

UNIT- V **7hrs**

- **Materials of pharmaceutical plant construction, Corrosion and its prevention:** Factors affecting during materials selected for Pharmaceutical plant construction, Theories of corrosion, types of corrosion and there prevention. Ferrous and nonferrous metals, inorganic and organic nonmetals.

Recommended Books: (Latest Editions)

1. Pharmaceutical engineering principles and practices – C.V.S Subrahmanyam et al., Latest edition.
2. Remington practice of pharmacy- Martin, Latest edition.
3. Theory and practice of industrial pharmacy by Lachmann., Latest edition.
4. Physical pharmaceutics- C.V.S Subrahmanyam et al., Latest edition.
5. Cooper and Gunn's Tutorial pharmacy, S.J. Carter, Latest edition.

BPharm - Semester III

PCE-BP308P: PHARMACEUTICAL ENGINEERING (Practical)

4hrs/wk

COURSE CODE	**PCE-BP308P**
COURSE TITLE	**PHARMACEUTICAL ENGINEERING (Practical)**

SCOPE/SYNOPSIS	**OBJECTIVES/COs**
Manufacturing of pharmaceutical formulations involves various unit operations such as drying, size reduction, crystallization etc. These operations are interrelated and a thorough knowledge of these operations is necessary to optimize the various variables related to the equipment used in the manufacture of bulk preparations as well as formulations. Thus, the Pharmaceutical Engineering Practical is designed to make the students learn the various unit-operations and to apply the principles therein in handing of the related equipment.	Upon completion of this course the student should be able to: 1. Understand the concept and perform the calculations involved in various unit-operations 2. Have experimental knowledge with respect to various equipment used in pharmaceutical processing

List of experiments:

1. Determination of moisture content and loss on drying.
2. Description of Construction, working and application of Pharmaceutical Machinery such as rotary tablet machine, fluidized bed coater, fluid energy mill, de humidifier.
3. Size analysis by sieving – To evaluate size distribution of tablet granulations – Construction of various size frequency curves including arithmetic and logarithmic probability plots.
4. Size reduction: To verify the laws of size reduction using ball mill and evaluation.
5. Demonstration of colloid mill, planetary mixer, fluidized bed dryer, freeze dryer and such other major equipment.
6. Factors affecting Rate of Filtration and Evaporation (Surface area, Concentration and Thickness/ viscosity
7. To study the effect of time on the Rate of Crystallization.
8. To calculate the uniformity Index for given sample by using a suitable pharma Blender.

BPharm

SEMESTER IV – COURSE WORK

Course of study for semester IV					
Course code	**Name of the course**	**No of hours/wk**			**Credit points (C)**
		Lecture (L)	**Tutorial (T)**	**Practical (P)**	
PCH-BP401T	Pharmaceutical Organic Chemistry III (Theory)	3	1	--	4
PCH-BP402T	Medicinal Chemistry I (Theory)	3	1	--	4
PCE-BP403T	Physical Pharmaceutics II (Theory)	3	1	--	4
PHA-BP404T	Pharmacology I (Theory)	3	1	--	4
PCO-BP405T	Pharmacognosy and Phytochemistry I (Theory)	3	1	--	4
PCH-BP406P	Medicinal Chemistry I (Practical)	--	--	4	2
PCE-BP407P	Physical Pharmaceutics II (Practical)	--	--	4	2
PHA-BP408P	Pharmacology I (Practical)	--	--	4	2
PCO-BP409P	Pharmacognosy and Phytochemistry I (Practical)	--	--	4	2
	Total	**15**	**5**	**16**	**28**

BPharm IV Semester - COs POs Mapping														
Sl No.	**Course Code**	**Course Name**	**Credits**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
29	PCH- BP401T	Pharmaceutical Organic Chemistry III (Theory)	4	CO1 CO2 CO3	CO1 CO2 CO3	CO2			CO1 CO3					CO3
30	PCH- BP402T	Medicinal Chemistry I (Theory)	4	CO1 CO2 CO3	CO1 CO2 CO3				CO3					CO2 CO3
31	PCE- BP403T	Physical Pharmaceutics II (Theory)	4	CO1 CO2 CO3	CO1 CO2 CO3	CO1 CO2 CO3					CO1 CO2 CO3	CO1 CO2 CO3		CO1 CO2 CO3
32	PHA- BP404T	Pharmacology I (Theory)	4	CO1 CO2	CO1 CO2 CO3 CO4	CO3 CO4		CO3 CO4	CO3 CO4		CO1 CO2 CO3 CO4			
33	PCO- BP405T	Pharmacognosy and Phytochemistry I (Theory)	4	CO1 CO2	CO3 CO4									
34	PCH- BP406P	Medicinal Chemistry I (Practical)	2	CO1 CO2 CO3	CO2 CO3	CO1			CO3					CO2 CO3
35	PCE- BP407P	Physical Pharmaceutics II (Practical)	2	CO1 CO2	CO1 CO2	CO1 CO2								
36	PHA- BP408P	Pharmacology I (Practical)	2	CO1 CO2	CO2 CO3	CO2	CO3	CO1 CO2 CO3	CO1 CO2 CO3	CO1 CO2 CO3	CO1 CO2 CO3	CO1 CO2 CO3		CO1 CO2 CO3
37	PCO- BP409P	Pharmacognosy and Phytochemistry I (Practical)	2	CO1 CO2 CO3	CO1 CO2 CO3									CO1 CO2 CO3

BPharm - Semester IV

COURSE CODE	**PCH-BP401T**
COURSE TITLE	**PHARMACEUTICAL ORGANIC CHEMISTRY-III (Theory)**

SCOPE/SYNOPSIS	OBJECTIVES/COs
This course is designed to impart a 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.	Upon completion of this course the student shall be able to: 1. Understand the basics of stereochemistry and their nomenclature. 2. Understand the nomenclature and chemistry of heterocyclic compounds. 3. Synthetic strategy, reactions and medicinal applications of heterocyclic compounds. 4. Know the reaction mechanism of some named reactions.

Course Content and Assessment Plan

SL No.	Course Content	Syllabus (Chapters or Units with hours)	Marks of assessment	Distribution of marks of assessment		
				Sessional exam (*30% of marks of assessment)*		End Sem exam (*70% of marks of assessment)*
				S1	S2	
1	Student will understand the concepts of optical isomerism including racemic modification and asymmetric synthesis.	Unit I (10hrs)	23	8		15
2	Student will understand the concepts of geometrical isomerism.	Unit II (10hrs)	23		8	15
3	Student will understand the nomenclature, classification, synthesis, reactions, and medicinal uses of heterocyclic compounds and their derivatives	Unit III (10hrs)	23	4	4	15
4	Student will understand the nomenclature, classification, synthesis, reactions, and medicinal uses of heterocyclic compounds and their derivatives	Unit IV (8hrs)	19	3	-	16
5	Student will understand the reactions of synthetic importance	Unit V (7hrs)	17		3	14
		Total marks of assessment	105	15	15	75

PCH-BP401T: PHARMACEUTICAL ORGANIC CHEMISTRY III (Theory)

Course Content **45hrs**

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

UNIT-I **10hrs**

Stereo isomerism

Optical isomerism – Optical activity, enantiomerism, diastereoisomerism, meso compounds

Elements of symmetry, chiral and achiral molecules

DL system of nomenclature of optical isomers, sequence rules, RS system of nomenclature of optical isomers. Reactions of chiral molecules

Racemic modification and resolution of racemic mixture.

Asymmetric synthesis: partial and absolute

UNIT-II **10hrs**

Geometrical isomerism

Nomenclature of geometrical isomers (Cis Trans, EZ, Syn Anti systems)

Methods of determination of configuration of geometrical isomers.

Conformational isomerism in Ethane, n-Butane and Cyclohexane.

Stereo isomerism in biphenyl compounds (Atropisomerism) and conditions for optical activity.

Stereospecific and stereoselective reactions

UNIT-III **10hrs**

Heterocyclic compounds:

Nomenclature and classification

Synthesis, reactions and medicinal uses of following compounds/derivatives

Pyrrole, Furan, and Thiophene

Relative aromaticity and reactivity of Pyrrole, Furan and Thiophene

UNIT-IV **8hrs**

Synthesis, reactions and medicinal uses of following compounds/derivatives

Pyrazole, Imidazole, Oxazole and Thiazole.

Pyridine, Quinoline, Isoquinoline, Acridine and Indole. Basicity of pyridine

Synthesis and medicinal uses of Pyrimidine, Purine, azepines and their derivatives

UNIT-V **7hrs**

Reactions of synthetic importance

Metal hydride reduction ($NaBH_4$ and LiAlH4), Clemmensen reduction, Birch reduction, Wolff Kishner reduction.

Oppenauer-oxidation and Dakin reaction.

Beckmann rearrangement and Schmidt rearrangement.

Claisen-Schmidt condensation

Recommended Books (Latest Editions)

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

BPharm - Semester IV

COURSE CODE	**PCH-BP402T**
COURSE TITLE	**MEDICINAL CHEMISTRY I (Theory)**

SCOPE/SYNOPSIS	OBJECTIVES/COs
This course is designed to impart a fundamental knowledge on the structure, chemistry and therapeutic value of drugs. The course emphasize on SAR of drugs, importance of physicochemical properties and metabolism of drugs including chemical synthesis of important drugs under each class	Upon completion of this course the student shall be able to: 1. Understand the chemistry of drugs with respect to their pharmacological activity 2. Know the SAR of different class of drugs 3. Study the chemical synthesis of selected drugs

Course Content and Assessment Plan

SL No.	Course Content	Syllabus (Chapters or Units with hours)	Marks of assessment	Distribution of marks of assessment		
				Sessional exam (*30% of marks of assessment)*		End Sem exam (*70% of marks of assessment)*
				S1	S2	
1	Student will understand the physiochemical properties of drugs in relation to their biological action, drug metabolism.	Unit I (5hrs)	11	3		08
2	Student will understand the chemistry, pharmacological activity, metabolic pathways, adverse effects, SAR and chemical synthesis of selected drugs acting as adrenergic agents	Unit II (10hrs)	24	4	4	16
3	Student will understand the chemistry, pharmacological activity, metabolic pathways, adverse effects, SAR and chemical synthesis of selected drugs acting as cholinergic agents	Unit III (10hrs)	24	8		16
4	Student will understand the chemistry, pharmacological activity, metabolic pathways, adverse effects, SAR and chemical synthesis of selected drugs acting on CNS: Sedatives and Hypnotics, antipsychotics and anticonvulsants	Unit IV (11hrs)	24		6	18

5	Student will understand the chemistry, pharmacological activity, metabolic pathways, adverse effects, SAR and chemical synthesis of selected drugs acting on CNS: General anesthetics, narcotic and non-narcotic analgesics	Unit V (9hrs)	22		5	17
Total marks of assessment			105	15	15	75

PCH-BP402T: MEDICINAL CHEMISTRY I (Theory)

Course Content **45hrs**

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

UNIT- I **6hrs**

Introduction to Medicinal Chemistry

History and development of medicinal chemistry

Physicochemical properties in relation to biological action

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

Drug metabolism

Drug metabolism principles- Phase I and Phase II.

Factors affecting drug metabolism including stereo chemical aspects.

UNIT- II **10hrs**

Drugs acting on Autonomic Nervous System

Adrenergic Neurotransmitters:

Biosynthesis and catabolism of catecholamine.

Adrenergic receptors (Alpha & Beta) and their distribution.

Sympathomimetic agents: SAR of Sympathomimetic agents

Direct acting: Nor-epinephrine, Epinephrine, Phenylephrine*, Dopamine,

Methyldopa, Clonidine, Dobutamine, Isoproterenol, Terbutaline, Salbutamol*, Bitolterol, Naphazoline, Oxymetazoline and Xylometazoline.

- Indirect acting agents: Hydroxyamphetamine, Pseudoephedrine, Propylhexedrine.
- Agents with mixed mechanism: Ephedrine, Metaraminol.

Adrenergic Antagonists:

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

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

UNIT-III **10hrs**

Cholinergic neurotransmitters:

Biosynthesis and catabolism of acetylcholine.

Cholinergic receptors (Muscarinic & Nicotinic) and their distribution.

Parasympathomimetic agents: SAR of Parasympathomimetic agents

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

Indirect acting/ Cholinesterase inhibitors (Reversible & Irreversible):

Physostigmine, Neostigmine*, Pyridostigmine, Edrophonium chloride, Tacrine hydrochloride, Ambenonium chloride, Isofluorphate, Echothiophate iodide, Parathione, Malathion.

Cholinesterase reactivator: Pralidoxime chloride.

Cholinergic Blocking agents: SAR of cholinolytic agents

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

Synthetic cholinergic blocking agents: Tropicamide, Cyclopentolate hydrochloride, Clidinium bromide, Dicyclomine hydrochloride*, Glycopyrrolate, Methantheline bromide, Propantheline bromide,

Benztropine mesylate, Orphenadrine citrate, Biperidine hydrochloride, Procyclidine hydrochloride*, Tridihexethyl chloride, Isopropamide iodide, Ethopropazine hydrochloride.

UNIT- IV **11hrs**

Drugs acting on Central Nervous System

A. Sedatives and Hypnotics:

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

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

Miscelleneous:

Amides & imides: Glutethimide.

Alcohol & their carbamate derivatives: Meprobamate, Ethchlorvynol.

Aldehyde & their derivatives: Triclofos sodium, Paraldehyde.

B. Antipsychotics

Phenothiazines: SAR of Phenothiazines - Promazine hydrochloride, Chlorpromazine hydrochloride*, Triflupromazine, Thioridazine hydrochloride, Piperacetazine hydrochloride, Prochlorperazine maleate, Trifluoperazine hydrochloride.

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

Fluoro buterophenones: Haloperidol, Droperidol, Risperidone.

Beta amino ketones: Molindone hydrochloride.

Benzamides: Sulpiride.

C. Anticonvulsants: SAR of Anticonvulsants**,** mechanism of anticonvulsant action

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

Benzodiazepines: Clonazepam

Miscellaneous: Primidone, Valproic acid, Gabapentin, Felbamate

UNIT – V **8hrs**

Drugs acting on Central Nervous System

General anesthetics:

Inhalation anesthetics: Halothane*, Methoxyflurane, Enflurane,

Sevoflurane, Isoflurane, Desflurane.

Ultra-short acting barbitutrates: Methohexital sodium*, Thiamylal sodium, Thiopental sodium.

Dissociative anesthetics: Ketamine hydrochloride.*

Narcotic and non-narcotic analgesics

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

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

Anti-inflammatory agents: Sodium salicylate, Aspirin, Mefenamic acid*,

Meclofenamate, Indomethacin, Sulindac, Tolmetin, Zomepriac, Diclofenac, Ketorolac, Ibuprofen*, Naproxen, Piroxicam, Phenacetin, Acetaminophen, Antipyrine, Phenylbutazone.

BPharm - Semester IV

PCH-BP406P: MEDICINAL CHEMISTRY I (Practical)

4hrs/wk

COURSE CODE	**PCH-BP406P**
COURSE TITLE	**MEDICINAL CHEMISTRY I (Practical)**

SCOPE/SYNOPSIS	**OBJECTIVES/COs**
Medicinal Chemistry Practical course deals with synthesis of various heterocyclic compounds/ intermediates/ drugs by various chemical reactions and analysis of various drugs or pharmaceuticals for quality control. Besides, it also deals with the determination of partition coefficient of medicinally important compounds	Upon completion of this course the student should be able to: 1. Synthesize, purify and characterize heterocyclic compounds/drugs 2. Analyse drugs/pharmaceuticals as per pharmacopoeial procedure for quality control 3. Determine partition coefficient of the compounds/drugs and evaluate its hydrophobicity

List of Experiments:

I Preparation of drugs/ intermediates

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

II Assay of drugs

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

III Determination of Partition coefficient for any two drugs

Recommended Books (Latest Editions)

1 Wilson and Gisvold's Organic medicinal and Pharmaceutical Chemistry.

2 Foye's Principles of Medicinal Chemistry.

3 Burger's Medicinal Chemistry, Vol I to IV.

4 Introduction to principles of drug design- Smith and Williams.

5 Remington's Pharmaceutical Sciences.

6 Martindale's extra pharmacopoeia.

7. Organic Chemistry by I.L. Finar, Vol. II.

8. The Organic Chemistry of Drug Synthesis by Lednicer, Vol. 1-5.

9. Indian Pharmacopoeia.

10. Text book of practical organic chemistry- A.I.Vogel.

COURSE CODE	**PCE-BP403T**
COURSE TITLE	**PHYSICAL PHARMACEUTICS-II (Theory)**

SCOPE/SYNOPSIS	OBJECTIVES/COs
The course deals with the various physical and physicochemical properties, and the principles' 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.	Upon completion of the course student shall be able to : 1. Understand various characteristics and physicochemical properties of colloidal dispersions. 2. Understand the flow properties of the liquid preparations and mechanisms involved in deformation of solids 3. Know the principles and characteristics in the formulation of coarse dispersions. 4. Understand the concepts of micromeritics and study of properties of particles and powders. 5. Know the principles of chemical kinetics & to use them for stability testing and determination of expiry date of formulations

Course Content and Assessment Plan

SL No.	Course Content	Syllabus (Chapters or Units with hours)	Marks of assessment	Distribution of marks of assessment		
				Sessional exam (*30% of marks of assessment)*		End Sem exam (*70% of marks of assessment)*
				S1	S2	
1	Student will be able to understand the difference between different types of colloidal systems and their characterizations. Learners will also be able to learn the different properties of colloids and their applications.	Unit I (7hrs)	16	4		12
2	Student will be able to understand the nature and quality of raw materials and finished product. This will also help to understand the fundamental nature of system and their applications in manufacturing processes.	Unit II (10hrs)	22	4	3	15
3	Student will be able to understand the differences between different types of coarse dispersion systems. Learners will also be able to the characterizations, applications and stabilizations of coarse dispersions.	Unit III (10hrs)	22		6	16
4	It will help learners to understand the effect of physicochemical properties of powders on formulation of dosage	Unit IV (10hrs)	23	7		16

	forms and to understand their fate in the body. It will also help in understanding the quality of raw materials, and their applications with respect to therapeutic activity, stability of formulation and dose uniformity in formulations.					
5	Student will be able to understand the different process and pathways of drug degradation, quality of formulation safety and efficacy of formulation.	Unit V (10hrs)	22		6	16
Total marks of assessment			105	15	15	75

PCE-BP403T: PHYSICAL PHARMACEUTICS II (Theory)

Course Content **45hrs**

UNIT-I **7hrs**

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

UNIT-II **10hrs**

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

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

UNIT-III **10hrs**

Coarse dispersion: Suspension, interfacial properties of suspended 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.

UNIT-IV **10hrs**

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

UNIT-V **10hrs**

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

BPharm - Semester IV

PCE-BP407P: PHYSICAL PHARMACEUTICS II (Practical)

4hrs/wk

COURSE CODE	PCE-BP407P
COURSE TITLE	PHYSICAL PHARMACEUTICS II (Practical)

SCOPE/SYNOPSIS	OBJECTIVES/COs
Information on the physicochemical properties and chemical kinetics of drugs is very essential in the development of a formulation for a drug and in the assessment of stability of the formulation. Hence, this course deals with different tests to be performed to assess the physicochemical properties and chemical kinetics of drugs.	Upon completion of this course the student should be able to: 1. Carryout various tests to determine the physicochemical properties of drugs 2. Conduct tests to understand the chemical kinetics of the drug to assess stability

List of Experiments:

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

Recommended Books: (Latest Editions)

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

BPharm - Semester IV

COURSE CODE	**PHA-BP404T**
COURSE TITLE	**PHARMACOLOGY-I (Theory)**

SCOPE/SYNOPSIS	OBJECTIVES/COs
The main purpose of the subject is to understand what drugs do to the living organisms and how they are explored in therapeutics. The subject covers the information about the drugs such as mechanism of action, physiological and biochemical effects (pharmacodynamics) as well as absorption, distribution, metabolism and excretion (pharmacokinetics) along with the adverse effects, clinical uses, interactions, doses, contraindications and routes of administration of different classes of drugs.	Upon completion of the course, the student shall be able to: 1. Understand the pharmacological actions of different categories of drugs 2. Explain the mechanisms of drug action at the organ system/subcellular/ macromolecular levels 3. Apply the basic pharmacological knowledge in the prevention and treatment of various diseases 4. Appreciate correlation of pharmacology with other biomedical sciences

Course Content and Assessment Plan

SL No.	Course Content	Syllabus (Chapters or Units with hours)	Marks of assessment	Distribution of marks of assessment		
				Sessional exam (*30% of marks of assessment)*		End Sem exam (*70% of marks of assessment)*
				S1	S2	
1	Student will be aware of historical perspectives in evolution of pharmacology as well as sources of drugs, route of administration and understand what body does to the drugs (Pharmacokinetics)	Unit I (6hrs)	19	7		12
2	Student will acquire knowledge on what drug does to the body (pharmacodynamics) at the system level and cellular level (mechanism of action of drugs). Student will also learn the consequences after drug administration, such as adverse drug reactions and drug interactions. Student will also learn how drugs are discovered and developed during preclinical and clinical trials.	Unit II (14hrs)	32	8		24
3	Student will be thorough with the drugs acting on the peripheral nervous systems such as parasympathetic drugs, Parasympatholytics, Sympathomimetics, sympatholytics, drugs used in myasthenia gravis, glaucoma, skeletal muscle relaxants and local anaesthetic agents.	Unit III (10hrs)	22		6	16

4	Student will learn about the drugs acting on the central nervous systems such as general anaesthetics and pre-anaesthetic medication. Also, understand the pharmacology of alcohol sedatives-hypnotics and anti-epileptics	Unit IV (8hrs)	19		5	14
5	Student will learn about antipsychotics, antidepressants, antianxiety agents, anti-manic and hallucinogenic drugs. Also learn about drugs used in neurodegenerative diseases such as anti-Parkinson's disease and anti-Alzheimer's drugs. Comprehend CNS-stimulants, nootropics, opioid pain killers, drug addiction, drug abuse, tolerance and dependence.	Unit V (7Hr)	13		4	9
Total marks of assessment			105	15	15	75

PHA-BP404T: PHARMACOLOGY I (Theory)

Course Content **45hrs**

UNIT-I **6hrs**

1. General Pharmacology

a) Introduction to Pharmacology- Definition, historical landmarks and scope of pharmacology, nature and source of drugs, essential drugs concept and routes of drug administration.

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

UNIT-II **14hrs**

2. General Pharmacology

a) Pharmacodynamics- Principles and mechanisms of drug action. Receptor theories and classification of receptors, drug receptors interactions- agonists, antagonists (competitive and non-competitive), regulation of receptors, 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, spare receptors

b) Dose response relationship and therapeutic index.

c) Factors modifying drug action: Pharmaceutical, drug related and patient related factors.

d) Adverse drug reactions.

e) Drug interactions (pharmacokinetic and pharmacodynamic)

f) Drug discovery and Development processes: preclinical and clinical evaluation.

UNIT-III **10hrs**

3. Pharmacology of drugs acting on peripheral nervous system

a. Organization and function of ANS.

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

c. Parasympathetic drugs, Parasympatholytics, Sympathomimetics and sympatholytics.

d. Drugs used in myasthenia gravis and glaucoma

e. Skeletal muscle relaxants.

f. Local anesthetic agents.

UNIT-IV **8hrs**

4. Pharmacology of drugs acting on central nervous system

a) Neuro-humoral transmission in CNS with special emphasis on importance of various neurotransmitters like GABA, Glutamate, Glycine, serotonin, dopamine.

b) General anesthetics and pre-anesthetic medication

c) Alcohols and disulfiram

d) Sedatives and hypnotics

e) Anti-epileptics

UNIT-V **7hrs**

5. Pharmacology of drugs acting on central nervous system

a. Psychopharmacological agents: Antipsychotics, antidepressants, antianxiety agents, antimaniac drugs and hallucinogens.

b. Drugs used in Parkinson's disease and Alzheimer's disease.

c. CNS stimulants and nootropics.

d. Opioid analgesics and antagonists

e. Drug addiction, drug abuse, tolerance and dependence.

BPharm - Semester IV

PHA-BP408P: PHARMACOLOGY I (Practical)

4hrs/wk

COURSE CODE	PHA-BP408P
COURSE TITLE	PHARMACOLOGY I (Practical)

SCOPE/SYNOPSIS	OBJECTIVES/COs
The practical experiments are complimentary to the topics discussed in theory. Here students get to observe the effect of drugs on various in-vitro and in-vivo systems. These experiments also help the students to learn the principles of screening methods in drug development. The students will also learn to use computer assisted learning techniques as alternatives to animal experimentation.	Upon completion of this course the student should be able to: 1. Understand the ethical considerations governing animal experimentation and learn the best practices for safe handling of animals 2. Learn about the general instruments, handling and dosing of animals, and techniques employed in the preclinical experiments 3. Employ computer assisted learning and simulated experiments as alternatives to animal experimentation for studying drug effects

List of Experiments:

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

13) Study of stereotype and anti-catatonic activity of drugs on rats/mice.

14) Study of anxiolytic activity of drugs using rats/mice.

15) Study of local anesthetics by different methods

Note: All laboratory techniques and animal experiments are demonstrated by simulated experiments software 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 M N. Fundamentals of Experimental Pharmacology. Hilton & Company, Kolkata.
10. Kulkarni SK. Handbook of experimental pharmacology. Vallabh Prakashan, New Delhi.

BPharm - Semester IV

COURSE CODE	**PCO-BP405T**
COURSE TITLE	**PHARMACOGNOSY AND PHYTOCHEMISTRY I (Theory)**

SCOPE/SYNOPSIS	OBJECTIVES/COs
The subject involves the fundamentals of Pharmacognosy like scope, classification of crude drugs, their identification and evaluation, phytochemicals present in them and their medicinal properties.	Upon completion of the course, the student sall be able to: 1. Know the techniques in the cultivation and production of crude drugs 2. Know the crude drugs, their uses and chemical nature 3. Know the evaluation techniques for the herbal drugs 4. Carry out the microscopic and morphological evaluation of crude drugs

Course Content and Assessment Plan

SL No	Course Content	Syllabus (Chapters or Units with hours)	Marks of assessment	Distribution of marks of assessment		
				Sessional exam (*30% of marks of assessment)*		End Sem exam (*70% of marks of assessment)*
				S1	**S2**	
1	Student will gain knowledge about various scope of Pharmacognosy, crude drugs and its quality control methods.	Unit I (10hrs)	24	8		16
2	Student will gain knowledge about various techniques in the cultivation and production of crude drugs	Unit II (10hrs)	24		8	16
3	Student will learn the importance of plant tissue culture in agriculture and pharmaceutical field	Unit III (7hrs)	19		7	12
4	Student will gain information about various systems of medicine and knowledge of secondary metabolites and its importance in pharmacy	Unit IV (10hrs)	23	7		16
5	Student will gain knowledge of primary metabolite like carbohydrates, proteins and lipids. Novel medicinal agents from marine sources	Unit V (8hrs)	15		--	15
Total marks of assessment			105	15	15	75

PCO-BP405T: PHARMACOGNOSY AND PHYTOCHEMISTRY I (Theory)

Course content **45hrs**

UNIT-I **10hrs**

Introduction to Pharmacognosy:

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

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

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

Classification of drugs:

Alphabetical, morphological, taxonomical, chemical, pharmacological, chemo taxonomical classification of drugs.

Quality control of Drugs of Natural Origin:

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

Quantitative microscopy of crude drugs including lycopodium spore method, leaf constants, microscopical linear measurements using camera lucida.

UNIT-II **10hrs**

Cultivation, Collection, Processing and storage of drugs of natural origin: Cultivation and Collection of drugs of natural origin. Factors influencing cultivation of medicinal plants.

Plant hormones and their applications.

Polyploidy, mutation and hybridization with reference to medicinal plants.

Conservation of medicinal plants

UNIT-III **7hrs**

Plant tissue culture:

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

Applications of plant tissue culture in pharmacognosy.

Edible vaccines.

UNIT IV **10hrs**

Pharmacognosy in various systems of medicine:

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

Introduction to secondary metabolites:

Definition, classification, properties and test for identification of Alkaloids, Glycosides,

Flavonoids, Tannins, Volatile oil and Resins.

UNIT V **8hrs**

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

Plant Products:

Fibers - Cotton, Jute, Hemp

Hallucinogens, Teratogens and Natural allergens

Primary metabolites:

General introduction, detailed study with respect to chemistry, sources, preparation, evaluation, preservation, storage, 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, Serratiopeptidase, Urokinase, Streptokinase, Pepsin).

Lipids (Waxes, Fats, Fixed oils): Castor oil, Chaulmoogra oil, Wool Fat and Bees Wax

Marine Drugs: Novel medicinal agents from marine sources.

BPharm - Semester IV

PCO-BP409P: PHARMACOGNOSY AND PHYTOCHEMISTRY I (Practical)

4hrs/wk

COURSE CODE	**PCO-BP409P**
COURSE TITLE	**PHARMACOGNOSY AND PHYTOCHEMISTRY I (Practical)**

SCOPE/SYNOPSIS	**OBJECTIVES/COs**
The subject involves the fundamentals of Pharmacognosy like crude drugs, their identification and evaluation, phytochemicals present in them and their medicinal properties.	Upon completion of this course the student should be able to: 1. Gain knowledge of identification of unorganized drugs 2. Learn to perform various quantitative microscopical studies 3. Gain knowledge on quality control parameter for herbal drugs

List of Experiments

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

Recommended Books: (Latest Editions)

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

BPharm

SEMESTER V : COURSE WORK

Course of study for semester V					
Course code	**Name of the course**	**No of hours/wk**			**Credit points (C)**
		Lecture (L)	**Tutorial (T)**	**Practical (P)**	
PCH-BP501T	Medicinal Chemistry II (Theory)	3	1	--	4
PCE-BP502T	Industrial Pharmacy I (Theory)	3	1	--	4
PHA-BP503T	Pharmacology II (Theory)	3	1	--	4
PCO-BP504T	Pharmacognosy and Phytochemistry II (Theory)	3	1	--	4
PRM-BP505T	Pharmaceutical Jurisprudence (Theory)	3	1	--	4
PCE-BP506P	Industrial Pharmacy I (Practical)	--	--	4	2
PHA-BP507P	Pharmacology II (Practical)	--	--	4	2
PCO-BP508P	Pharmacognosy and Phytochemistry II (Practical)	--	--	4	2
	Total	**15**	**5**	**12**	**26**

BPharm V Semester - COs POs Mapping														
Sl No.	**Course Code**	**Course Name**	**Credits**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
38	PCH- BP501T	Medicinal Chemistry II (Theory)	4	CO1 CO2 CO3	CO1 CO2 CO3				CO3					CO2 CO3
39	PCE- BP502T	Industrial Pharmacy I (Theory)	4	CO1 CO2 CO3	CO1 CO2 CO3	CO3								
40	PHA- BP503T	Pharmacology II (Theory)	4		CO1 CO2	CO1	CO1 CO2	CO1 CO2	CO1 CO2	CO1 CO2	CO1 CO2	CO1 CO2		CO1 CO2
41	PCO- BP504T	Pharmacognosy and Phytochemistry II (Theory)	4	CO1 CO2 CO3		CO1 CO2 CO3	CO2 CO3	CO1						CO1 CO2 CO3
42	PRM- BP505T	Pharmaceutical Jurisprudence (Theory)	4	CO1	CO1 CO2		CO4	CO1 CO2 CO3 CO4	CO2	CO2				
43	PCE- BP506P	Industrial Pharmacy I (Practical)	2	CO1 CO2 CO3	CO1 CO2 CO3	CO1	CO1				CO1 CO2 CO3			
44	PHA- BP507P	Pharmacology II (Practical)	2	CO1	CO1 CO2 CO3	CO1 CO2 CO3	CO1 CO2	CO1 CO2 CO3	CO1 CO2 CO3	CO1 CO3	CO1 CO2 CO3	CO1 CO2 CO3		CO1 CO2 CO3
45	PCO- BP508P	Pharmacognosy and Phytochemistry II (Practical)	2	CO1 CO2 CO3	CO1 CO2 CO3									

BPharm - Semester V

COURSE CODE	**PCH-BP501T**
COURSE TITLE	**MEDICINAL CHEMISTRY II (Theory)**

SCOPE/SYNOPSIS	OBJECTIVES/COs
This course is designed to impart a fundamental knowledge on the structure, chemistry and therapeutic value of drugs. The course emphasize on SAR of drugs, importance of physicochemical properties and metabolism of drugs including chemical synthesis of important drugs under each class	Upon completion of this course the student shall be able to: 1. Understand the chemistry of drugs with respect to their pharmacological activity 2. Know the SAR of different class of drugs 3. Study the chemical synthesis of selected drugs

Course Content and Assessment Plan

SL No.	Course Content	Syllabus (Chapters or Units with hours)	Marks of assessment	Distribution of marks of assessment		
				Sessional exam (*30% of marks of assessment)*		End Sem exam (*70% of marks of assessment)*
				S1	S2	
1	Student will understand the chemistry, pharmacological activity, metabolic pathways, adverse effects, SAR and chemical synthesis of selected drugs used as antihistaminic agents and antineoplastic agents	Unit I (10hrs)	23	7		16
2	Student will understand the chemistry, pharmacological activity, metabolic pathways, adverse effects, SAR and chemical synthesis of selected drugs used as antianginal, diuretics and antihypertensive agents	Unit II (10hrs)	23	8		15
3	Student will understand the chemistry, pharmacological activity, metabolic pathways, adverse effects, SAR and chemical synthesis of selected drugs used as antiarrhythmic drugs, antihyperlipidemic agents, coagulants and anticoagulants and	Unit III (10hrs)	23		7	16

	drugs used for congestive cardiac failure					
4	Student will understand the chemistry, pharmacological activity, metabolic pathways, adverse effects, SAR and chemical synthesis of selected drugs acting on endocrine system	Unit IV (8hrs)	17		2	15
5	Student will understand the chemistry, pharmacological activity, metabolic pathways, adverse effects, SAR and chemical synthesis of selected drugs used as antidiabetic agents and local anesthetics	Unit V (7hrs)	19		6	13
Total marks of assessment			105	15	15	75

PCH-BP501T: MEDICINAL CHEMISTRY II (Theory)

Course Content **45hrs**

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

UNIT- I **10hrs**

Antihistaminic agents: Histamine, receptors and their distribution in the human body

H_1–antagonists: Diphenhydramine hydrochloride*, Dimenhydrinate,

Doxylamines cuccinate, Clemastine fumarate, Diphenylphyraline hydrochloride, Tripelenanmine hydrochloride, Chlorcyclizine hydrochloride, Meclizine hydrochloride, Buclizine hydrochloride, Chlorpheniramine maleate, Triprolidine hydrochloride*, Phenindamine tartrate, Promethazine hydrochloride*, Trimeprazine tartrate, Cyproheptadine hydrochloride, Azatidine maleate, Astemizole, Loratadine, Cetirizine, Levocetirizine, Cromolyn sodium

H_2-antagonists: Cimetidine*, Famotidine, Ranitidine.

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

Anti-neoplastic agents:

Alkylating agents: Meclorethamine*, Cyclophosphamide, Melphalan, Chlorambucil, Busulfan, Thiotepa.

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

Antibiotics: Dactinomycin, Daunorubicin, Doxorubicin, Bleomycin

Plant products: Etoposide, Vinblastine sulphate, Vincristine sulphate

Miscellaneous: Cisplatin, Mitotane.

UNIT – II **10hrs**

Anti-anginal:

Vasodilators: Amyl nitrite, Nitroglycerin*, Pentaerythritol tetranitrate, Isosorbide dinitrate*, Dipyridamole.

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

Diuretics:

Carbonic anhydrase inhibitors: Acetazolamide*, Methazolamide, Dichlorphenamide.

Thiazides: Chlorthiazide*, Hydrochlorothiazide, Hydroflumethiazide, Cyclothiazide,

Loop diuretics: Furosemide*, Bumetanide, Ethacrynic acid.

Potassium sparing Diuretics: Spironolactone, Triamterene, Amiloride.

Osmotic Diuretics: Mannitol

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

UNIT- III **10hrs**

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

Anti-hyperlipidemic agents: Clofibrate, Lovastatin, Cholestyramine and Cholestipol

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

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

UNIT- IV **7hrs**

Drugs acting on Endocrine system

Nomenclature, Stereochemistry and metabolism of steroids

Sex hormones: Testosterone, Nandrolone, Progesterone, Oestriol, Estradiol, Oestrione, Diethyl stilbestrol.

Drugs for erectile dysfunction: Sildenafil, Tadalafil.

Oral contraceptives: Mifepristone, Norgestril, Levonorgestrol

Corticosteroids: Cortisone, Hydrocortisone, Prednisolone, Betamethasone, Dexamethasone

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

UNIT – V **8hrs**

Antidiabetic agents:

Insulin and its preparations

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

Biguanides: Metformin.

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*, Betacaine, Propoxycaine, Tetracaine, Benoxinate.

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

Miscellaneous: Phenacaine, Diperodon, Dibucaine.*

Recommended Books (Latest Editions)

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

COURSE CODE	**PCE-BP502T**
COURSE TITLE	**INDUSTRIAL PHARMACY I (Theory)**

SCOPE/SYNOPSIS	OBJECTIVES/COs
Course enables the student to understand and appreciate the influence of pharmaceutical additives and various pharmaceutical dosage forms on the performance of the drug product.	Upon completion of this course the student shall be able to: 1. Understand the importance of physicochemical properties and drug-excipient studies in pre-formulation of dosage forms 2. Know the various pharmaceutical dosage forms and their manufacturing techniques 3. Know the quality control tests for evaluation of various pharmaceutical dosage forms 4. Know various considerations in development of parenteral and ophthalmic preparations. 5. Know various cosmetic preparations, pharmaceutical aerosols and packaging materials science.

Course Content and Assessment Plan

SL No.	Course Content	Syllabus (Chapters or Units with hours)	Marks of assessment	Distribution of marks of assessment		
				Sessional exam (*30% of marks of assessment)*		End Sem exam (*70% of marks of assessment)*
				S1	S2	
1	Student will understand the importance of physicochemical properties, drug-excipient studies prior to formulation of dosage forms	Unit I (7hrs)	16	6		10
2	Student will gain knowledge about tablet & liquid oral dosage forms, various types of tablets, formulation and Quality Control testing.	Unit II (10hrs)	23	7		16
3	Student will gain knowledge about capsules and pellet dosage forms, formulation aspects, process, equipment, packing and Quality Control tests.	Unit III (8hrs)	20	2	5	13
4	Student will understand and learn the importance of aseptic techniques, formulation and Quality Control tests in manufacturing of parenteral and ophthalmic preparations.	Unit IV (10hrs)	23		7	16
5	Student will gain knowledge on cosmetic preparations, pharmaceutical aerosols and packaging materials science.	Unit V (10hrs)	23		3	20
		Total marks of assessment	105	15	15	75

PCE-BP502T: INDUSTRIAL PHARMACY I (Theory)

Course Content **45hrs**

UNIT-I **7hrs**

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

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

b. ***Chemical Properties:*** Hydrolysis, oxidation, reduction, racemisation, polymerization BCS classification of drugs & its significance

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

UNIT-II **10hrs**

Tablets:

a. Introduction, ideal characteristics of tablets, classification of tablets. Excipients, Formulation of tablets, granulation methods, compression and processing problems. Equipment and tablet tooling.

b. Tablet coating: Types of coating, coating materials, formulation of coating composition, methods of coating, equipment employed and defects in coating.

c. Quality control tests: In process and finished product tests

Liquid orals: Filling and packaging

UNIT-III **8hrs**

Capsules:

a. ***Hard gelatin capsules:*** Introduction, Production of hard gelatin capsule shells, size of capsules, Filling, finishing and special techniques of formulation of hard gelatin capsules and manufacturing defects. In process and final product quality control tests for capsules.

b. ***Soft gelatin capsules:*** 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

UNIT-IV **10hrs**

Parenteral Products:

a) Definition, types, advantages and limitations. Preformulation factors and essential requirements, vehicles, additives, importance of isotonicity

b) Production procedure, production facilities and controls, aseptic processing

c) Formulation of injections, sterile powders, large volume parenterals and lyophilized products.

d) Containers and closures selection, filling and sealing of ampoules, vials and infusion fluids. Quality control tests of parenteral products.

Ophthalmic Preparations: Introduction, formulation considerations; formulation of eye drops, eye ointments and eye lotions; methods of preparation; labeling, containers; evaluation of ophthalmic preparations

UNIT-V **10hrs**

Cosmetics: Formulation and preparation of the following cosmetic preparations: lipsticks, shampoos, cold cream and vanishing cream, tooth pastes, hair dyes and sunscreens.

Pharmaceutical Aerosols: Definition, propellants, containers, valves, types of aerosol systems; formulation and manufacture of aerosols; Evaluation of aerosols; Quality control and stability studies.

Packaging Materials Science: Materials used for packaging of pharmaceutical products, factors influencing choice of containers, legal and official requirements for containers, stability aspects of packaging materials, quality control tests.

BPharm - Semester V

PCE-BP506P: INDUSTRIAL PHARMACY I (Practical)

4hrs/wk

COURSE CODE	**PCE-BP506P**
COURSE TITLE	**INDUSTRIAL PHARMACY I (Practical)**

SCOPE/SYNOPSIS	**OBJECTIVES/COs**
A thorough knowledge on the preformulation, formulation, various manufacturing aspects and quality control testing of various dosage forms is required to conceptually understand each dosage form/practical experiment. Also, evaluation of primary packing materials is equally important as it comes in contact with product directly. Thus, this course deals with preformulation, formulation, evaluation of dosage forms and packing materials.	Upon completion of this course the student should be able to: 1. Understand importance of preformulation studies to develop a stable product 2. Formulate and evaluate dosage forms (tablets, capsules, injections and creams) 3. Evaluate few packaging materials

List of Experiments

1. Preformulation 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)

Recommended Books: (Latest Editions)

1. Pharmaceutical dosage forms - Tablets, volume 1 -3 by H.A. Lieberman, Leon Lachman & J.B. Schwartz
2. Pharmaceutical dosage form - Parenteral medication Vol- 1&2 by Lieberman & Lachman
3. Pharmaceutical dosage form disperse system VOL-1 by Lieberman & Lachman

4. Modern Pharmaceutics by Gilbert S. Banker & C.T. Rhodes, 3rd Edition
5. Remington: The Science and Practice of Pharmacy, 20th edition Pharmaceutical Science (RPS)
6. Theory and Practice of Industrial Pharmacy by Lieberman & Lachman
7. Pharmaceutics- The science of dosage form design by M.E. Aulton, Churchill Livingstone, Latest edition
8. Introduction to Pharmaceutical Dosage Forms by H. C. Ansel, Lea & Febiger, Philadelphia, 5thedition, 2005
9. Drug stability - Principles and practice by Cartensen & C.J. Rhodes, 3rd Edition, Marcel Dekker Series, Vol 107.

BPharm - Semester V

COURSE CODE	**PHA-BP503T**
COURSE TITLE	**PHARMACOLOGY II (Theory)**

SCOPE/SYNOPSIS	OBJECTIVES/COs
This subject is intended to impart the fundamental knowledge on various aspects (classification, mechanism of action, therapeutic effects, clinical uses, side effects and contraindications) of drugs acting on different systems of body and in addition, emphasis on the basic concepts of bioassay.	Upon completion of the course the student shall be able to: 1. Understand the mechanism of drug action and its relevance in the treatment of different diseases 2. Appreciate correlation of pharmacology with related medical sciences

Course Content and Assessment Plan

SL No.	Course Content	Syllabus (Chapters or Units with hours)	Marks of assessment	Distribution of marks of assessment		
				Sessional exam (*30% of marks of assessment)*		End Sem exam (*70% of marks of assessment)*
				S1	S2	
1	The students will learn the hemodynamic and electrophysiology of heart and pharmacological principles of drugs affecting congestive heart failure, anti-hypertensives, anti-anginals, anti-arrhythmics and anti-hyperlipidemic drugs.	Unit I (10hrs)	22	8		14
2	The candidates will be able to explain the drugs used in the therapy of shock, Classify and develop understanding of the pharmacological principles of hematinics, coagulants & anticoagulants, fibrinolytics and anti-platelet drugs and Plasma volume expanders, diuretics and anti-diuretics.	Unit II (10hrs)	22	7		15
3	Students will learn the physiological actions of Histamine, 5-HT, Prostaglandins, Thromboxanes and Leukotrienes, Angiotensin, Bradykinin and Substance P and drugs affecting these systems.	Unit III (10hrs)	22		8	14

4	The students will learn the basic concepts in endocrine pharmacology and learn the pharmacological actions of drugs used to treat the endocrine disorders.	Unit IV (8hrs)	22		7	15
5	The candidates will understand pharmacological actions of Androgens, Estrogens, progesterone, oral contraceptives and drugs acting on the uterus. They will learn the principles and types of bioassay.	Unit V (7hrs)	17		-	17
Total marks of assessment			105	15	15	75

PHA-BP503T: PHARMACOLOGY II (Theory)

Course Content **45hrs**

UNIT-I **10hrs**

1. Pharmacology of drugs acting on cardio vascular system

a. Introduction to hemodynamics and electrophysiology of heart.
b. Drugs used in congestive heart failure
c. Anti-hypertensive drugs.
d. Anti-anginal drugs.
e. Anti-arrhythmic drugs.
f. Drug used in the therapy of shock.

UNIT-II **10hrs**

2. Pharmacology of drugs affecting blood and blood formation

a. Haematinics, coagulants and anticoagulants.
b. Fibrinolytics and anti-platelet drugs.
c. Plasma volume expanders
d. Anti-hyperlipidemic drugs.

3. Pharmacology of drugs acting on urinary system

a. Diuretics
b. Anti-diuretics.

UNIT-III **10hrs**

4. Autacoids and related drugs

a. Introduction to autacoids and classification
b. Histamine, 5-HT and their antagonists.
c. Prostaglandins, Thromboxanes and Leukotrienes.
d. Angiotensin, Bradykinin and Substance P.
e. Non-steroidal anti-inflammatory agents
f. Anti-gout drugs
g. Antirheumatic drugs

UNIT-IV **8hrs**

5. Pharmacology of drugs acting on endocrine system

a. Basic concepts in endocrine pharmacology.
b. Anterior pituitary hormones- analogues and their inhibitors.
c. Thyroid hormones- analogues and their inhibitors.
d. Hormones regulating plasma calcium levels- Parathormone, Calcitonin and Vitamin-D.
d. Insulin, oral hypoglycemic agents and glucagon.
e. ACTH and corticosteroids.

UNIT-V **7hrs**

5. Pharmacology of drugs acting on endocrine system

a. Androgens and Anabolic steroids.
b. Estrogens, progesterone and oral contraceptives.
c. Drugs acting on uterus.

6. Bioassay

a. Principles and applications of bioassay.
b. Types of bioassay
c. Bioassay of insulin, oxytocin, vasopressin, ACTH, d-tubocurarine, digitalis, histamine and 5- HT

BPharm - Semester V

PHA-BP507P: PHARMACOLOGY II (Practical)

4hrs/wk

COURSE CODE	**PHA-BP507P**
COURSE TITLE	**PHARMACOLOGY II (Practical)**

SCOPE/SYNOPSIS	**OBJECTIVES/COs**
With these experiments, students will learn to apply pharmacodynamic principles in quantification of drug responses in *in-vitro* and *in-vivo* systems. The experiments will advance their knowledge in designing preclinical experiments for drug discovery. The students will also learn to use computer assisted learning techniques as alternatives to animal experimentation.	Upon completion of this course the student should be able to: 1. Demonstrate and compare dose response relationship of drugs and quantification of responses of receptor ligands using in-vitro experiments. 2. Employ simulated experiments as alternatives to animal experimentation for studying drug effects. 3. Demonstrate, design and interpret preclinical evaluation techniques for drug discovery process.

List of Experiments:

1. Introduction to *in-vitro* pharmacology and physiological salt solutions.
2. Effect of drugs on isolated frog heart.
3. Effect of drugs on blood pressure and heart rate of dog.
4. Study of diuretic activity of drugs using rats/mice.
5. DRC of acetylcholine using a suitable preparation.
6. Effect of physostigmine and atropine on DRC of acetylcholine.
7. Bioassay of histamine using guinea pig ileum by matching method.
8. Bioassay of oxytocin using rat uterine horn by interpolation method.
9. Bioassay of serotonin using rat fundus strip by three point bioassay.
10. Bioassay of acetylcholine using chick ileum/colon by four point bioassay.
11. Determination of PA_2 value of prazosin using rat anococcygeus muscle (by Schild's plot method).
12. Determination of PD_2 value using guinea pig ileum.

13. Effect of spasmogens and spasmolytics using rabbit jejunum.
14. Anti-inflammatory activity of drugs using carrageenan induced paw-edema model.
15. Analgesic activity of drugs using central and peripheral methods

Note: All laboratory techniques and animal experiments are demonstrated by simulated experiments by software 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 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 M. N., Fundamentals of Experimental Pharmacology. Hilton & Company, Kolkata.
10. Kulkarni S. K., Handbook of experimental pharmacology. Vallabh Prakashan.

BPharm - Semester V

COURSE CODE	**PCO-BP504T**
COURSE TITLE	**PHARMACOGNOSY AND PHYTOCHEMISTRY II (Theory)**

SCOPE/SYNOPSIS	OBJECTIVES/COs
This course is designed 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. Also this subject involves the study of producing the plants and phytochemicals through plant tissue culture, drug interactions and basic principles of traditional system of medicine	Upon completion of this course the student shall be able to: 1. Know the modern extraction techniques, characterization and identification of herbal drugs and phytoconstituents 2. Understand the preparation and development of herbal formulation 3. Understand the herbal drug interaction

Course Content and Assessment Plan

SL No.	Course Contents	Syllabus (Chapters or Units with hours)	Marks of assessment	Distribution of marks of assessment		
				Sessional exam (*30% of marks of assessment)*		End Sem exam (*70% of marks of assessment)*
				S1	S2	
1	Student will understand the concepts of basic metabolic pathways and use of radioactive isotopes in the production and investigation of secondary metabolite	Unit I (7hrs)	16		05	11
2	Student will gain knowledge about chemistry, commercial/ therapeutic applications of crude drugs	Unit II (14hrs)	33	10		23
3	Student will understand the various aspects of isolation , identification and analysis of therapeutically important phytoconstituents	Unit III (6hrs)	14	05		9
4	Student will gain knowledge about industrial production, estimation and utilization of various phytoconstituents	Unit IV (10hrs)	24		10	14
5	Student will understand various methods of extraction techniques, isolation, purification, identification of secondary metabolite	Unit V (8hrs)	18			18
	Total marks of assessment		105	15	15	75

PCO-BP504T: PHARMACOGNOSY AND PHYTOCHEMISTRY II (Theory)

Course content **45hrs**

UNIT-I **7hrs**

Metabolic pathways in higher plants and their determination

a) Brief study of basic metabolic pathways and formation of different secondary metabolites through these pathways- Shikimic acid pathway, Acetate pathway and Isoprenoid pathway.

b) Study of utilization of radioactive isotopes in the investigation of Biogenetic studies.

UNIT-II **14hrs**

General introduction, composition, chemistry & chemical classes, biosources, therapeutic uses and commercial applications of following secondary metabolites:

Alkaloids: Vinca, Rauwolfia, Belladonna, Opium,

Phenylpropanoids and Flavonoids: Lignans, Tea, Ruta

Steroids, Cardiac glycosides & Triterpenoids: Liquorice, Dioscorea, Digitalis

Volatile oils: Mentha, Clove, Cinnamon, Fennel, Coriander

Tannins: Catechu, Pterocarpus

Resins: Benzoin, Guggul, Ginger, Asafoetida, Myrrh, Colophony

Glycosides: Senna, Aloes, Bitter Almond

Iridoids, Other terpenoids & Naphthaquinones: Gentian, Artemisia, Taxus, Carotenoids

UNIT-III **6hrs**

Isolation, Identification and Analysis of Phytoconstituents

a) Terpenoids: Menthol, Citral, Artemisin

b) Glycosides: Glycyrrhetinic acid & Rutin

c) Alkaloids: Atropine,Quinine,Reserpine,Caffeine

d) Resins: Podophyllotoxin, Curcumin

UNIT-IV **10hrs**

Industrial production, estimation and utilization of the following phytoconstituents:

Forskolin, Sennoside, Artemisinin, Diosgenin, Digoxin, Atropine, Podophyllotoxin, Caffeine, Taxol, Vincristine and Vinblastine

UNIT- V **8hrs**

Basics of Phytochemistry

Modern methods of extraction, application of latest techniques like spectroscopy, chromatography and electrophoresis in the isolation, purification and identification of crude drugs.

BPharm - Semester V

PCO-BP508P: PHARMACOGNOSY AND PHYTOCHEMISTRY II (Practical)

4hrs/wk

COURSE CODE	**PCO-BP508P**
COURSE TITLE	**PHARMACOGNOSY AND PHYTOCHEMISTRY II (Practical)**

SCOPE/SYNOPSIS	**OBJECTIVES/COs**
This course is designed to impart the students the knowledge of crude drugs, isolation of phytoconstituents and their identification.	Upon completion of this course the student should be able to: 1. Learn in detail, the macroscopy, microscopy and chromatographic techniques for the identification of phytoconstituents and crude drugs. 2. Gain the knowledge of isolation and identification of phytoconstituents. 3. Gain the knowledge of identification of unorganized drugs.

List of Experiments:

1. Morphology, histology, powder microscopy, extraction and detection of: Cinchona, Cinnamon, Senna, Clove, Ephedra, Fennel and Coriander
2. Exercise involving isolation & detection of active principles
   a) Caffeine from tea dust.
   b) Diosgenin from Dioscorea
   c) Atropine from Belladonna
   d) Sennosides from Senna
3. Separation of sugars by Paper Chromatography
4. TLC of herbal extract
5. Distillation of volatile oils and detection of phytoconstitutents by TLC
6. Analysis of crude drugs by chemical tests: **(**i) Asafoetida (ii) Benzoin (iii) Colophony (iv) Aloes (v) Myrrh

Recommended Books: (Latest Editions)

1. W.C.Evans, Trease and Evans Pharmacognosy, 16th edition, W.B. Sounders & Co., London, 2009.
2. Mohammad Ali. Pharmacognosy and Phytochemistry, CBS Publishers & Distribution, New Delhi.
3. Text book of Pharmacognosy by C.K. Kokate, Purohit, Gokhlae (2007), 37th Edition, Nirali Prakashan, New Delhi.
4. Herbal drug industry by R.D. Choudhary (1996), Ist Edn, Eastern Publisher, New Delhi.
5. Essentials of Pharmacognosy, Dr.SH.Ansari, IInd edition, Birla publications, New Delhi, 2007
6. Herbal Cosmetics by H.Pande, Asia Pacific Business press, Inc, New Delhi.
7. A.N. Kalia, Textbook of Industrial Pharmacognosy, CBS Publishers, New Delhi, 2005.
8. R Endress, Plant cell Biotechnology, Springer-Verlag, Berlin, 1994.
9. Pharmacognosy & Pharmacobiotechnology. James Bobbers, Marilyn KS, VE Tylor.
10. The formulation and preparation of cosmetic, fragrances and flavours.
11. Remington's Pharmaceutical sciences.
12. Text Book of Biotechnology by Vyas and Dixit.
13. Text Book of Biotechnology by R.C. Dubey.

BPharm - Semester V

COURSE CODE	**PRM-BP505T**
COURSE TITLE	**PHARMACEUTICAL JURISPRUDENCE (Theory)**

SCOPE/SYNOPSIS	OBJECTIVES/COs
This course is designed to impart basic knowledge on important legislations related to the profession of pharmacy in India	Upon completion of this course the student shall be able to: 1. Understand pharmaceutical legislations, their implications in the development and marketing of pharmaceuticals 2. Various Indian Pharmaceutical Acts and Laws 3. The regulatory authorities and agencies governing the manufacture and sale of pharmaceutical products 4. The code of ethics during the pharmaceutical practice

Course Content and Assessment Plan

SL No.	Course Content	Syllabus (Chapters or Units with hours)	Marks of assessment	Distribution of marks of assessment		
				Sessional exam (*30% of marks of assessment)*		End Sem exam (*70% of marks of assessment)*
				S1	S2	
1	Student will learn regulations governing import, manufacture of Drugs and Cosmetics	Unit I (10hrs)	25	8		17
2	Student will understand Schedules, roles & responsibilities of govt. officials, provisions related to sales, able to reading product labels	Unit II (10hrs)	25		2	23
3	Student will appreciate the importance of Education Regulations, rules regarding registration of pharmacists, provisions for preparations containing alcohol and narcotic substances	Unit III (10hrs)	25	7		18
4	Student will learn about advertisement regulations, CPCSEA guidelines and pricing of pharmaceutical products	Unit IV (8hrs)	20		5	15
5	Student will learn about history of Pharmaceutical Legislations and ethics, termination of pregnancy and provisions related to Intellectual property	Unit V (7hrs)	10		8	02
		Total marks of assessment	105	15	15	75

PRM-BP505T: PHARMACEUTICAL JURISPRUDENCE (Theory)

45hrs

Course Content

UNIT-I **10hrs**

Drugs and Cosmetics Act, 1940 and its rules 1945:

Objectives, Definitions, Legal definitions of schedules to the Act and Rules

Import of drugs – Classes of drugs and cosmetics prohibited from import, Import under license or permit. Offences and penalties**.**

Manufacture of drugs – Prohibition of manufacture and sale of certain drugs, Conditions for grant of license and conditions of license for manufacture of drugs, Manufacture of drugs for test, examination and analysis, manufacture of new drug, loan license and repacking license.

UNIT-II **10hrs**

Drugs and Cosmetics Act, 1940 and its rules 1945:

Detailed study of Schedule G, H, M, N, P, T, U, V, X, Y, Part XII B, Sch F & DMR (OA)

Sale of Drugs – Wholesale, Retail sale and Restricted license. Offences and penalties.

Labeling & Packing of drugs- General labeling requirements and specimen labels for drugs and cosmetics, List of permitted colors. Offences and penalties.

Administration of the Act and Rules – Drugs Technical Advisory Board, Central drugs Laboratory, Drugs Consultative Committee, Government drug analysts, Licensing authorities, controlling authorities, Drugs Inspectors.

UNIT-III **10hrs**

- **Pharmacy Act – 1948**: Objectives, Definitions, Pharmacy Council of India; its constitution and functions, Education Regulations, State and Joint state pharmacy councils; constitution and functions, Registration of Pharmacists, Offences and Penalties
- **Medicinal and Toilet Preparation Act – 1955**: Objectives, Definitions, Licensing, Manufacture In bond and Outside bond, Export of alcoholic preparations, Manufacture of Ayurvedic, Homeopathic, Patent & Proprietary Preparations. Offences and Penalties.

- **Narcotic Drugs and Psychotropic Substances Act-1985 and Rules**: Objectives, Definitions, Authorities and Officers, Constitution and Functions of narcotic & Psychotropic Consultative Committee, National Fund for Controlling the Drug Abuse, Prohibition, Control and Regulation, opium poppy cultivation and production of poppy straw, manufacture, sale and export of opium, Offences and Penalties

UNIT-IV **8hrs**

- **Study of Salient Features of Drugs and Magic Remedies Act and its rules:** Objectives, Definitions, Prohibition of certain advertisements, Classes of Exempted advertisements, Offences and Penalties.
- **Prevention of Cruelty to Animals Act-1960:** Objectives, Definitions, Institutional Animal Ethics Committee, CPCSEA guidelines for Breeding and Stocking of Animals, Performance of Experiments, Transfer and acquisition of animals for experiment, Records, Power to suspend or revoke registration, Offences and Penalties
- **National Pharmaceutical Pricing Authority:** Drugs Price Control Order (DPCO)-2013. Objectives, Definitions, Sale prices of bulk drugs, Retail price of formulations, Retail price and ceiling price of scheduled formulations, National List of Essential Medicines (NLEM).

UNIT-V **7hrs**

Pharmaceutical Legislations – A brief review, Introduction, Study of drugs enquiry committee, Health survey and development committee, Hathi committee and Mudaliar committee

- **Code of Pharmaceutical Ethics –** Definition, Pharmacist in relation to his job, trade, medical profession and his profession, Pharmacist's oath.
- **Medical Termination of Pregnancy Act**
- **Right to Information Act**
- **Introduction to Intellectual Property Rights (IPR)**
- **A brief study of Drug Regulatory Authorities**

Recommended books: (Latest Edition)

1. Forensic Pharmacy by B. Suresh
2. Text book of Forensic Pharmacy by B.M. Mithal
3. Hand book of drug law-by M.L. Mehra
4. A text book of Forensic Pharmacy by N.K. Jain
5. Drugs and Cosmetics Act/Rules by Govt. of India publications.
6. Medicinal and Toilet preparations act 1955 by Govt. of India publications.
7. Narcotic drugs and psychotropic substances act by Govt. of India publications
8. Drugs and Magic Remedies act by Govt. of India publication
9. Bare Acts of the said laws published by Government. Reference books (Theory)

BPharm

SEMESTER VI : COURSE WORK

Course of study for semester VI					
Course code	**Name of the course**	**No of hours/wk**			**Credit points (C)**
		Lecture (L)	**Tutorial (T)**	**Practical (P)**	
PCH-BP601T	Medicinal Chemistry III (Theory)	3	1	--	4
PHA-BP602T	Pharmacology III (Theory)	3	1	--	4
PCO-BP603T	Herbal Drug Technology (Theory)	3	1	--	4
PCE-BP604T	Biopharmaceutics and Pharmacokinetics (Theory)	3	1	--	4
PBT-BP605T	Pharmaceutical Biotechnology (Theory)	3	1	--	4
PQA-BP606T	Pharmaceutical Quality Assurance (Theory)	3	1	--	4
PCH-BP607P	Medicinal Chemistry III (Practical)	--	--	4	2
PHA-BP608P	Pharmacology III (Practical)	--	--	4	2
PCO-BP609P	Herbal Drug Technology (Practical)	--	--	4	2
	Total	**18**	**6**	**12**	**30**

BPharm VI Semester - COs POs Mapping														
Sl. No.	**Course Code**	**Course Name**	**Credits**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
46	PCH- BP601T	Medicinal Chemistry III (Theory)	4	CO1 CO2 CO3	CO1 CO2 CO3									
47	PHA- BP602T	Pharmacology III (Theory)	4	CO1 CO2 CO3	CO1 CO2 CO3	CO1 CO3		CO1 CO3			CO1 CO2			CO1 CO2 CO3
48	PCO- BP603T	Herbal Drug Technology (Theory)	4	CO1 CO2 CO3 CO4	CO1 CO2 CO3 CO4				CO2					
49	PCE- BP604T	Biopharmaceutics and Pharmacokinetics (Theory)	4	CO1 CO2 CO3 CO4	CO1 CO2 CO3 CO4	CO1 CO2								
50	PBT- BP605T	Pharmaceutical Biotechnology (Theory)	4	CO1 CO2 CO3 CO4	CO1 CO2 CO3 CO4	CO1 CO2 CO3			CO1 CO2 CO3 CO4	CO2 CO3 CO4	CO1 CO2 CO3 CO4	CO1 CO2 CO3 CO4		CO1 CO2 CO3 CO4
51	PQA- BP606T	Pharmaceutical Quality Assurance (Theory)	4	CO1 CO2 CO3	CO1 CO2 CO3	CO2 CO3	CO1	CO2	CO3		CO1 CO3			
52	PCH- BP607P	Medicinal Chemistry III (Practical)	2	CO1 CO2 CO3	CO1 CO2 CO3									
53	PHA- BP608P	Pharmacology III (Practical)	2	CO1 CO2 CO3	CO1 CO2 CO3					CO3				
54	PCO- BP609P	Herbal Drug Technology (Practical)	2	CO1 CO2 CO3	CO1 CO2 CO3		CO1 CO2 CO3			CO1 CO2 CO3				

BPharm - Semester VI

COURSE CODE	**PCH-BP601T**
COURSE TITLE	**MEDICINAL CHEMISTRY III (Theory)**

SCOPE/SYNOPSIS	OBJECTIVES/COs
This subject is designed to impart fundamental knowledge on the structure, chemistry and therapeutic value of drugs. The subject emphasis on modern techniques of rational drug design like quantitative structure activity relationship (QSAR), Prodrug concept, combinatorial chemistry and Computer aided drug design (CADD). The subject also emphasizes on the chemistry, mechanism of action, metabolism, adverse effects, Structure Activity Relationships (SAR), therapeutic uses and synthesis of important drugs.	Upon completion of course student shall be able to: 1. Understand the chemistry, mechanism of action and chemical classification of drugs . 2. Understand the SAR, synthetic route of important drugs and therapeutic value of drugs. 3. Understand the importance of drug design and different techniques of drug design

Course Content and Assessment Plan

SL No.	Course Content	Syllabus (Chapters or Units with hours)	Marks of assessment	Distribution of marks of assessment		
				Sessional exam (*30% of marks of assessment)*		End Sem exam (*70% of marks of assessment)*
				S1	S2	
1	Student will know the development, classification, mechanism of action, nomenclature, synthesis, uses, structure activity relationship, stereochemistry of drugs belonging to the class of penicillins, cephalosporins and related antibiotics, aminoglycosides, tetracyclines.	Unit I (10hrs)	23	8		15
2	Student will know the development, classification, mechanism of action, nomenclature, synthesis, uses, structure activity relationship, stereochemistry of drugs belonging to the class of macrolides, antimalarials as well as basics and applications of prodrugs	Unit II (10hrs)	23	7		16
3	Student will know the development, classification, mechanism of action, nomenclature, synthesis, uses, structure activity relationship, stereochemistry of drugs belonging to the class of antituberculars, antivirals, urinary tract anti-infective agents.	Unit III (10hrs)	23		8	15

4	Student will know the development, classification, mechanism of action, nomenclature, synthesis, uses, structure activity relationship, stereochemistry of drugs belonging to the class of antifungal agents, sulfones and sulfonamides, anti-protozoal agents, anthelmintics.	Unit IV (8hrs)	19			19
5	Student will understand the basics and applications of approaches for drug design, quantitative structure activity relationship, molecular modeling techniques, combinatorial chemistry.	Unit V (7hrs)	17		7	10
Total marks of assessment			105	15	15	75

PCH-BP601T: MEDICINAL CHEMISTRY III (Theory)

45hrs

Course Content

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

UNIT – I **10hrs**

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

Aminoglycosides: Streptomycin, Neomycin, Kanamycin

Tetracyclines: Tetracycline, Oxytetracycline, Chlortetracycline, Minocycline, Doxycycline

UNIT – II **10hrs**

Antibiotics

Historical background, Nomenclature, Stereochemistry, Structure activity relationship, Chemical degradation classification and important products of the following classes.

Macrolide: Erythromycin Clarithromycin, Azithromycin.

Miscellaneous: Chloramphenicol*, Clindamycin.

Prodrugs: Basic concepts and application of prodrugs design.

Antimalarials: Etiology of malaria.

Quinolines: SAR, Quinine sulphate, Chloroquine*, Amodiaquine, Primaquine phosphate, Pamaquine*, Quinacrine hydrochloride, Mefloquine.

Biguanides and dihydro triazines: Cycloguanil pamoate, Proguanil.

Miscellaneous: Pyrimethamine, Artesunete, Artemether, Atovoquone.

UNIT – III **10hrs**

Anti-tubercular Agents

Synthetic anti tubercular agents: Isoniozid*, Ethionamide, Ethambutol, Pyrazinamide, Para amino salicylic acid.*

Anti-tubercular antibiotics: Rifampicin, Rifabutin, Cycloserine Streptomycin, Capreomycin sulphate.

Urinary tract anti-infective agents

Quinolones: SAR of quinolones, Nalidixic Acid, Norfloxacin, Enoxacin, Ciprofloxacin*, Ofloxacin, Lomefloxacin, Sparfloxacin, Gatifloxacin, Moxifloxacin

Miscellaneous: Furazolidine, Nitrofurantoin*, Methanamine.

Antiviral agents:

Amantadine hydrochloride, Rimantadine hydrochloride, Idoxuridine trifluoride, Acyclovir*, Gancyclovir, Zidovudine, Didanosine, Zalcitabine, Lamivudine, Loviride, Delavirdine, Ribavirin, Saquinavir, Indinavir, Ritonavir.

UNIT – IV **8hrs**

Antifungal agents:

Antifungal antibiotics: Amphotericin-B, Nystatin, Natamycin, Griseofulvin.

Synthetic Antifungal agents: Clotrimazole, Econazole, Butoconazole, Oxiconazole Tioconozole, Miconazole*, Ketoconazole, Terconazole, Itraconazole, Fluconazole, Naftifine hydrochloride, Tolnaftate*.

Anti-protozoal Agents: Metronidazole*, Tinidazole, Ornidazole, Diloxanide, Iodoquinol, Pentamidine Isethionate, Atovaquone, Eflornithine.

Anthelmintics: Diethylcarbamazine citrate*, Thiabendazole, Mebendazole*, Albendazole, Niclosamide, Oxamniquine, Praziquantel, Ivermectin.

Sulphonamides and Sulfones

Historical development, chemistry, classification and SAR of Sulfonamides: Sulphamethizole, Sulfisoxazole, Sulphamethazine, Sulfacetamide*, Sulphapyridine, Sulfamethoxaole*, Sulphadiazine, Mefenide acetate, Sulfasalazine.

Folate reductase inhibitors: Trimethoprim*, Cotrimoxazole.

Sulfones: Dapsone*.

UNIT – V **7hrs**

Introduction to Drug Design

Various approaches used in drug design.

Physicochemical parameters used in quantitative structure activity relationship (QSAR) such as partition coefficient, Hammet's electronic parameter, Tafts steric parameter and Hansch analysis.

Pharmacophore modeling and docking techniques.

Combinatorial Chemistry: Concept and applications of combinatorial chemistry: solid phase and solution phase synthesis.

BPharm - Semester VI

PCH-BP607P: MEDICINAL CHEMISTRY III (Practical)

4hrs/wk

COURSE CODE	**PCH-BP607P**
COURSE TITLE	**MEDICINAL CHEMISTRY III (Practical)**

SCOPE/SYNOPSIS	**OBJECTIVES/COs**
Medicinal Chemistry III Practical course deals with the preparation and analysis of medicinally important compounds and intermediates. Besides, it also deals with the determination of physicochemical properties of medicinally important compounds.	Upon completion of this course the student should be able to: 1. Analyze medicinally important compounds as per pharmacopoeial procedure. 2. Synthesize, purify and characterize medicinally important compounds and intermediates. 3. Evaluate important physicochemical properties and determine drug likeness of compounds.

List of Experiments

I Preparation of drugs and intermediates

1. Sulphanilamide
2. 7-Hydroxy, 4-methyl coumarin
3. Chlorobutanol
4. Triphenyl imidazole
5. Tolbutamide
6. Hexamine

II Assay of drugs

1. Isonicotinic acid hydrazide
2. Chloroquine
3. Metronidazole
4. Dapsone
5. Chlorpheniramine maleate
6. Benzyl penicillin

III Preparation of medicinally important compounds or intermediates by Microwave irradiation technique

IV Drawing structures and reactions using chem draw®

V Determination of physicochemical properties such as logP, clogP, MR, Molecular weight, Hydrogen bond donors and acceptors for class of drugs course content using drug design software Drug likeliness screening (Lipinskies RO5)

Recommended Books (Latest Editions)

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

BPharm - Semester VI

COURSE CODE	**PHA-BP602T**
COURSE TITLE	**PHARMACOLOGY III (Theory)**
SCOPE/SYNOPSIS	OBJECTIVES/COs
This subject is intended to impart the fundamental knowledge on various aspects (classification, mechanism of action, therapeutic effects, clinical uses, side effects and contraindications) of drugs acting on respiratory and gastrointestinal system, infectious diseases, immuno-pharmacology and in addition, emphasis on the principles of toxicology.	Upon completion of this course the student shall be able to: 1. Understand the mechanism of drug action and its relevance in the treatment of different infectious diseases 2. Comprehend the principles of toxicology and treatment of various poisonings 3. Appreciate correlation of pharmacology with related medical sciences

Course Content and Assessment Plan

SL No.	Course Content	Syllabus (Chapters or Units with hours)	Marks of assessment	Distribution of marks of assessment		
				Sessional exam (*30% of marks of assessment)*		End Sem exam (*70% of marks of assessment)*
				S1	S2	
1	The students will learn pharmacological principles of Anti - asthmatics, Drugs for COPD, Expectorants & antitussives and drugs affecting GIT.	Unit I (10hrs)	22	8		14
2	The students will learn the general principles of chemotherapy and pharmacology of Sulfonamides and cotrimoxazole, Penicillins, cephalosporins, chloramphenicol, macrolides, quinolones and fluoroquinolones, tetracycline and aminoglycosides	Unit II (10hrs)	22	7		15
3	The students will learn pharmacology of antitubercular agents, antileprotic agents, antifungal agents, antiviral drugs, anthelmintics, antimalarial drugs and antiamoebic agents.	Unit III (12hrs)	22		8	14
4	The students will understand pharmacological actions of drugs for urinary tract infections and anti-cancer drugs, Immune stimulants & suppressants, and biosimilars.	Unit IV (8hrs)	22		7	15

5	Student will understand various types of toxicity studies, general principles of poisoning management	Unit V (5hrs)	17		-	17
Total marks of assessment			105	15	15	75

PHA-BP602T: PHARMACOLOGY III (Theory)

Course Content **45hrs**

UNIT-I **10hrs**

1. Pharmacology of drugs acting on Respiratory system

a. Drugs used for asthma and COPD
b. Expectorants and antitussives
c. Nasal decongestants
d. Respiratory stimulants

2. Pharmacology of drugs acting on the Gastrointestinal Tract

a. Antiulcer agents.
b. Drugs for constipation and diarrhea.
c. Appetite stimulants and suppressants.
d. Digestants and carminatives.
e. Emetics and anti-emetics.

UNIT-II **10hrs**

3. Chemotherapy

a. General principles of chemotherapy.
b. Sulfonamides and cotrimoxazole.
c. Antibiotics- Penicillins, cephalosporins, chloramphenicol, macrolides, quinolones and fluoroquinolones, tetracycline and aminoglycosides

UNIT-III **12hrs**

4. Chemotherapy

a. Antitubercular agents
b. Antileprotic agents
c. Antifungal agents
d. Antiviral drugs

e. Anthelmintics

f. Antimalarial drugs

g. Antiamoebic agents

UNIT-IV **8hrs**

5. Chemotherapy

a. Urinary tract infections and sexually transmitted diseases.

b. Chemotherapy of malignancy.

6. Immunopharmacology

a. Immunostimulants

b. Immunosuppressants

7. Biologicals and Biosimilars: Monoclonal antibodies.

UNIT-V **5hrs**

8. Principles of toxicology

a. Definition and basic knowledge of acute, subacute and chronic toxicity.

b. Definition and basic knowledge of genotoxicity, carcinogenicity, teratogenicity and mutagenicity

c. General principles of treatment of poisoning

d. Clinical symptoms and management of barbiturates, morphine, organophosphorus compounds, lead, mercury and arsenic poisoning.

BPharm - Semester VI

PHA-BP608P: PHARMACOLOGY III (Practical)

4hrs/wk

COURSE CODE	**PHA-BP608P**
COURSE TITLE	**PHARMACOLOGY III (Practical)**

SCOPE/SYNOPSIS	**OBJECTIVES/COs**
With the help of the following experiments, students will develop and employ the knowledge of principle and procedures for assigning the specific pharmacodynamics, calculation of pharmacokinetic & toxicity parameters. The students will apply the knowledge of biostatistics methods to establish the statistical significance and experiment outcome.	Upon completion of this course, the student should be able to: 1. Demonstrate *in vitro / in vivo* screening methods for agents acting on various systems such as gastrointestinal, respiratory, histaminergic etc. 2. Perform statistical analysis for the results obtained in pharmacological experiments. 3. Appreciate the principles and methods of acute toxicity studies.

List of experiments:

1. Dose calculation in pharmacological experiments
2. Antiallergic activity by mast cell stabilization assay
3. Study of anti-ulcer activity of a drug using pylorus ligation (SHAY) rat model and NSAIDs induced ulcer model.
4. Study of effect of drugs on gastrointestinal motility
5. Effect of agonist and antagonists on guinea pig ileum
6. Estimation of serum biochemical parameters.
7. Effect of saline purgative on frog intestine
8. Insulin hypoglycemic effect in rabbit
9. Test for pyrogens
10. Determination of acute oral toxicity (LD_{50}) of a drug from a given data
11. Determination of acute skin irritation / corrosion of a test substance
12. Determination of acute eye irritation / corrosion of a test substance
13. Calculation of pharmacokinetic parameters from a given data

14. Biostatistics methods in experimental pharmacology (student's t test, ANOVA)
15. Biostatistics methods in experimental pharmacology (Chi square test, Wilcoxon Signed Rank test)

**Experiments are demonstrated by simulated experiments/videos. Students are expected to know the principle and procedure of the aforementioned experiments.*

Recommended Books (Latest Editions)

1. Rang H. P., Dale M. M., Ritter J. M., Flower R. J., Henderson G., Rang and Dale's Pharmacology, Churchill Livingstone, Elsevier.
2. Katzung B. G., Masters S. B., Trevor A. J., Basic and Clinical Pharmacology, McGraw-Hill Education.
3. Goodman and Gilman's, The Pharmacological Basis of Therapeutics. The McGraw-Hill Companies, Inc.
4. Mycek M. J., Gelnet S. B. and Perper M. M. Lippincott's Illustrated Reviews- Pharmacology.
5. K. D. Tripathi. Essentials of Medical Pharmacology, Jaypee brothers Medical Publishers (P) Ltd, New Delhi.
6. Sharma H. L., Sharma K. K., Principles of Pharmacology, Paras medical publisher.
7. Modern Pharmacology with clinical Applications, by Charles R. Craig & Robert,
8. Ghosh M. N. Fundamentals of Experimental Pharmacology. Hilton & Company, Kolkata.
9. Kulkarni S. K. Handbook of experimental pharmacology. Vallabh Prakashan.
10. Mahajan B.K. Methods in biostatistics, Jaypee Brothers Medical Publishers, New Delhi.

    Daniel W. Biostatistics, NJ, John Wiley and Sons, Inc.

BPharm - Semester VI

COURSE CODE	**PCO-BP603T**
COURSE TITLE	**HERBAL DRUG TECHNOLOGY (Theory)**

SCOPE/SYNOPSIS	OBJECTIVES/COs
This course gives the knowledge of basic understanding of herbal drug industry, quality of raw material and herbal drugs, herbal cosmetics, natural sweeteners and nutraceuticals. It also emphasizes on GMP, patenting and regulatory issues of herbal drugs.	Upon completion of this course the student shall be able to: 1. Understand raw material as source of herbal drugs from cultivation to herbal drug product. 2. Know the WHO and ICH guidelines for evaluation of herbal drugs 3. Know the herbal cosmetics, natural sweeteners, nutraceuticals 4. Appreciate patenting of herbal drugs and GMP.

Course Contents and Assessment Plan

SL No.	Course Content	Syllabus (Chapters or Units with hours)	Marks of assessment	Distribution of marks of assessment		
				Sessional exam (*30% of marks of assessment)*		End Sem exam (*70% of marks of assessment)*
				S1	S2	
1	Student will know the definitions of herbs and its preparations, GACP and various systems of medicine	Unit I (11hrs)	25	9		16
2	Student will learn about herbal-drug/herbal-food interactions, use of nutraceuticals for the treatment of various diseases, and	Unit II (7hrs)	16	6		10
3	Student will learn about the raw materials and excipients used for preparation of herbal cosmetics and herbal formulations	Unit III (10hrs)	24		8	16
4	Student will learn about evaluation of drugs as per WHO and ICH guidelines. Patenting and regulatory requirements of natural products and regulatory issues	Unit IV (10hrs)	24		7	17
5	Student will understand the herbal industry and GMP of Indian system of medicines	Unit V (7hrs)	16		--	16
Total marks of assessment			105	15	15	75

PCO-BP603T: HERBAL DRUG TECHNOLOGY (Theory)

Course Content **45hrs**

UNIT-I **11hrs**

Herbs as raw materials

Definition of herb, herbal medicine, herbal medicinal product, herbal drug preparation

Source of Herbs

Selection, identification and authentication of herbal materials

Processing of herbal raw material

Biodynamic Agriculture

Good agricultural practices in cultivation of medicinal plants including Organic farming.

Pest and Pest management in medicinal plants: Biopesticides/Bioinsecticides.

Indian Systems of Medicine

a) Basic principles involved in Ayurveda, Siddha, Unani and Homeopathy

b) Preparation and standardization of Ayurvedic formulations *viz* Aristas and Asavas, Gutika, Churna, Lehya and Bhasma.

UNIT-II **7hrs**

Nutraceuticals

General aspects, Market, growth, scope and types of products available in the market. Health benefits and role of Nutraceuticals in ailments like Diabetes, CVS diseases, Cancer, Irritable bowel syndrome and various Gastro intestinal diseases.

Study of following herbs as health food: Alfalfa, Chicory, Ginger, Fenugreek, Garlic, Honey, Amla, Ginseng, Ashwagandha, Spirulina

Herbal-Drug and Herb-Food Interactions: General introduction to interaction and classification. Study of following drugs, their possible side effects and interactions: Hypericum, kava-kava, Ginkgo biloba, Ginseng, Garlic, Pepper & Ephedra.

UNIT-III **10hrs**

Herbal Cosmetics

Sources and description of raw materials of herbal origin used viz, fixed oils, waxes, gums colours, perfumes, protective agents, bleaching agents, antioxidants in products such as skin care, hair care and oral hygienic products.

Herbal excipients:

Herbal Excipients – Significance of substances of natural origin as excipients – colorants, sweeteners, binders, diluents, viscosity builders, disintegrants, flavors & perfumes.

Herbal formulations:

Conventional herbal formulations like syrups, mixtures and tablets. Novel dosage forms like phytosomes

UNIT- IV **10hrs**

Evaluation of Drugs: WHO & ICH guidelines for the assessment of herbal drugs. Stability testing of herbal drugs.

Patenting and Regulatory requirements of natural products:

a) Definition of the terms: Patent, IPR, Farmers right, Breeder's right, Bioprospecting and Biopiracy

b) Patenting aspects of Traditional Knowledge and Natural Products. Case study of Curcuma & Neem.

Regulatory Issues - Regulations in India (ASU DTAB, ASU DCC) Regulation of manufacture of ASU drugs - Schedule Z of Drugs & Cosmetics Act for ASU drugs.

UNIT-V **7hrs**

General Introduction to Herbal Industry

Herbal drugs industry: Present scope and future prospects.

A brief account of plant based industries and institutions involved in work on medicinal and aromatic plants in India.

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, standard operating procedures, health and hygiene, documentation and records.

BPharm - Semester VI

PCO-BP609P: HERBAL DRUG TECHNOLOGY (Practical)

4hrs/wk

COURSE CODE	**PCO-BP609P**
COURSE TITLE	**HERBAL DRUG TECHNOLOGY (Practical)**
SCOPE/SYNOPSIS	**OBJECTIVES/COs**
This course gives the knowledge of basic understanding of herbal drug formulations and preliminary phytochemical screening.	Upon completion of this course the student should be able to: 1. Gain the knowledge on preparation and evaluation of various herbal formulations. 2. Understand the evaluation of excipients used in herbal preparations. 3. Acquire knowledge on preliminary phytochemical screening and monographic analysis of herbal drugs.

List of Experiments:

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, shampoos and their evaluation.
5. Incorporation of prepared and standardized extract in formulations like syrups, mixtures and tablets and their evaluation as per Pharmacopoeial requirements
6. Monograph analysis of herbal drugs from recent Pharmacopoeias
7. Determination of Aldehyde content
8. Determination of Phenol content
9. Determination of total alkaloids

Recommended Books: (Latest Editions)

1. Textbook of Pharmacognosy by Trease & Evans.
2. Textbook of Pharmacognosy by Tyler, Brady & Robber.
3. Pharmacognosy by Kokate, Purohit and Gokhale
4. Essential of Pharmacognosy by Dr.S.H. Ansari
5. Pharmacognosy & Phytochemistry by V.D. Rangari
6. Pharmacopoeal standards for Ayurvedic Formulation (Council of Research in Indian Medicine & Homeopathy)
7. Mukherjee, P.W. Quality Control of Herbal Drugs: An Approach to Evaluation of Botanicals. Business Horizons Publishers, New Delhi, India, 2002.

BPharm - Semester VI

COURSE CODE	**PCE-BP604T**
COURSE TITLE	**BIOPHARMACEUTICS AND PHARMACOKINETICS (Theory)**

SCOPE/SYNOPSIS	OBJECTIVES/COs
This subject is designed to impart knowledge and skills of Biopharmaceutics, pharmacokinetics, their applications in pharmaceutical development, design of dose and dosage regimen and in solving the problems arising therein.	Upon completion of this course the student shall be able to: 1. Understand the basic concepts in biopharmaceutics and pharmacokinetics and their significance. 2. Use of plasma drug concentration-time data to calculate the pharmacokinetic parameters to describe the kinetics of drug absorption, distribution, metabolism, excretion and elimination. 3. Understand the concepts of bioavailability and bioequivalence of drug products and their significance. 4. Understand various pharmacokinetic parameters, their significance & applications.

Course Content and Assessment Plan

SL No.	Course Content	Syllabus (Chapters or Units with hours)	Marks of assessment	Distribution of marks of assessment		
				Sessional exam (*30% of marks of assessment)*		End Sem exam (*70% of marks of assessment)*
				S1	S2	
1	Student will know the mechanisms of drug absorption and distribution in the body.	Unit I (10hrs)	23	7		16
2	Student will learn about the elimination of drug from body, the concepts of bioavailability and bioequivalence of drug products and their significance	Unit II (10hrs)	23		8	15
3	Student will learn about significance and applications of one compartment model and pharmacokinetic parameters.	Unit III (10hrs)	23	8		15
4	Student will understand and learn about multi compartment models, kinetics of multiple dosing.	Unit IV (8hrs)	20		7	13
5	Student will understand the concept of nonlinear pharmacokinetics.	Unit V (7hrs)	16		--	16
		Total marks of assessment	105	15	15	75

PCE-BP604T: BIOPHARMACEUTICS AND PHARMACOKINETICS (Theory)

Course Content **45hrs**

UNIT-I **10hrs**

Introduction to Biopharmaceutics

Absorption: Mechanisms of drug absorption through GIT, factors influencing drug absorption though GIT, absorption of drug from non per-oral extravascular routes,

Distribution: Tissue permeability of drugs, binding of drugs, apparent volume of drug distribution, plasma and tissue protein binding of drugs, factors affecting protein-drug binding. Kinetics of protein binding, Clinical significance of protein binding of drugs

UNIT- II **10hrs**

Elimination: Drug metabolism and basic understanding of metabolic pathways, renal excretion of drugs, factors affecting renal excretion of drugs, renal clearance, Non renal routes of excretion of drugs

Bioavailability and Bioequivalence: Definition and Objectives of bioavailability, absolute and relative bioavailability, measurement of bioavailability, *in-vitro* drug dissolution models, *in-vitro-in-vivo* correlations, bioequivalence studies, methods to enhance the dissolution rates and bioavailability of poorly soluble drugs.

UNIT- III **10hrs**

Pharmacokinetics: 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) Extravascular administrations. Pharmacokinetics parameters - K_E, $t_{1/2}$, Vd, AUC, Ka, Clt and CL_R- definitions, methods of eliminations, understanding of their significance and application.

UNIT- IV **8hrs**

Multicompartment models: Two compartment open model IV bolus,

Kinetics of multiple dosing, steady state drug levels, calculation of loading and maintenance doses and their significance in clinical settings.

UNIT- V **7hrs**

Nonlinear Pharmacokinetics: Introduction, Factors causing Non-linearity, Michaelis-Menton method of estimating parameters, explanation with examples of drugs.

Recommended Books: (Latest Editions)

1. Biopharmaceutics and Clinical Pharmacokinetics by Milo Gibaldi.
2. Biopharmaceutics and Pharmacokinetics; By Robert F Notari
3. Applied biopharmaceutics and pharmacokinetics, Leon Shargel and Andrew B.C.YU, 4th edition, Prentice-Hall International edition. USA
4. Biopharmaceutics and Pharmacokinetics-A Treatise, By D. M. Brahmankar and Sunil B. Jaiswal, Vallabh Prakashan, Pitampura, Delhi
5. Pharmacokinetics: By Milo Glbaldi Donald, R. Mercel Dekker Inc.
6. Hand Book of Clinical Pharmacokinetics, By Milo Gibaldi and Laurie Prescott by ADIS Health Science Press.
7. Biopharmaceutics: By Swarbrick.
8. Clinical Pharmacokinetics, Concepts and Applications: By Malcolm Rowland and Thomas, N. Tozen, Lea and Febrger, Philadelphia, 1995.
10. Dissolution, Bioavailability and Bioequivalence, By Abdou H.M, Mack Publishing Company, Pennsylvania 1989.
11. Biopharmaceutics and Clinical Pharmacokinetics-An introduction 4th edition, Revised and expanded by Rebort F Notari Marcel Dekker Inn, New York and Basel, 1987.
12. Remington's Pharmaceutical Sciences, By Mack Publishing Company, Pennsylvnia

BPharm - Semester VI

COURSE CODE	PBT-BP605T
COURSE TITLE	PHARMACEUTICAL BIOTECHNOLOGY (Theory)

SCOPE/SYNOPSIS	OBJECTIVES/COs
• Scientific application of biotechnology in the field of genetic engineering, medicine and fermentation technology makes the subject interesting. • Biotechnology is leading to new biological revolutions in diagnosis, prevention and cure of diseases by providing new and cheaper pharmaceutical drugs. • Biotechnology has already produced transgenic crops and animals and the future promises lot more. • It is basically a research-based subject.	Upon completion of this course, the student shall be able to: 1. Appreciate the history of biotechnology, basics of protein engineering and enzyme technology 2. Understand the principle, method and applications of genetic engineering and PCR 3. Know the immunological principles in therapeutics 4. Understand the basics of microbial genetics, mutations, immuno-diagnostics and microbial transformation 5. Appreciate the use of microorganisms in production of biological drugs using fermentation technology

Course Content and Assessment Plan

SL No.	Course Content	Syllabus (Chapters or Units with hours)	Marks of assessment	Distribution of marks of assessment		
				Sessional exam (*30% of marks of assessment)*		End Sem exam (*70% of marks of assessment)*
				S1	S2	
1	Student will learn about production and applications of free and immobilized enzymes in Pharmaceutical sciences and protein engineering	Unit I (7hrs)	21	8		13
2	Student will understand the principle, components and applications of genetic engineering and polymerase chain reaction	Unit II (10hrs)	23	7		16
3	Student will understand the basics of immunology and immune system, learn the methods involved in the production of vaccines	Unit III (10hrs)	21		6	15
4	Student will understand microbial genetics, appreciate the applications of immune-blotting techniques and monoclonal antibodies	Unit IV (8hrs)	19		4	15
5	Student will understand the principle involved in design of fermenters, production of important microbial products and blood products.	Unit V (10hrs)	21		5	16
	Total marks of assessment		105	15	15	75

PBT-BP605T: PHARMACEUTICAL BIOTECHNOLOGY (Theory)

Course Content **45hrs**

Unit I **7hrs**

a) Brief introduction to biotechnology with reference to pharmaceutical sciences

b) Enzyme biotechnology: methods of enzyme immobilization and its applications

c) Biosensors: working and applications in pharmaceutical industries

d) Brief introduction to protein engineering

Unit II **10hrs**

Basic principles of genetic engineering under the following headings:

a) Study of cloning vectors, restriction endonucleases and DNA ligase

b) Application of genetic engineering in medicine

c) Application of rDNA technology and genetic engineering in the production of:

i) Interferon ii) Vaccines: Hepatitis - B iii) Hormones: Insulin

d) Brief introduction to PCR

Unit III **10hrs**

Immunology

a) Types of immunity: Humoral immunity and cellular immunity

b) Structure of immunoglobulins

c) Structure and function of MHC

d) Hypersensitivity reactions, immune stimulation and immune suppressions

e) General method of preparation of bacterial vaccines, toxoids, viral vaccine, antitoxins and antiserums

f) Storage conditions and stability of official vaccines

Unit IV **8hrs**

a) Hybridoma technology: Production, purification and applications

b) Immuno blotting techniques: ELISA, Western blotting, Southern blotting

c) Genetic organization of eukaryotes and prokaryotes

d) Microbial genetics including transformation, transduction, conjugation, plasmids and transposons

e) Introduction to microbial biotransformation and applications

f) Mutation: Types of mutations

Unit V **10hrs**

a) Fermentation methods: General requirements, study of media, equipment, sterilization methods, aeration process and stirring

b) Large scale production: Fermenter design and its various controls

c) Study of the production of Penicillin, Citric acid, Vitamin B12, Glutamic acid and Griseofulvin

d) Use of microbes in industry. Production of enzymes: General consideration in the production of Amylase, Catalase, Peroxidase, Lipase, Protease and Penicillinase

e) Blood products: Collection, processing and storage of whole human blood, dried human plasma and plasma substitutes

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, W H Freeman & Co
3. J.W. Goding: Monoclonal Antibodies, Academic Press
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, Blackwell Scientific Publication.
7. Stanbury F., P., Whitakar A., and Hall J., S., Principles of fermentation technology, Aditya Books Ltd., New Delhi

BPharm - Semester VI

COURSE CODE	**PQA-BP606T**
COURSE TITLE	**PHARMACEUTICAL QUALITY ASSURANCE (Theory)**

SCOPE/SYNOPSIS	OBJECTIVES/COs
This course deals with the various aspects of quality control and quality assurance aspects of pharmaceutical industries like cGMP, QC tests, documentation, quality certification and regulatory affairs.	Upon completion of this course the student shall be able to understand: 1. Basic concepts of QMS. 2. Basic concepts of cGMP. 3. Basic concepts of GLP. 4. The importance of implementation of GDP & market complaints. 5. The basic concepts of Calibration & Validation.

Course Content and Assessment Plan

SL No.	Course Content	Syllabus (Chapters or Units with hours)	Marks of assessment	Distribution of marks of assessment		
				Sessional exam (*30% of marks of assessment)*		End Sem exam (*70% of marks of assessment)*
				S1	S2	
1	Student will know the concept of QA, QC, TQM, QBD approaches, and benefits of NABL, ISO 9000 & 14000 accreditation in Pharma industry.	Unit I (10hrs)	23	8		15
2	Student will understand the concept of cGMP and basic aspects of equipment and raw materials used in pharmaceutical industries	Unit II (10hrs)	23	7		16
3	Student will understand and learn in detail the quality control tests for packaging materials and aspects of GLP.	Unit III (10hrs)	23		8	15
4	Student will understand how complaints, recalls, and return goods are handled in pharmaceutical industry. Will learn the types of documents and document handling as per Good Documentation Practices.	Unit IV (8hrs)	19		7	12
5	Student will know the principles of calibration, qualification and validation of various instruments. Will learn good warehouse practices.	Unit V (7hrs)	17		--	17
		Total marks of assessment	105	15	15	75

PQA-BP606T: PHARMACEUTICAL QUALITY ASSURANCE (Theory)

Course Content **45hrs**

UNIT – I **10hrs**

Quality Assurance and Quality Management Concepts: Definition and concept of Quality Control, Quality Assurance and GMP

Total Quality Management (TQM): Definition, elements, philosophies

ICH Guidelines: Purpose, participants, process of harmonization, brief overview of QSEM, with special emphasis on Q-series guidelines, ICH stability testing guidelines

Quality by design (QbD): Definition, overview, elements of QbD program and tools

ISO 9000 & ISO14000: Overview, benefits, elements, steps for registration

NABL accreditation: Principles and procedures.

UNIT - II **10hrs**

Organization and personnel: Personnel responsibilities, training, hygiene and personal records.

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.

UNIT – III **10hrs**

Quality Control: Quality control test for containers, rubber closures and secondary packing materials.

Good Laboratory Practices: General provisions, Organization and personnel, Facilities, Equipment, Testing facilities operation, Test and control articles, Protocol for conduct of a nonclinical laboratory study, Records and reports, Disqualification of testing facilities.

UNIT – IV **8hrs**

Complaints: Complaints and evaluation of complaints, Handling of return goods, 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.

UNIT – V **7hrs**

Calibration and Validation: Introduction, definition and general principles of calibration, qualification and validation, importance and scope of validation, types of validation, validation master plan. Calibration of pH meter, Qualification of UV-Visible spectrophotometer, General principles of Analytical Method Validation.

Warehousing: Good warehousing practice, materials management

Recommended Books: (Latest Edition)

1. Quality Assurance Guide by organization of Pharmaceutical Products of India.
2. Good Laboratory Practice Regulations, 2nd Edition, Sandy Weinberg Vol. 69.
3. Quality Assurance of Pharmaceuticals- A compendium of Guide lines and Related materials Vol I WHO Publications.
4. A guide to Total Quality Management- Kushik Maitra and Sedhan K Ghosh
5. How to Practice GMP's – P P Sharma.
6. ISO 9000 and Total Quality Management – Sadhank G Ghosh
7. The International Pharmacopoeia – Vol I, II, III, IV- General Methods of Analysis and Quality specification for Pharmaceutical Substances, Excipients and Dosage forms
8. Good laboratory Practices – Marcel Deckker Series
9. ICH guidelines, ISO 9000 and 14000 guidelines

BPharm

SEMESTER VII : COURSE WORK

Table-VII: Course of study for semester VII					
Course code	**Name of the course**	**No of hours/wk**			**Credit points (C)**
		Lecture (L)	**Tutorial (T)**	**Practical (P)**	
PQA-BP701T	Instrumental Methods of Analysis (Theory)	3	1	--	4
PCE-BP702T	Industrial Pharmacy II (Theory)	3	1	--	4
PPR-BP703T	Pharmacy Practice (Theory)	3	1	--	4
PCE-BP704T	Novel Drug Delivery Systems (Theory)	3	1	--	4
PRM-BP705T	Consumer Affairs*	3	--	--	3
PQA-BP706P	Instrumental Methods of Analysis (Practical)	--	--	4	2
BP707PS	Practice School	--	--	12	6
	Total	**15**	**4**	**16**	**27**
*Non University Examination (NUE). Internal assessment only					

BPharm VII Semester - COs POs Mapping														
Sl No.	**Course Code**	**Course Name**	**Credits**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
55	PQA- BP701T	Instrumental Methods of Analysis	4	CO1 CO2 CO3	CO1 CO2 CO3									
56	PCE- BP702T	Industrial Pharmacy II (Theory)	4	CO1 CO2 CO3 CO4 CO5	CO1 CO2 CO3 CO4 CO5	CO1 CO2								
57	PPR- BP703T	Pharmacy Practice (Theory)	4	CO1 CO2 CO3 CO4 CO5	CO1 CO2 CO3 CO4 CO5	CO3 CO4	CO1	CO1 CO4				CO3 CO4		
58	PCE- BP704T	Novel Drug Delivery Systems (Theory)	4	CO1 CO2	CO1 CO2	CO1 CO2								
59	PRM-BP705T	Consumer Affairs	3	CO1 CO2 CO3 CO4	CO1 CO2 CO3 CO4		CO1 CO2	CO1 CO2 CO3 CO4		CO1 CO2 CO3 CO4	CO1 CO2 CO3 CO4			CO1 CO2 CO3 CO4
60	PQA- BP706P	Instrumental Methods of Analysis (Practical)	2	CO1 CO2	CO1 CO2		CO2			CO2				
61	BP707PS	Practice School	6	CO1 CO2	CO2 CO4	CO4	CO4				CO2		CO3 CO4	CO3

COURSE CODE	**PQA-BP701T**
COURSE TITLE	**INSTRUMENTAL METHODS OF ANALYSIS (Theory)**

SCOPE/SYNOPSIS	OBJECTIVES/COs
This course deals with the application of instrumental methods in qualitative and quantitative analysis of drugs. The course is designed to impart a fundamental knowledge on the principles and instrumentation of modern analytical techniques. Emphasis is on the application of these techniques for analysis of pharmaceuticals.	Upon completion of the course the student shall be able to understand: 1. Basics of Spectroscopy, instrumentation & applications of UV Visible spectroscopy & Fluorimetry. 2. The principle, instrumentation & application of IR, AAS, AES, Flame Photometry & Nepheloturbidimetry 3. The basics of Chromatography & electrophoresis 4. Principle, theory, instrumentation & applications of GC & HPLC. 5. Principle, instrumentation and applications of electrochemical methods such as potentiometry, polarography and conductometry.

Course Content and Assessment Plan

SL No.	Course Content	Syllabus (Chapters or Units with hours)	Marks of assessment	Distribution of marks of assessment		
				Sessional exam (*30% of marks of assessment)*		End Sem exam (*70% of marks of assessment)*
				S1	S2	
1	Student will understand the principle, instrumentation and application of absorption and emission spectroscopy.	Unit I (10hrs)	23	8		15
2	Student will understand the principle, instrumentation and application of infrared and atomic spectroscopy.	Unit II (10hrs)	23	7		16
3	Student will know the historical development, techniques and factors affecting conventional chromatography.	Unit IV (8hrs)	19		5	14
4	Student will understand the techniques, factors affecting and applications of advanced chromatographic techniques.	Unit V (10hrs)	23		7	16
5	Student will understand the techniques, instrumentation and applications of electrometric methods of analysis	Unit VI (7hrs)	17		3	14
Total marks of assessment			105	15	15	75

PQA-BP701T: INSTRUMENTAL METHODS OF ANALYSIS (Theory)

Course Content **45hrs**

UNIT –I **10hrs**

UV Visible spectroscopy

Electronic transitions, chromophores, auxochromes, spectral shifts, solvent effect on absorption spectra, Beer and Lambert's law (Including derivation) and deviations.

Instrumentation - Sources of radiation, wavelength selectors, sample cells, detectors- Photo tube, Photomultiplier tube, Photo voltaic cell, Silicon Photodiode.

Applications - Spectrophotometric titrations, Single component and multi component analysis

Fluorimetry

Theory, concepts of singlet, doublet and triplet electronic states, internal and external conversions, factors affecting fluorescence, quenching, instrumentation and applications

UNIT –II **10hrs**

IR spectroscopy

Introduction, fundamental modes of vibrations in poly atomic molecules, sample handling, factors affecting vibrations

Instrumentation - Sources of radiation, wavelength selectors, detectors - Golay cell, Bolometer, Thermocouple, Thermister, Pyroelectric detector and applications

Flame Photometry-Principle, interferences, instrumentation and applications

Atomic absorption spectroscopy- Principle, interferences, instrumentation and applications

Nepheloturbidometry- Principle, instrumentation and applications

UNIT –III **8hrs**

Introduction to chromatography

Adsorption and partition column chromatography - Methodology, advantages, disadvantages and applications.

Thin layer chromatography - Introduction, principle, methodology, Rf values, advantages, disadvantages and applications.

Paper chromatography - Introduction, methodology, development techniques, advantages, disadvantages and applications

Electrophoresis– Introduction, factors affecting electrophoretic mobility, techniques of paper, gel, capillary electrophoresis, applications

UNIT –IV **10hrs**

Gas chromatography - Introduction, theory, instrumentation, derivatization, temperature programming, advantages, disadvantages and applications

High Performance Liquid Chromatography(HPLC): Introduction, theory, instrumentation, advantages and applications.

Ion exchange chromatography- Introduction, classification, ion exchange resins, properties, mechanism of ion exchange process, factors affecting ion exchange, methodology and applications

Gel chromatography- Introduction, theory, instrumentation and applications

Affinity chromatography- Introduction, theory, instrumentation and applications

UNIT-V **7hrs**

- **Electrochemical methods of analysis**
    - **Conductometry**- Introduction, conductivity cell, conductometric titrations, applications.
    - **Potentiometry -** Electrochemical cell, construction and working of reference (Standard hydrogen electrode, Silver-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

BPharm - Semester VII

PQA-BP706P: INSTRUMENTAL METHODS OF ANALYSIS (Practical)

4hrs/wk

COURSE CODE	**PQA-BP706P**
COURSE TITLE	**INSTRUMENTAL METHODS OF ANALYSIS (Practical)**
SCOPE/SYNOPSIS	**OBJECTIVES/COs**
To understand the operations of advanced analytical instruments and to perform qualitative and quantitative analysis	Upon completion of this course the student should be able to: 1. Learn the operation of advanced instruments and documentation. 2. Perform quantitative & qualitative analysis of drugs using various analytical instruments.

List of Experiments:

1 Determination of absorption maxima and effect of solvents on absorption maxima of organic compounds
2 Estimation of dextrose by colorimetry
3 Estimation of sulfanilamide by colorimetry
4 Simultaneous estimation of ibuprofen and paracetamol by UV spectroscopy
5 Assay of paracetamol by UV- Spectrophotometry
6 Estimation of quinine sulfate by fluorimetry
7 Study of quenching of fluorescence
8 Determination of sodium by flame photometry
9 Determination of potassium by flame photometry
10 Determination of chlorides and sulphates by nephelo turbidometry
11 Separation of amino acids by paper chromatography
12 Separation of sugars by thin layer chromatography
13 Separation of plant pigments by column chromatography
14 Determination of normality of strong acid against strong base by conductometry
15 Conductometric titration of strong acid and weak acid against strong base
16 Potentiometric titration of strong acid against strong base
17 Demonstration experiment on HPLC
18 Demonstration experiment on Gas Chromatography

Recommended Books (Latest Editions)

1. Instrumental Methods of Chemical Analysis by B.K Sharma
2. Organic spectroscopy by Y.R Sharma
3. Text book of Pharmaceutical Analysis by Kenneth A. Connors
4. Vogel's Text book of Quantitative Chemical Analysis by A.I. Vogel
5. Practical Pharmaceutical Chemistry by A.H. Beckett and J.B. Stenlake
6. Organic Chemistry by I. L. Finar
7. Organic spectroscopy by William Kemp
8. Quantitative Analysis of Drugs by D. C. Garrett
9. Quantitative Analysis of Drugs in Pharmaceutical Formulations by P. D. Sethi
10. Spectrophotometric identification of Organic Compounds by Silverstein.

BPharm - Semester VII

COURSE CODE	**PCE-BP702T**
COURSE TITLE	**INDUSTRIAL PHARMACY II (Theory)**
SCOPE/SYNOPSIS	OBJECTIVES/COs
This course is designed to impart fundamental knowledge on pharmaceutical product development and translation from laboratory to market.	Upon completion of the course, the student shall be able to: 1. Know the process of pilot plant scale-up of pharmaceutical dosage forms 2. Understand the process of technology transfer from lab scale to commercial scale 3. Understand regulatory requirements for drug approvals 4. Learn quality management systems and certifications for pharmaceutical industry 5. Understand pharmaceutical regulatory requirements in the Indian context

Course Content and Assessment Plan

SL No.	Course Content	Syllabus (Chapters or Units with hours)	Marks of assessment	% of marks of assessment		
				Sessional exam (*30% of marks of assessment)*		End Sem exam (*70% of marks of assessment)*
				S1	S2	
1	Student will gain knowledge of pilot plant scale-up techniques, SUPAC guidelines and platform technology	Unit I (10hrs)	23	6		17
2	Student will understand about technology transfer and relevant guidelines, documentation and protocols	Unit II (10hrs)	23	6		17
3	Student will gain knowledge about regulatory affairs and requirements for drug approvals.	Unit III (10hrs)	23	3	3	17
4	Student will gain knowledge of quality management systems and certifications for pharmaceutical industry	Unit IV (8hrs)	19		7	12
5	Student will understand about Indian regulatory requirements for pharmaceuticals, gain knowledge about state and central licensing organizations	Unit V (7hrs)	17		5	12
	Total marks of assessment		105	15	15	75

PCE-BP702T: INDUSTRIAL PHARMACY II (Theory)

Course Content **45hrs**

UNIT-I **10hrs**

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.

UNIT-II **10hrs**

Technology development and transfer: WHO guidelines for Technology Transfer (TT): Terminology, Technology transfer protocol, Quality risk management, Transfer from R & D to production (Process, Packaging and Cleaning), Granularity of TT Process (API, excipients, finished products, packaging materials) Documentation, Premises and equipment, qualification and validation, quality control, analytical method transfer, Approved regulatory bodies and agencies, Commercialization - practical aspects and problems (case studies), TT agencies in India - APCTD, NRDC, TIFAC, BCIL, TBSE / SIDBI; TT related documentation - confidentiality agreement, licensing, MoUs, legal issues.

UNIT-III **10hrs**

Regulatory affairs: Introduction, Historical overview of Regulatory Affairs, Regulatory authorities, Role of Regulatory affairs department, Responsibility of Regulatory Affairs Professionals.

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.

UNIT-IV **8hrs**

Quality management systems: Quality management & Certifications: Concept of Quality, Total Quality Management (TQM), Quality by Design (QbD), Six Sigma concept, Out of Specifications (OOS), Change control, Introduction to ISO 9000 series of quality systems standards, ISO 14000, NABL, GLP.

UNIT-V **7hrs**

Indian Regulatory Requirements: Central Drug Standard Control Organization (CDSCO) and State Licensing Authority: Organization, Responsibilities, Certificate of Pharmaceutical Product (COPP), Regulatory requirements and approval procedures for New Drugs.

Recommended Books: (Latest Editions)

1. Regulatory Affairs from Wikipedia, the free encyclopedia modified on 7th April. Available at http://en.wikipedia.org/wiki/Regulatory_Affairs.

2. International Regulatory Affairs Updates, 2005. Available at http://www.iraup.com/about.php

3. Douglas J Pisano and David S. Mantus. Text book of FDA Regulatory Affairs: A Guide for Prescription Drugs, Medical Devices and Biologics. 2nd Edition 2008. New York: Informa Healthcare. Print ISBN: 978-1-4200-7354-6.

4. Regulatory Affairs brought by learning plus, Inc. available at http://www.cgmp.com/ra.htm.

BPharm- Semester VII

COURSE CODE	**PPR-BP703T**
COURSE TITLE	**PHARMACY PRACTICE (Theory)**
SCOPE/SYNOPSIS	OBJECTIVES/COs
In the changing scenario of pharmacy practice in India, for the successful practice of hospital pharmacy, the students are required to learn various skills like drug distribution, drug information, and therapeutic drug monitoring for improved patient care. In community pharmacy, students learn various skills such as dispensing of drugs, responding to minor ailments by providing suitable safe medication, patient counselling for improved patient care in the community pharmacy set up.	Upon completion of the course, the student shall be able to: 1. Learn about the importance of Pharmacy and Therapeutic Committee (PTC) and hospital Formulary 2. Learn the different methods of drug distribution system, drug store management and including budget 3. Learn the concept of community pharmacy and its management and importance of prescription and OTC medications 4. Learn the communication skill required for practicing pharmacist, along with the importance of medication adherence and education and training program in the hospital 5. Learn the concept of clinical pharmacy and learn various clinical pharmacy services

Course Content and Assessment Plan

SL No.	Course Content	Syllabus (Chapters or Units with hours)	Marks of assessment	Distribution of marks of assessment		
				Sessional exam (*30% of marks of assessment)*		End Sem exam (*70% of marks of assessment)*
				S1	S2	
1	Student will understand and learn the concept and functioning of the hospital and hospital pharmacy. Also learn about the importance of Pharmacy and Therapeutic Committee (PTC) and hospital formulary	Unit I (10hrs)	23	8		15
2	Student will learn the different methods of drug distribution system, drug store management and different methods of inventory control, including budget	Unit II (10hrs)	23	7		16
3	Student will learn the concept of community pharmacy and its management and importance of prescription and OTC medications	Unit III (10hrs)	23		10	13
4	Student will learn the communication skill required for practicing pharmacist, along with the importance of medication	Unit IV (5hrs)	12		5	07

	adherence and education and training program in the hospital					
5	Student will understand the concept of clinical pharmacy and learn various clinical pharmacy services like ADR monitoring, TDM, patient medication history interview, DI services and patient counselling. In addition, gain knowledge regarding investigational use drugs and interpretation of clinical laboratory tests	Unit V (10hrs)	24		-	24
	Total marks of assessment		105	15	15	75

PPR-BP703T: PHARMACY PRACTICE II (Theory)

Course Content **45hrs**

Unit I: **10hrs**

a) Hospital and its organization

Definition, classification of hospital- primary, secondary and tertiary hospitals, classification based on clinical and non- clinical basis, organization structure of a hospital, and medical staffs involved in the hospital and their functions.

b) Hospital pharmacy and its organization

Definition, functions of hospital pharmacy, organization structure, location, layout and staff requirements, and responsibilities and functions of hospital pharmacist.

c) Pharmacy and therapeutic committee(PTC)

Definition, objectives, organization, functions and policies of the PTC. Role of PTC in drug safety, automatic stop order, emergency drug list preparation, drug defect reporting program and drug utilization evaluation

d) Hospital formulary and hospital formulary system

Definition, contents of hospital formulary, differentiation of hospital formulary and drug list, preparation and revision and addition and deletion of drugs from the hospital formulary. Legal aspects of hospital formulary system.

Unit II: **10hrs**

a) Drug distribution system in a hospital

Dispensing of drugs to inpatients, types of drug distribution systems, charging policy and labelling, dispensing of drugs to ambulatory patients and dispensing of controlled drugs.

b) Drug store management and inventory control

Organization of drug store, types of materials stocked and storage conditions, purchase and inventory control: principles, purchase procedure, purchase order, procurement and stocking. ABC, VED, EOQ, RQL, and methods used for the analysis of the drug expenditure

c) Budget preparation and implementation

Budget preparation and implementation

Unit III: **15hrs**

a) **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.

b) **Community pharmacy management**

Financial, materials, staff, and infrastructure requirements.

c) **Over the counter (OTC) sales**

Introduction and sale of over the counter medications, and rational use of commonly used over the counter medications.

d) **Prescribed medication order and communication skills**

Prescribed medication order-interpretation and legal requirements, and communication skills-communication with prescribers and patients

e) **Medication adherence**

Definition, causes of medication non-adherence, pharmacist role in the medication adherence, and monitoring of patient medication adherence.

f) **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 pharmacist, and role of pharmacist in the interdepartmental communication and community health education.

Unit IV: **10hrs**

a) 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.

b) Adverse drug reaction

Classifications - Excessive pharmacological effects, secondary pharmacological effects, idiosyncrasy, allergic drug reactions, genetically determined toxicity, toxicity following sudden withdrawal of drugs. Spontaneous case reports and record linkage studies, and adverse drug reaction reporting and management.

c) Drug interaction - beneficial interactions, adverse interactions, and pharmacokinetic and pharmacodynamic drug interactions. Methods for detecting drug interactions,

d) Therapeutic drug monitoring

Need for Therapeutic Drug Monitoring (TDM), Factors to be considered during the TDM.

e) Patient medication history interview

Need for the patient medication history interview, medication interview forms.

f) Drug information services

Drug and poison information centre, different resources of drug information, computerized services, and storage and retrieval of information.

g) Patient counseling

Definition of patient counseling; steps involved in patient counseling and barriers for patient counseling.

h) Investigational use of drugs

Description, principles involved, classification, control, identification, role of hospital pharmacist, advisory committee.

i) Interpretation of Clinical Laboratory Tests

Hematological tests, cardiac function tests, pulmonary function tests, liver function tests, renal function tests

Recommended Books (Latest Edition):

i. Merchant S.H. and Dr. J.S. Quadry. *A textbook of hospital pharmacy*, 4th ed. Ahmadabad: B.S. Shah Prakakshan; 2001.

ii. Parthasarathi G, Karin Nyfort-Hansen, Milap C Nahata. *A textbook of Clinical Pharmacy Practice- essential concepts and skills,* 1st ed. Chennai: Orient Longman Private Limited; 2004.

iii. William E. Hassan. *Hospital pharmacy*, 5th ed. Philadelphia: Lea & Febiger; 1986.

iv. Tipnis Bajaj. *Hospital Pharmacy*, 1st ed. Maharashtra: Career Publications; 2008.

v. Scott LT. *Basic skills in interpreting laboratory data*, 4thed. American Society of Health System Pharmacists Inc; 2009.

vi. Parmar N.S. *Health Education and Community Pharmacy,* 18th ed. India: CBS Publishers & Distributers; 2008.

Journals:

1. Therapeutic drug monitoring. ISSN: 0163-4356
2. Journal of pharmacy practice. ISSN : 0974-8326
3. American journal of health system pharmacy. ISSN: 1535-2900 (online)
4. Pharmacy times (Monthly magazine)

BPharm- Semester VII

COURSE CODE	**PCE-BP704T**
COURSE TITLE	**NOVEL DRUG DELIVERY SYSTEMS (Theory)**

SCOPE/SYNOPSIS	OBJECTIVES/COs
This subject is designed to impart basic knowledge in the area of novel drug delivery systems.	Upon completion of the course, the student shall be able to: 1. Understand various approaches for the development of novel drug delivery systems. 2. Understand the criteria for selection of drugs and polymers for the development of Novel drug delivery systems, their formulation and evaluation.

Course Content and Assessment Plan

Sl No.	Course Content	Syllabus (Chapters or Units with hours)	Marks of assessment	Distribution of marks of assessment		
				Sessional exam (*30% of marks of assessment)*		End Sem exam (*70% of marks of assessment)*
				S1	S2	
1	Student will learn the basics of CDDS and their advantages and disadvantages from various approaches to prepare them.	Unit I (10hrs)	23	8		15
2	Student will learn about techniques involved in the preparation of Microencapsules, Mucosal DDS, Implantable DDS and their evaluation.	Unit II (10hrs)	23	7		16
3	Student will know the preparation of TDDS, Gastro retentive and Naso-pulmanory DDS and their advantages and disadvantages.	Unit III (10hrs)	23		10	13
4	Student will know the basics of Targeted drug delivery systems and their applications.	Unit IV (8hrs)	19		5	14
5	Student will know about the ocular and intra uterine DDS and their applications.	Unit V (7hrs)	17		-	17
	Total marks of assessment		105	15	15	75

PCE-BP704T: NOVEL DRUG DELIVERY SYSTEMS (Theory)

Course Content **45hrs**

Unit-I **10hrs**

Controlled drug delivery systems: Introduction, terminology/ definitions, rationale, advantages, disadvantages and 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 the formulation of controlled release drug delivery systems.

Unit-II **10hrs**

Microencapsulation: Definition, advantages and disadvantages, microspheres/ microcapsules, microparticles, methods of microencapsulation and applications.

Mucosal Drug Delivery system: Introduction, principles of bioadhesion/ mucoadhesion, concepts, advantages and disadvantages, transmucosal permeability and formulation considerations for buccal delivery systems.

Implantable Drug Delivery Systems: Introduction, advantages and disadvantages, concept of implants and osmotic pump.

Unit-III **10hrs**

Transdermal Drug Delivery Systems (TDDS): Introduction, permeation through skin, factors affecting the permeation, permeation enhancers, basic components of TDDS and formulation approaches.

Gastro-retentive drug delivery systems (GRDDS): Introduction, advantages, disadvantages, approaches for GRDDS – Floating, high density systems, inflatable and gastro-adhesive systems and their applications

Naso-pulmonary drug delivery systems: Introduction to nasal and pulmonary routes of drug delivery, formulation of Inhalers (dry powder and metered dose), nasal sprays and nebulizers.

Unit-IV **8hrs**

Targeted drug Delivery: Concepts and approaches, advantages and disadvantages, introduction to liposomes, niosomes, nanoparticles, monoclonal antibodies and their applications.

Unit-V **7hrs**

Ocular Drug Delivery Systems: Introduction, intra ocular barriers and methods to overcome – Preliminary study, ocular formulations and Ocuserts.

Intrauterine Drug Delivery Systems: Introduction, advantages and disadvantages, development of intra uterine devices (IUDs) and applications.

Recommended Books: (Latest Editions)

1. Y.W. Chien, Novel Drug Delivery Systems, 2nd edition, Revised and expanded, Marcel Dekker Inc., New York, 1992.
2. Robinson, J.R., Lee V.H.L, Controlled Drug Delivery Systems, Marcel Dekker Inc., New York, 1992.
3. Encyclopedia of Controlled Delivery. Edith Mathiowitz, Published by Wiley Interscience Publication, John Wiley and Sons, Inc, New York. Chichester/Weinheim
4. N.K. Jain, Controlled and Novel Drug Delivery, CBS Publishers & Distributors, New Delhi, First edition 1997 (reprint in 2001).
5. S.P. Vyas and R.K. Khar, Controlled Drug Delivery -concepts and advances, Vallabh Prakashan, New Delhi, First edition 2002.

Journals

1. Indian Journal of Pharmaceutical Sciences (IPA)
2. Indian Drugs (IDMA)
3. Indian Journal of Pharmaceutical Education and Research
4. Journal of Controlled Release (Elsevier Sciences)
5. Drug Development and Industrial Pharmacy (Marcel & Decker)
6. International Journal of Pharmaceutics (Elsevier Sciences)
7. AAPS PharmSciTech
8. Drug Delivery
9. International Journal of Nanomedicine

BPharm- Semester VII

COURSE CODE	**PRM-BP705T**
COURSE TITLE	**CONSUMER AFFAIRS (Theory)**
SCOPE/SYNOPSIS	OBJECTIVES/COs
Scope/ Synopsis: This subject seeks to familiarize the students with their rights and responsibilities as a consumer, the social framework of consumer rights and legal framework of protecting consumer rights. It also provides an understanding of the procedure of redress of consumer complaints, and the role of different agencies in establishing product and service standards.	Upon completion of the course, the student shall be able to: 1. Learn about market structure and pricing of products. 2. Know about consumer rights and legal provisions. 3. Identify the industry regulators protecting consumer rights. 4. Study contemporary issues in consumer protection movement.

Course Content and Assessment Plan

Sl No.	Course Content	Syllabus (Chapters or Units with hours)	Marks of assessment	Distribution of marks of assessment	
				S1	S2
1	Student will understand the market dynamics, price structures and consumer rights	Unit I (9hrs)	08	08	
2	Student will comprehend consumer rights and learn about national and international statutory organizations advocating protection of consumer rights	Unit II (9hrs)	08	08	
3	Student will understand the methods to file complaints and grievance redressal system under the Consumer Protection Law	Unit III (9hrs)	08	04	04
4	Student will know the role of Industry regulators in consumer protection	Unit IV (9hrs)	08		08
5	Student will study contemporary issues in consumer affairs and statutory standards	Unit V (9hrs)	08		08
	Total marks of assessment		40	20	20

PRM-BP705T: CONSUMER AFFAIRS (Theory)

Course Content **45hrs**

Unit 1: Conceptual Framework **9hrs**

Consumer and Markets: Concept of Consumer, Nature of markets: Liberalization and Globalization of markets with special reference to Indian Consumer Markets, E-Commerce with reference to Indian Market, Concept of Price in Retail and Wholesale, Maximum Retail Price (MRP), Fair Price, GST, labeling and packaging along with relevant laws, Legal Metrology.

Experiencing and Voicing Dissatisfaction: Consumer buying process, Consumer Satisfaction/Dissatisfaction-Grievances-complaint, Consumer Complaining Behaviour: Alternatives available to Dissatisfied Consumers; Complaint Handling Process: ISO 10000 suite

Unit 2: The Consumer Protection Law in India **9hrs**

Objectives and Basic Concepts: Consumer rights and UN Guidelines on consumer protection, Consumer goods, defect in goods, spurious goods and services, service, deficiency in service, unfair trade practice, restrictive trade practice.

Organizational set-up under the Consumer Protection Act: Advisory Bodies: Consumer Protection Councils at the Central, State and District Levels; Adjudicatory Bodies: District Forums, State Commissions, National Commission: Their Composition, Powers, and Jurisdiction (Pecuniary and Territorial), Role of Supreme Court under the CPA with important case law.

Unit 3: Grievance Redressal Mechanism under the Indian Consumer Protection Law **9hrs**

Who can file a complaint? Grounds of filing a complaint; Limitation period; Procedure for filing and hearing of a complaint; Disposal of cases, Relief/Remedy available; Temporary Injunction, Enforcement of order, Appeal, frivolous and vexatious complaints; Offences and penalties.

Leading Cases decided under Consumer Protection law by Supreme Court/National Commission: Medical Negligence; Banking; Insurance; Housing & Real Estate; Electricity and Telecom Services; Education; Defective Products; Unfair Trade Practices.

Unit 4: Role of Industry Regulators in Consumer Protection **9hrs**

i. Banking: RBI and Banking Ombudsman
ii. Insurance: IRDA and Insurance Ombudsman

iii. Telecommunication: TRAI

iv. Food Products: FSSAI

v. Electricity Supply: Electricity Regulatory Commission

vi. Real Estate Regulatory Authority

Unit 5: Contemporary Issues in Consumer Affairs 9hrs

Consumer Movement in India: Evolution of Consumer Movement in India, Formation of consumer organizations and their role in consumer protection, Misleading Advertisements and sustainable consumption, National Consumer Helpline, Comparative Product testing, Sustainable consumption and energy ratings.

Quality and Standardization: Voluntary and Mandatory standards; Role of BIS, Indian Standards Mark (ISI), Ag-mark, Hallmarking, Licensing and Surveillance; Role of International Standards: ISO an Overview

Note: Unit 2 and 3 refers to the Consumer Protection Act, 1986. Any change in law would be added appropriately after the new law is notified

Books:

1. Khanna, Sri Ram, Savita Hanspal, Sheetal Kapoor, and H.K. Awasthi. (2007) *Consumer Affairs,* Universities Press.
2. Choudhary, Ram Naresh Prasad (2005). *Consumer Protection Law Provisions and Procedure,* Deep and Deep Publications Pvt. Ltd.
3. G. Ganesan and M. Sumathy. (2012). *Globalisation and Consumerism: Issues and Challenges*, Regal Publications.
4. Suresh Misra and Sapna Chadah (2012). Consumer Protection in India: Issues and Concerns, IIPA, New Delhi.
5. Rajyalaxmi Rao (2012), *Consumer is King,* Universal Law Publishing Company.
6. Girimaji, Pushpa (2002). *Consumer Right for Everyone* Penguin Books.
7. E-books: www.consumereducation.in
8. Empowering Consumers e-book, www.consumeraffairs.nic.in
9. ebook, www.bis.org
10. *The Consumer Protection Act, 1986 and its later versions.*

Articles

1. Misra Suresh, (Aug 2017) "Is the Indian Consumer Protected? One India One People.
2. Raman Mittal, Sonkar Sumit and Parineet Kaur (2016) Regulating Unfair Trade Practices: An Analysis of the Past and Present Indian Legislative Models, Journal of Consumer Policy.
3. Chakravarthy, S. (2014). MRTP Act metamorphoses into Competition Act. CUTS Institute for Regulation and Competition position paper. Available online at www.cuts-international.org/doc01.doc.
4. Kapoor Sheetal (2013) "Banking and the Consumer" Akademos (ISSN 2231-0584)

5. Bhatt K. N., Misra Suresh and Chadah Sapna (2010). Consumer, Consumerism and Consumer Protection, Abhijeet Publications.
6. Kapoor Sheetal (2010) "Advertising-An Essential Part of Consumer's Life-Its Legal and Ethical Aspects", Consumer Protection and Trade Practices Journal, October 2010.
7. Verma, D.P.S. (2002). Regulating Misleading Advertisements, Legal Provisions and Institutional Framework. Vikalpa. Vol. 26. No. 2. pp. 51-57.

Periodicals

Consumer Protection Judgments (CPJ) (Relevant cases reported in various issues).

1. Recent issues of magazines: International Journal on consumer law and practice, National Law School of India University, Bengaluru.
2. '*Consumer Voice*', Published by VOICE Society, New Delhi.

Websites:

www.ncdrc.nic.in

www.consumeraffairs.nic.in

www.iso.org

www.bis.org.in

www.consumereducation.in

www.consumervoice.in

www.fssai.gov.in

www.cercindia.org

BPharm- Semester VII

COURSE CODE	**BP707PS**
COURSE TITLE	**PRACTICE SCHOOLS (PRACTICAL)**
SCOPE/SYNOPSIS	**OBJECTIVES/COs**
Scope/ Synopsis: The Undergraduate students of MCOPS are interested in higher education. To facilitate their aspirations this course is designed to tune the students and orient themselves for higher education. Further it forms the basis for selecting project work in their 8th semester.	Upon completion of the course, the student shall be able to: 1. Demonstrate skills that would suit development of business and benefit of society 2. Perform assigned modules individually and as team to understand the complexity of health care system. 3. Cultivate a sense of understanding to undertake a project, its financial implication and necessity for continuous learning. 4. Handle modern tools and sophisticated instruments used in drug testing, discovery and development process.

BP707PS - PRACTICE SCHOOL

BP-PCE-707PS : The School of Formulation Development & Manufacturing Pharmaceuticals

Host Department: Pharmaceutics

Objectives:

- To impart the knowledge on the SOP, cGMP, regulatory requirements, handling of advanced instruments used in the development of various dosage forms.
- To equip the students with various technical, industrial and manufacturing aspects involved in the development of conventional as well as novel drug delivery systems including nano-formulations

Contents Delivery:

- Lectures, Case studies, Task based learning, Hands-on-training, Practical demonstrations, Virtual demonstration

Knowledge and Skills:

At the end of this Practice School, the students will be able to -

- Understand cGMP, regulatory guidelines, SOPs
- Learn the practical and technical skills with respect to operation and handling of the instruments
- Acquire practical and technical knowledge on Preformulation, Formulation, Quality Control, Scale-up, Stability and Packaging of Pharmaceutical dosage forms including nano formulations

Course Contents and Assessment Plan:

Module I: Introduction to Pharmaceutical Product Development

Contents: Regulatory guidelines (USFDA, EMA, Australia, India - Web search & case studies), General aspects of Formulation development (Vendor and excipients (IIG) Selection, Theoretical aspects of preformulation, Generic Product Development and Formulation design using QbD and DoE)

Module II: Instrument Handling

Contents: SOP making & handling and Handling of instruments such as Tableting machine, Coating machine, Colloid Mill, FBP, FBD, Lyophilizer, Dissolution apparatus, Diffusion cell, Zeta Sizer, HME, HPH, Viscometer

Module III: Industrial Aspects of Conventional DDS – I: Solid Orals and Liquid Orals

Contents: Preformulation, Unit operations, Manufacturing, Quality aspects, Packaging, Scale up & Process validation, Product Development report, Stability aspects and Technology transfer

Module IV: Industrial Aspects of Conventional DDS – II: Parenteral and Semisolids dosage forms

Contents: Preformulation, Unit operations, Manufacturing, Quality aspects, cGMP, Personnel hygiene, Packaging, Scale up & Process validation, Stability aspects, Technology transfer

Module V: Novel Drug Delivery Systems: Preparation and evaluation

Contents: Preformulation, Preparation, Characterization and Stability aspects of Transdermal systems, Lipid/ Polymeric Nanoparticles, Self-emulsifying DDS

Mode of Assessment:

- **Continuous Mode:** 25 Marks (by MCQs, short report, test, attendance, etc)
- **End Sem:** 125 Marks (Report – 75 Marks and Presentation and viva – 50 Marks)

BP-PCH-707PS : The School of Drug design and Process Chemistry

Host Department: Pharmaceutical Chemistry

Objective : To train the students in drug design and synthetic techniques and make them fit for pharmaceutical industry and research.

Contents delivery:

Lectures, task based learning, hands on training, practical demonstrations and experiments and virtual demonstrations.

Knowledge and Skills:

- At the end of this Practice School the students will be able to:
- Understand the documentation of research work and basics of drug design using insilico techniques
- Learn the basics of experimental chemistry which includes practical and technical skills in the handling of chemicals, their preparation, storage, purification and separation techiniques.
- Acquire practical and technical knowledge in the synthesis of intermediates / API by conventional or microwave assisted technique, reaction monitoring, reaction workup and characterization of the compounds using spectroscopic techniques.

Module-I:

- Documentation of research work.
- Basics of drug design: Introduction to computational techniques in drug design.
- Target selection and preparation, Homology modelling, Ligand preparation, Receptor grid generation, Molecular docking, ADMET prediction.
- Molecular dynamic simulation.

Module-II:

- QSAR and Pharmacophore modeling
- Virtual screening of data bases
- Scifinder database searching

Module-III:

- Basic Experimental techniques in Chemistry
- Introduction to calculations
- Introduction to hazardous chemicals, Material Safety Datasheet (MSD), handling and safety of hazardous chemicals. Disposal of waste.
- Reagent preparation, labeling and storage.
- Purification of organic solvents.
- Polarity index and solvent miscibility.
- Purification techniques ---- Crystallization-Solvent selection for crystallization.
- Column chromatography- Mobile phase selection, column preparation, sample loading techniques and separation of components present in a mixture.

Module-IV:

- Synthesis of intermediates / API using Conventional and Microwave assisted synthetic techniques.
- Reaction monitoring
- Reaction workup

Module-V:

- Characterization of synthesized compounds by M.P, UV, IR, NMR & Mass spectral techniques

Mode of Assessment (Evaluation):

- Continuous Mode: 25 Marks (by MCQs, short report, test, attendance, etc)
- End Sem : 125 Marks (Report – 75 Marks and Presentation and viva – 50 Marks)

BP-PQA-707PS : The School of Pharmaceutical QC and QA

Host Department: Pharmaceutical Quality Assurance

Objectives:

- To equip the students with the concept and procedures of Quality Control and Quality Assurance in Pharmaceutical Industry.
- To impart knowledge on the standards, specifications and documentation requirements in Pharmaceutical Industry.
- To equip the students with the technique of analytical method development and validation process for quality control on sophisticated instruments such as UV-Spectrometer/HPLC/LC-MS/GC-MS etc.

Course contents (Modules):

Module I: Introduction to Quality Control Testing of Pharmaceuticals

Course contents: Pharmacopoeial standards and specifications, collecting monograph details, preparation of Standard Testing Protocol (STP), performing monograph analysis of selected drugs, specification matching and inference drawing.

Module II: Introduction to Quality Assurance of Pharmaceuticals

Course contents: Calibration of glassware/instrument, Validation and qualification of equipment, Preparation of Audit checklist for GMP, SOP preparation, Stability testing and ICH zones, In Process QC/In Process QA/Stability QA, Case studies on change control, Deviation, Out of Specification (OOS), Out of Trend (OOT) etc., Compliance specifications of ICH and FDA.

Module III: Analytical method development using HPLC

Course contents: Introduction to HPLC operation and software, creation of batch table, sample run, data integration, report generation. Mobile phase selection, solvent strength and selectivity, preparation of buffer. Column specifications, column chemistry and separation, selection of column. Detector selection, and optimization. Optimization of other chromatographic conditions to ensure reproducible separation.

Module IV: Analytical method validation (UV-Spectrometer/HPLC/LC-MS)

Course contents: Preparation of calibrators and quality control solutions, performing method validation as per the FDA guidelines. Determination of Linearity, LOD, LOQ, Accuracy and Precision. Specification matching and inference drawing.

Module V: Good documentation practices and preparation of reports

Course contents: Quality documentation, its importance and impact in the regulatory environment. Case studies and designing on different levels of documentation, Data integrity and its importance with case studies. Real time audit as an auditor to check the integrity of data in instrument flat form along with related documents. Preparation of QC & QA protocols and reports such as Instrument calibration reports, Instrument qualification protocols and reports, Analytical method validation protocols and reports, Training reports (Personnel, SOP, instrument operation etc.), Preparation of certificate of Analysis (CoA) for API (Active Pharmaceutical Ingredient), Excipients and Packaging material.

Week 6 (Evaluation): Submission of Report, Presentation and Viva.

At the end of module V, students will be submitting the report on the school and will present the report in front of the evaluators.

Content Delivery:

- Lectures, Case studies, Task based learning, Hands-on-training, Practical demonstrations, Virtual demonstration

Knowledge and Skills:

At the end of this Practice School, the students will be able to -

- Understand the practice of Quality Control and Quality Assurance in Pharmaceutical Industry.
- Understand the Pharmacopoeal and other regulatory standards and specifications.
- Learn the technical skills in operating and handling of sophisticated analytical instruments like HPLC, UV-Spectrometer etc.
- Acquire practical and technical knowledge on calibration of instruments and validation of analytical methods.
- Acquire skills in Good Documentation Practices and report writing.

Mode of Assessment :

- Continuous Mode: 25 Marks (by MCQs, short report, test, attendance, etc)
- End Sem : 125 Marks (Report – 75 Marks and Presentation and viva – 50 Marks)

BP-PBT-707PS : The School of Microbiological Evaluation and Testing

Host Department: Pharmaceutical Biotechnology

Objectives:
This training is designed to impart knowledge and basic skills needed for carrying out evaluation and testing of drugs and environment using microorganisms.

Contents Delivery:
- Lectures, Case studies, Task based learning, Hands-on-training, Practical demonstrations, Virtual demonstration

Knowledge and Skills:
At the end of this Practice School, the students will be able to -
- Know the importance and methods involved in microbiological testing of pharmaceutical products and environment.
- Understand the importance of microbiological evaluation in quality control of pharmaceutical preparations.
- Acquire practical and technical knowledge on microbial quality control tests.

Course Contents and Assessment Plan:

Module I: Introduction to microbial evaluation and testing of Pharmaceutical products

Contents: Preparation and sterilization of media, good laboratory practices. Procurement of standard microbial cultures and their maintenance.

Module II: Microbiological assay of antibiotics and vitamins

Contents: Preparation of media, standard solution, sample solution and inoculum. Estimation of potency by cylinder plate or cup plate method and turbidimetiric or tube assay method (i) One level assay with standard curve and (ii) Two level factorial assay.

Module III: Evaluation of non-sterile products

Contents: Evaluation of liquid orals, solid dosage forms for microbial limit test and presence of specific microorganisms. Preliminary testing and study of various culture media used in the identification of microorganisms. Total aerobic microbial count: for water soluble and insoluble products. Tests for specified microorganisms

Module IV: Evaluation of sterile products

Contents: Evaluation of sterility for detecting the presence of viable forms of microorganisms in or on pharmacopoeial preparations. Determination of minimum number of items recommended to be tested. Culture media used, growth promotion test, standard microorganisms to be used. Test procedure: Method A: Membrane filtration and Method B: Direct inoculation test

Module V: Evaluation of environment

Contents: Testing of air and water for microbial load and contamination. Testing the potability of water: indicator organisms, multiple tube method to test the presence of coliforms and confirmatory tests. Air sampling methods and microbial count analysis.

Mode of Assessment:
- Continuous Mode: 25 Marks (by MCQs, short report, test, attendance, etc)
- End Sem: 125 Marks (Report – 75 Marks and Presentation and viva – 50 Marks)

BP-PPR-707PS : The School of Clinical Pharmacy Practice

Host Department: Pharmacy Practice

Objectives:

- To impart the knowledge on the various clinical pharmacy services
- To understand the concept of pharmaceutical care

Contents Delivery:

- Lectures, Case studies, Task based learning, Hands-on-training, Practical demonstrations, Virtual demonstration

Knowledge and Skills:

At the end of this Practice School, the students will be able to -

- Understand to provide various clinical pharmacy services like providing drug information, assessing drug-drug interactions, patient counselling and reporting and monitoring ADRs
- Acquire skill to assess the therapy using SOAP format and to provide pharmaceutical care

Course Contents and Assessment Plan:

Module I: Introduction to Pharmacy practice and providing drug information

Contents:

- Establishing a drug and poison information center.
- Resources used: Primary/secondary/tertiary resources.
- Various software's used in drug and poison information and its use in Drug Information. Detail hands on Micromedex and Poisonedex
- Orientation on various databases like Pub-Med, Scopus
- Modified systematic approach to provide drug information
- Documentation

Module II: Assessing Drug-drug Interactions

Contents:

- Assessing for drug-drug interactions
- Pharmacokinetic and Pharmacodynamic Drug interactions
- Assessment of onset and severity of Drug Interactions
- Management of Drug interactions
- Documentation

Module III: Providing patient medication counselling

Contents:

- Patient medication counseling
- Demonstration of counseling aids
- Documentation

Module IV: ADR reporting and monitoring

Contents:

- Identification of ADRs
- ADR reporting and monitoring
- Causality and Severity assessment
- Applying various reporting system of Reporting of ADR

Module V: Providing Pharmaceutical care

Contents:

- Data retrieval from medical records
- Preparation of patient profile
- SOAP analysis

Mode of Assessment (Evaluation):

- Continuous Mode: 25 Marks (by MCQs, short report, test, attendance, etc)
- End Sem : 125 Marks (Report – 75 Marks and Presentation and viva – 50 Marks)

BP-PHA-707PS : The School of Preclinical Evaluation

Host Department: Pharmacology

Objectives:

1. Understand basic concepts and evolving changes in preclinical evaluation of medicines
2. Appreciate in silico, in vitro and in vivo challenges in preclinical evaluation of medicines
3. Gain the prerequisite skills in preclinical assessment of medicines

Contents Delivery:

- Lectures, Case studies, Task based learning, Hands-on-training, Practical demonstrations, Virtual demonstration

Knowledge and Skills:

At the end of this Practice School, the students will be able to -

- Understand fundamental of preclinical evaluation
- Learn the practical and technical skills with respect to *in-silico, in vitro* and *in vivo* evaluation of new chemical entities
- Acquire practical and technical knowledge on molecular techniques used to explore the mechanism of drug action.

Course Contents and Assessment Plan:

Module I: Fundamentals of preclinical pharmacology

Contents: Traditional pharmacological experiments, Definitions & components of preclinical evaluation. Ethics in pharmacological experiments in animal experiments & biosafety in genetic/genomic pharmacology experiments. Isolated tissue experiments: Glucose uptake/ Absorption

Module II: *In silico* & Systems Pharmacology

Contents: Definition of in silico and systems pharmacology including network pharmacology, Protein structure & drug targets, their simulation in computer; Docking, prediction of drug-likeness, & activity by docking scores, MD simulations; Toxicity predictions; In silico designing targets; In silico docking experiments.

Module III: *In vitro* pharmacology

Contents: Difference between in vitro and ex vivo experiments Advantages of in vitro and basic techniques. Cel lines & Tissue culture advances in *in vitro* assays (MTT & SRB), In vitro ADMET models; In vitro antioxidant assay (DPPH, LPO); Enzyme inhibition assays; Cytotoxicity/ Anticancer activity – MTT assay

Module IV: *In vivo* pharmacology

Contents: Ethics in animal experiments; 3Rs, Alternative to animal experiments; Basic skills of in vivo experiments; PK models in animals & disease models for diseases, humanizing the disease model; Haematology; Liver & Kidney function test; Estimation of blood concentration of drugs using spectroscopic/ HPLC methods.

Module V: Molecular tools to explore drug action

Contents: Principles involved in advanced pharmacological instruments and their applications; Advanced experiments in pharmacology; Demonstration or Hands-on training on following instruments; PCR; Western blot; Microscopy; Flowcytometry

Mode of Assessment:

- **Continuous Mode:** 25 Marks (by MCQs, short report, test, attendance, etc)
- **End Sem:** 125 Marks (Report – 75 Marks and Presentation and viva – 50 Marks)

BP-PCO-707PS: The School of Herbal Technology

Host Department: Pharmacognosy

Objectives:

- To impart knowledge and basic skills needed for preparation of herbal manograph for setting standards for future reference
- To impart the knowledge on development of Simple herbal dosage forms.

Contents Delivery:

- Lectures, Task based learning, Hands-on-training, Practical demonstrations.

Knowledge and Skills:

At the end of this Practice School, the students will be able to –

1. Identify, authenticate the plant material and preparation of herbarium specimen.
2. Gain knowledge and skills in preparation of herbal plant monograph as reference material
3. Develop skills and knowledge in development of simple herbal dosage forms
4. Gain knowledge and practical skills in handling HPTLC instrument in developing plant finger print profile.
5. Develop skills to gather, organize, deliver information in the form of a write-up, and defend a given topic in herbal research. And acquire communication and presentation skills
6. Develop skills to work in a group with cooperative learning culture and coordination

Course Contents and Assessment Plan:

Module I: Selection of the plant

Contents: Introduction, Literature review, Selection, authentication and collection of the plant, Ethno botanical information, Techniques for preparation of herbarium specimen and its importance

Module II: Macroscopic evaluation

Contents: Macroscopy – Description of the plant, Organoleptic characters, Foreign Matter – Foreign plants, animals and minerals contaminates

Module III: Microscopic evaluation

Contents: Microscopy – Histology, Linear measurements and Leaf constants

Module IV: Physico-chemical /Toxicological parameters

Contents: Ash values – Total ash, Acid insoluble ash and water soluble ash, Extractive values – Water, Ether and alcohol soluble. Moisture content and volatile matter, Volatile oil determination, Chemical – Various qualitative identification tests for chemical constituents, TLC/HPTLC plant Finger print profile, Heavy metals, Microbial contamination/aflatoxins

Module V: Therapeutic claims and dosage forms

Contents: Adulterants/Substitutes, major therapeutic claims and preparation of a simple dosage form

Mode of Assessment:

- **Continuous Mode:** 25 Marks (by MCQs, short report, test, attendance, etc)
- **End Sem:** 125 Marks (Report – 75 Marks and Presentation and viva – 50 Marks)

BP-PRM-707PS : The School of Pharmaceutical Marketing and Business Administration

Host Department: Pharmacy Management

Objectives:

- To orient undergraduate students of Bachelor of Pharmacy in the tools, techniques and recent trends in the pharmaceutical marketing and business administration
- To equip students with required knowledge and practice in the pharmaceutical industry and entrepreneurship
- To enable students to be industry ready supplemented with business data analytics skills

Contents

Delivery:

- Hands on Training in Visual Aid and Digital Marketing Technology Based learning, Experiential Learning. Dossier Access and Analysis, Patent Search Techniques, Patent Specification and claims drafting, Hands on Training on Professional Communication, Role Play Business Project Planning and Development

Knowledge and Skills:

At the end of this Practice School, the students will be able to -

- Understand use of technology in marketing through digital platforms and designing of visual aids
- Learn the practical and technical skills regulator dossier access and analysis
- Acquire practical knowledge on patent search and specifications
- Illustrate professional communication through planning and role play.

Course Contents and Assessment Plan:

Module I: Pharmaceutical Marketing and Management

Contents: Tools and Techniques in Pharmaceutical Marketing and Management, Recent trends in marketing management, Detailing and Visual Aid , Digital Marketing, Product Management , Heatlh Economics

Module II: Regulatory Affairs

Contents: Regulatory Management and Documentation, Current Drug Regulations, Cosmeceuticals and Nutraceutical regulations, Medical Device Regulations, Biological Drug Regulations, Pharmacovigilance

Module III: Intellectual Property Management

Contents: Intellectual Property Practice and Management, Types of Intellectual Property, Patent Search, Patent Specifications, Copyrights, Designs and Trademarks, Patent Landscape

Module IV: Professional Development and Entrepreneurship

Contents: Professional and Personal Development, Oral and Written communication, Designing CV/Resume, Preparing for job interviews, Pharmaceutical Data Analytics, Entrepreneurship

Mode of Assessment:

- **Continuous Mode:** 25 Marks (short reports, attendance, presentations etc)
- **End Sem:** 125 Marks (Report – 75 Marks and Presentation and viva – 50 Marks)

BPharm

SEMESTER VIII : COURSE WORK

Table-VIII: Course of study for semester VIII					
Course code	**Name of the course**	**No of hours/wk**			**Credit points (C)**
		Lecture (L)	**Tutorial (T)**	**Practical (P)**	
PHA-BP801T	Biostatistics and Research Methodology (Theory)	3	1	--	4
PPR-BP802T	Social and Preventive Pharmacy (Theory)	3	1	--	4
Group A					
PRM-BP803ET	Pharma Marketing Management (Theory)	3	1	--	4
PQA-BP804ET	Pharmaceutical Regulatory Science (Theory)				
PPR-BP805ET	Pharmacovigilance (Theory)				
PCO-BP806ET	Quality Control and Standardization of Herbals (Theory)				
PQA-BP811ET	Advanced Instrumentation Techniques (Theory)				
Group B					
PCH-BP807ET	Computer Aided Drug Design (Theory)	3	1	--	4
PBT-BP808ET	Cell and Molecular Biology (Theory)				
PCE-BP809ET	Cosmetic Science (Theory)				
PHA-BP810ET	Pharmacological Screening Methods (Theory)				
PCE-BP812ET	Dietary Supplements and Nutraceuticals (Theory)				
BP813PW	Project Work	--	--	12	6
	Total	**12**	**4**	**12**	**22**

BPharm VIII Semester - COs POs Mapping														
Sl No..	**Course Code**	**Course Name**	**Credits**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
61	PHA-BP801T	Biostatistics and Research Methodology (Theory)	4	CO1 CO2	CO1 CO2		CO2			CO1				
62	PPR-BP802T	Social and Preventive Pharmacy (Theory)	4		CO1 CO2 CO3 CO4 CO5			CO1 CO2 CO3 CO4 CO5		CO1 CO4 CO5	CO4 CO5	CO4 CO5		CO1 CO2 CO3 CO4 CO5
63	BP813PW	Project Work	6	CO1 CO2 CO3 CO4 CO5 CO6	CO1 CO2 CO3 CO4 CO5	CO1 CO2 CO3	CO2 CO3 CO4 CO5	CO2 CO5 CO6	CO5	CO1 CO3 CO4	CO3 CO4 CO5	CO4 CO5 CO6	CO1 CO2 CO4	CO1 CO5 CO6

BPharm - Semester VIII

COURSE CODE	**PHA-BP801T**
COURSE TITLE	**BIOSTATISTICS AND RESEARCH METHODOLOGY (Theory)**

SCOPE/SYNOPSIS	OBJECTIVES/COs
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, observational, experimental studies and statistical software.	Upon completion of this course the student shall be able to: 1. Know the various components of research design and methodology. 2. Appreciate statistical techniques in solving the research problems.

Course Content and Assessment Plan

Sl No.	Course Content	Syllabus (Chapters or Units with hours)	Marks of assessment	Distribution of marks of assessment		
				Sessional exam (*30% of marks of assessment)*		End Sem exam (*70% of marks of assessment)*
				S1	S2	
1	Student will learn the method of literature search, hypothesis development, design of protocol and ethics in research publications	Unit I (10hrs)	22	7		15
2	Student will the basic statistical principles and their application in solving the problems related to pharmaceutical research.	Unit II (10hrs)	26	8		18
3	Student will the calculations and solve the statistical problems related to regression, probability and parametric tests for data analysis.	Unit III (10hrs)	26		9	17
4	Student will the method to solve the given problem using a non-parametric test and their graphical representation.	Unit IV (10hrs)	23		6	17
5	Student will learn the application of software in calculating, data entry, analysis and inference from scientific data	Unit V (5hrs)	8		--	8
		Total marks of assessment	105	15	15	75

PHA-BP801T: BIOSTATISTICS AND RESEARCH METHODOLOGY (Theory)

Course Content **45hrs**

Unit-I **10hrs**

Introduction to Research: Importance of literature review**.** Need for research. Formulation of a research question, Protocol development, Hypothesis testing, research publication, plagiarism and ethics in research.

Unit-II **10hrs**

Introduction: Statistics, Biostatistics, Frequency distribution

Measures of central tendency: Mean, Median, Mode

Measures of dispersion: Dispersion, Range, standard deviation

Correlation: Definition, Karl Pearson's coefficient of correlation, multiple correlation

Unit-III **10hrs**

Regression: Curve fitting by the method of least squares, fitting the lines y= a + bx and x = a + by, Multiple regression, standard error of regression.

Probability: Definition of probability, Binomial distribution, Normal distribution, Poisson's distribution.

Sample, Population, large sample, small sample, Null hypothesis, alternative hypothesis, sampling, types of sampling, type I Error, type II Error, Standard error of mean (SEM)

Parametric test: t-test (Sample, Pooled or Unpaired and Paired), ANOVA, (One way and Two way), Least Significance difference.

Unit-IV **10hrs**

Non Parametric tests: Wilcoxon Rank Sum Test, Mann-Whitney U test, Kruskal-Wallis test, Friedman Test

Graphs: for data representation.

Clinical studies: Basic terminologies- Type of studies, placebo, bias, blinding, randomization etc.

Unit-V **5hrs**

Introduction to statistical software - Excel, SPSS, GraphPad Prism etc.

Recommended Books (Latest edition):

1. Statistics from Square One. BMJ
2. Pharmaceutical Statistics- Practical and clinical applications, Sanford Bolton, Marcel Dekker Inc. New York.
3. Fundamental of Statistics – Himalaya Publishing House- S.C. Gupta
4. Methods in Biostatistics. Jaypee publications. B.K. Mahajan.
5. Design and Analysis of Experiments – Wiley Students Edition, Douglas and C. Montgomery

BPharm - Semester VIII

COURSE CODE	PPR-BP802T
COURSE TITLE	SOCIAL AND PREVENTIVE PHARMACY (Theory)

SCOPE/SYNOPSIS	OBJECTIVES/COs
This course aims to introduce the students with common health issues, their challenges and various national health programs. Besides, the course also imparts knowledge and skills for optimizing the drug therapy by individualizing the treatment plan.	Upon completion of this course the student shall be able to: 1. Acquire knowledge of current issues related to health and its problems within country and globally. 2. Critically think on current healthcare development. 3. Evaluate alternative ways of problem solving related to health issues. 4. Summarize the therapeutic approaches for management of various disease condition and prepare individualized therapeutic plans. 5. Identify the patient specific parameters relevant in initiating drug therapy and monitoring therapy.

Course Content and Assessment Plan

SL No.	Course Content	Syllabus (chapters or Units with hours)	Marks of assessment	Distribution of marks of assessment		
				Sessional exam (*30% of marks of assessment)*		End Sem exam (*70% of marks of assessment)*
				S1	S2	
1	Student will learn the concepts of health & disease, social & health education, hygiene and general principles of prevention and control of diseases	Unit I (12hrs)	28	10		18
2	Student will understand national health programs, its objectives, functioning and outcomes	Unit II (8hrs)	19	5		14
3	Student will understand national intervention programs and role of WHO for maternity and child health, geriatric healthcare, family welfare, tobacco control, malaria prevention; and community services in rural, urban and school health	Unit III (10hrs)	23		10	13
4	Student will learn the pathogenesis and pharmacotherapy of major non-communicable diseases	Unit IV (10hrs)	23		5	18

5	Student will learn the pathogenesis and pharmacotherapy of important infectious diseases	Unit V (5hrs)	12		-	12
Total marks of assessment			105	15	15	75

PPR-BP802T: SOCIAL AND PREVENTIVE PHARMACY (Theory)

Course Content **45hrs**

Unit I: **12hrs**

Concept of health and disease: Definition, concepts and evaluation of public health. Understanding the concept of prevention and control of disease, social causes of diseases and social problems of the sick.

Social and health education: Food in relation to nutrition and health, balanced diet, nutritional deficiencies, vitamin deficiencies, malnutrition and its prevention.

Sociology and health: Socio cultural factors related to health and disease, impact of urbanization on health and disease, poverty and health.

Hygiene and health: Personal hygiene and health care; avoidable habits.

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 and drug addiction-drug substance abuse.

Unit II: **08hrs**

National health programs, its objectives, functioning and outcome of the following:
HIV & AIDS control program, TB, integrated disease surveillance program (IDSP), national leprosy control program, national mental health program, national program for prevention and control of deafness, universal immunization program, national program for control of blindness, pulse polio program.

Unit III: **10hrs**

National health intervention program for mother and child, national family welfare program, national tobacco control program, national malaria prevention program, national program for the health care for the elderly, social health program; role of WHO in Indian national program.

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.

Unit IV: **10hrs**

Problem based learning of selected major non-communicable diseases

Introduction to interpretation of laboratory data, SOAP analysis. Understanding of pathogenesis and pharmacotherapy of: hypertension, myocardial infarction, diabetes mellitus, asthma, anemia, epilepsy, stroke, rheumatoid arthritis, alcoholic liver diseases.

Unit V: **5hrs**

Problem based learning of selected major infectious diseases

Understanding of pathogenesis and pharmacotherapy of: urinary tract infections, tuberculosis, HIV and opportunistic infections

Recommended Books (Latest Edition):

1. Short Textbook of Preventive and Social Medicine, Prabhakara GN, 2nd Edition, 2010, ISBN: 9789380704104, JAYPEE Publications
2. Textbook of Preventive and Social Medicine (Mahajan and Gupta), Edited by Roy Rabindra Nath, Saha Indranil, 4th Edition, 2013, ISBN: 9789350901878, JAYPEE Publications
3. Review of Preventive and Social Medicine (Including Biostatistics), Jain Vivek, 12th Edition, 2020, ISBN: 9789389776843, 9389776848, JAYPEE Publications
4. Essentials of Community Medicine – A Practical Approach, Hiremath Lalita D, Hiremath Dhananjaya A, 2nd Edition, 2012, ISBN: 9789350250440, JAYPEE Publications
5. Park Textbook of Preventive and Social Medicine, K Park, 25st Edition, 2019, ISBN-14: 9788190128285, BANARSIDAS BHANOT PUBLISHERS.
6. Community Pharmacy Practice, Ramesh Adepu, BSP publishers, Hyderabad. **Publisher:** PharmaMed Press (2015)
7. Clinical Pharmacy and Therapeutics, Roger Walker and Cate Whittlesea, 5th Edition,2011 ISBN 978-0-7020-4293-5, Churchill Livingstone.
8. Pharmacotherapy: A Pathophysiologic Approach, Joseph T.Dipiro, 11th Edition. 2020 ISBN: 978-0-07-180054-9, McGraw-Hill.

Recommended Journal

Research in Social and Administrative Pharmacy, Elsevier, Ireland.

BPharm - Semester VIII

COURSE CODE	PRM-BP803ET
COURSE TITLE	PHARMA MARKETING MANAGEMENT (Theory)

SCOPE/SYNOPSIS	OBJECTIVES/COs
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 challenging role in sales and product management	Upon completion of this course the student shall be able to: Explain the marketing concepts and techniques and their applications in the pharmaceutical industry.

Course Content and Assessment Plan

SL No.	Course Content	Syllabus (Chapters or Units with hours)	Marks of assessment	Distribution of marks of assessment		
				Sessional exam (*30% of marks of assessment)*		End Sem exam (*70% of marks of assessment)*
				S1	S2	
1	Student will learn pharmaceutical marketing concepts and consumer behavior	Unit I (10hrs)	23	8		15
2	Student will learn about product life cycle and skills required for PMT	Unit II (10hrs)	23		8	15
3	Student will gain knowledge about promotional mix	Unit III (10hrs)	23	7		16
4	Student will understand and learn about distribution channels in pharmaceutical marketing as well as roles of professional sales representatives	Unit IV (10hrs)	23		7	16
5	Student will learn pricing strategies and current trends in pharmaceutical marketing	Unit V (5hrs)	13			13
Total marks of assessment			105	15	15	75

PRM-BP803ET: PHARMA MARKETING MANAGEMENT (Theory)

Course Content **45hrs**

Unit I **10hrs**

Marketing:

Definition, general concepts and scope of marketing; Distinction between marketing & selling; Marketing environment; Industry and competitive analysis; Analyzing consumer buying behavior; industrial buying behavior.

Pharmaceutical market:

Quantitative and qualitative aspects; size and composition of the market; demographic descriptions and socio-psychological characteristics of the consumer; market segmentation & targeting. Consumer profile; Motivation and prescribing habits of the physician; patients' choice of physician and retail pharmacist. Analyzing the Market; Role of market research.

Unit II **10hrs**

Product decision:

Classification, product line and product mix decisions, product life cycle, product portfolio analysis; product positioning; New product decisions; Product branding, packaging and labeling decisions, Product management in pharmaceutical industry.

Unit III **10hrs**

Promotion:

Methods, determinants of promotional mix, promotional budget; An overview of personal selling, advertising, direct mail, journals, sampling, retailing, medical exhibition, public relations, online promotional techniques for OTC Products.

Unit IV **10hrs**

Pharmaceutical marketing channels:

Designing channel, channel members, selecting the appropriate channel, conflict in channels, physical distribution management: Strategic importance, tasks in physical distribution management.

Professional sales representative (PSR):

Duties of PSR, purpose of detailing, selection and training, supervising, norms for customer calls, motivating, evaluating, compensation and future prospects of the PSR.

Unit V **05hrs**

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.

Recommended Books: (Latest Editions)

1. Philip Kotler and Kevin Lane Keller: Marketing Management, Prentice Hall of India, New Delhi.
2. Walker, Boyd and Larreche: Marketing Strategy- Planning and Implementation, Tata MC GrawHill, New Delhi.
3. Dhruv Grewal and Michael Levy: Marketing, Tata MC Graw Hill.
4. Arun Kumar and N Menakshi: Marketing Management, Vikas Publishing, India.
5. Rajan Saxena: Marketing Management; Tata MC Graw-Hill (India Edition).
6. Ramaswamy, U.S & Nanakamari, S: Marketing Managemnt: Global Perspective, Indian Context, 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.

BPharm - Semester VIII

COURSE CODE	**PQA-BP804ET**
COURSE TITLE	**PHARMACEUTICAL REGULATORY SCIENCE (Theory)**

SCOPE/SYNOPSIS	OBJECTIVES/COs
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 of registration procedures for marketing the drug products.	Upon completion of the course student shall be able to: 1. Know about the process of drug discovery and development 2. Know the regulatory authorities and agencies governing the manufacture and sale of pharmaceuticals 3. Know the regulatory approval process and their registration in Indian and international markets

Course Content and Assessment Plan

Sl No.	Course Content	Syllabus (Chapters or Units with hours)	Marks of assessment	Distribution of marks of assessment		
				Sessional exam (*30% of marks of assessment)*		End Sem exam (*70% of marks of assessment)*
				S1	S2	
1	Student will understand the process of new drug development.	10	23	8		15
2	Student will learn the process of drug approval in the United States of America, understand the structure, functioning and application process of selected regulatory agencies.	10	23	7		16
3	Student will learn the drug registration requirements in overseas markets (in particular, USA, and ASEAN) by Indian manufacturers.	10	23		7	16
4	Student will know the basics and requirements for the conduct of clinical trials.	8	19		5	14
5	Student will understand the concepts and terminologies of Drug regulatory affairs.	7	17		3	14
	Total marks of assessment		105	15	15	75

PQA-BP804ET: PHARMACEUTICAL REGULATORY SCIENCE (Theory)

Course Content **45hrs**

Unit I **10hrs**

New Drug Discovery and development

Stages of drug discovery and development process including pre-clinical/animal and clinical studies. Concept of Innovator drugs and generics. Generic drug product development.

Unit II **10hrs**

Regulatory Approval Process

Approval processes and timelines involved in Investigational New Drug (IND), New Drug Application (NDA), Abbreviated New Drug Application (ANDA). Changes to an approved NDA / ANDA.

Regulatory authorities and agencies

Overview of regulatory authorities of India, United States, European Union, Australia, Japan, Canada (Organization structure and types of applications)

Unit III **10hrs**

Registration of Indian drug product in overseas market

Procedure for export of pharmaceutical products, Technical documentation, Drug Master Files (DMF), Common Technical Document (CTD), electronic Common Technical Document (eCTD), ASEAN Common Technical Document (ACTD).

Unit IV **8hrs**

Clinical trials

Developing clinical trial protocols, Institutional Review Board / Independent Ethics committee - formation and working procedures, Informed consent process and procedures, GCP obligations of Investigators, sponsors & Monitors, Managing and Monitoring clinical trials, Pharmacovigilance - safety monitoring in clinical trials

Unit V **7hrs**

Regulatory Concepts

Basic terminology, guidance, guidelines, regulations, Laws and Acts, Orange book, Federal Register, Code of Federal Regulations, Purple book.

Recommended books (Latest edition):

1. Drug Regulatory Affairs by Sachin Itkar, Dr. N.S. Vyawahare, Nirali Prakashan.
2. The Pharmaceutical Regulatory Process, Second Edition Edited by Ira R. Berry and Robert P. Martin, Drugs and the Pharmaceutical Sciences,Vol.185. Informa Health care Publishers.
3. New Drug Approval Process: Accelerating Global Registrations By Richard A Guarino, MD, 5th edition, Drugs and the Pharmaceutical Sciences,Vol.190.
4. Guidebook for drug regulatory submissions / Sandy Weinberg. By John Wiley & Sons. Inc.
5. FDA Regulatory Affairs: a guide for prescription drugs, medical devices, and biologics /edited by Douglas J. Pisano, David Mantus.
6. Generic Drug Product Development, Solid Oral Dosage forms, Leon Shargel and Isader Kaufer, Marcel Dekker series, Vol.143
7. Clinical Trials and Human Research: A Practical Guide to Regulatory Compliance By Fay A. Rozovsky and Rodney K. Adams
8. Principles and Practices of Clinical Research, Second Edition Edited by John I. Gallin and Frederick P. Ognibene
9. Drugs: From Discovery to Approval, Second Edition By Rick Ng

COURSE CODE	**PPR-BP805ET**
COURSE TITLE	**PHARMACOVIGILANCE (Theory)**

SCOPE/SYNOPSIS	OBJECTIVES/COs
This course will provide an opportunity for the student to learn about development of pharmacovigilance as a science, basic terminologies used, global scenario of Pharmacovigilance, and train students on establishing pharmacovigilance program in an organization, various methods that can be used to generate safety data and signal detection. This course also develops the skills of classifying drugs, diseases and adverse drug reactions.	Upon completion of this course the student shall be able to: 1. Know the importance of drug safety monitoring, History and development of pharmacovigilance and National and international scenario of pharmacovigilance 2. Understand dictionaries, coding and terminologies used in pharmacovigilance, International standards for classification of diseases and drugs, information resources and establishing of pharmacovigilance program. 3. Learn about vaccine safety surveillance, pharmacovigilance methods, effective communication in pharmacovigilance. 4. Understand the safety data generation, ICH guidelines for ICSR, PSUR, expedited reporting, pharmacovigilance planning. 5. Pharmacogenomics of adverse reactions, drug safety evaluation in special population, CIOMS, CDSCO and Pharmacovigilance

Course Content and Assessment Plan

SL NO.	**Course Content**	**Syllabus (chapters or Units with hours)**	**Marks of assessment**	**Distribution of marks of assessment**		
				Sessional exam (30% of marks of assessment)		**End Sem exam(70% of marks of assessment)**
				S1	S2	
1	Student will learn the concepts of Pharmacovigilance, history, safety, ADR, detection and reporting of ADR, causality, severity, predictability and preventability and management of ADRs.	Unit I (10hrs)	24	8		16
2	Student will understand ATC, DDD and international classification, drug dictionaries and coding of pharmacovigilance, information resources and establishing of pharmacovigilance program.	Unit II (10hrs)	24	7		17
3	Student will learn about vaccine safety surveillance, pharmacovigilance methods, effective communication in pharmacovigilance.	Unit III (12hrs)	27		8	19

4	Student will learn about safety data generation, ICH guidelines for pharmacovigilance.	Unit IV (09hrs)	20		7	13
5	Student will learn about pharmacogenomics of adverse reactions, drug safety evaluation in special population, CIOMS, CDSCO and Pharmacovigilance	Unit V (04hrs)	10		-	10
Total marks of assessment			**105**	**15**	**15**	**75**

PPR-BP805ET: PHARMACOVIGILANCE (Theory)

Course Contents **45 Hrs**

Unit I **10 Hrs**

Introduction to Pharmacovigilance

- History and development of pharmacovigilance
- Importance of safety monitoring of medicine
- WHO international drug monitoring program
- Pharmacovigilance program of India (PvPI)

Introduction to adverse drug reactions (ADRs)

- Definitions and classification of ADRs
- Detection and reporting
- Methods in causality assessment
- Severity and seriousness assessment
- Predictability and preventability assessment
- Management of adverse drug reactions

Basic terminologies used in pharmacovigilance

- Terminologies of adverse medication related events
- Regulatory terminologies

Unit II **10hrs**

Drug and disease classification

- Anatomical, therapeutic and chemical classification of drugs
- International classification of diseases
- Daily defined doses
- International non-proprietary names for drugs

Drug dictionaries and coding in pharmacovigilance

- WHO adverse reaction terminologies
- MedDRA and standardized MedDRA queries
- WHO drug dictionary
- Eudravigilance medicinal product dictionary

Information resources in pharmacovigilance

- Basic drug information resources
- Specialized resources for ADRs

Establishing pharmacovigilance program

- Establishing in a hospital
- Establishment & operation of drug safety department in industry
- Contract research organizations
- Establishing a national program

Unit III **12hrs**

Vaccine safety surveillance

- Vaccine Pharmacovigilance
- Vaccination failure
- Adverse events following immunization

Pharmacovigilance methods

- Passive surveillance – spontaneous reports and case series
- Stimulated reporting
- Active surveillance – sentinel sites, drug event monitoring and registries
- Comparative observational studies – cross sectional study, case control study and cohort study
- Targeted clinical investigations

Communication in pharmacovigilance

- Effective communication in pharmacovigilance
- Communication in drug safety crisis management
- Communicating with regulatory agencies, business partners, healthcare facilities &media

Unit IV **9hrs**

Safety data generation

- Pre-clinical phase
- Clinical phase
- Post approval phase

ICH Guidelines for Pharmacovigilance

- Organization and objectives of ICH
- Expedited reporting
- Individual case safety reports
- Periodic safety update reports
- Post approval expedited reporting
- Pharmacovigilance planning
- Good clinical practice in pharmacovigilance studies

Unit V **4**hrs

Pharmacogenomics of adverse drug reactions

- Genetics related ADR with example focusing PK parameters.

Drug safety evaluation in special population

- Paediatrics
- Pregnancy and lactation
- Geriatrics

CIOMS

- CIOMS Working Groups
- CIOMS Form

CDSCO (India) and Pharmacovigilance

- D&C Act and Schedule Y
- Differences in Indian and global pharmacovigilance requirements

Recommended Books (Latest edition):

1. Textbook of Pharmacovigilance: Gupta SK. Jaypee Brothers Medical Publishers.
2. Practical Drug Safety from A to Z: Barton L Cobert, Pierre Biron, Jones & Bartlett Publishers.
3. Mann's Pharmacovigilance: Elizabeth B. Andrews, Nicholas Moore. Wiley Publishers.
4. Stephens' Detection of New Adverse Drug Reactions: John Talbot, Patrick Waller. Wiley Publishers.
5. An Introduction to Pharmacovigilance: Patrick Waller, Mira Harrison-Woolrych. Wiley Publishers.
6. Cobert's Manual of Drug Safety and Pharmacovigilance: Barton Cobert. Jones & Bartlett Publishers.
7. Textbook of Pharmacoepidemiology: Brian L. Strom, Stephen E Kimmel, Sean Hennessy, Wiley Publishers.
8. A Textbook of Clinical Pharmacy Practice-Essential Concepts and Skills: G. Parthasarathi, Karin Nyfort-Hansen, Milap C. Nahata
9. National Formulary of India
10. Text Book of Medicine by Yashpal Munjal
11. Text book of Pharmacovigilance: Concept and Practice: GP Mohanta, PK Manna
12. http://www.whoumc.org/
13. http://www.ich.org/
14. http://www.cioms.ch/
15. http://cdsco.nic.in/
16. http://www.who.int/vaccine_safety/en/
17. http://www.ipc.gov.in/PvPI/

BPharm - Semester VIII

COURSE CODE	PCO-BP806ET
COURSE TITLE	QUALITY CONTROL AND STANDARDIZATION OF HERBALS (Theory)

SCOPE/SYNOPSIS	OBJECTIVES/COs
This course gives the knowledge of various methods and guidelines for evaluation and standardization of herbs and herbal drugs. This also provides an opportunity for the student to learn cGMP, GAP and GLP in traditional systems of medicines.	Upon completion of this course the student shall be able to: 1. To know WHO guidelines for quality control of herbal drugs 2. To know Quality assurance in herbal drug industry 3. To know the regulatory approval process and their registration in Indian and international markets 4. To appreciate EU and ICH guidelines for quality control of herbal drugs

Course Content and Assessment Plan

Sl No.	Course Content	Syllabus (Chapters or Units with hours)	Marks of assessment	Distribution of marks of assessment		
				Sessional exam (*30% of marks of assessment)*		End Sem exam (*70% of marks of assessment)*
				S1	S2	
1	Student will know the basic tests for herbal materials, dosage forms, WHO guidelines in quality control of herbal drugs and their evaluation	Unit I (10hrs)	23	8		15
2	Student will learn about various aspects of quality assurance of herbal drugs including cGMP, GAP, GMP, GLP and GACP guidelines for medicinal plants	Unit II (10hrs)	23	7		16
3	Student will learn about EU and ICH guidelines (QC), research guidelines for evaluating the safety & efficacy of herbal medicines	Unit III (10hrs)	23		8	15
4	Student will learn about stability testing of herbal medicines, chromatographic techniques and preparation of documents for NDA, export registration, GMP requirements, D and C Act provisions	Unit IV (8hrs)	19		7	12
5	Student will understand the regulatory requirements, WHO guidelines on safety monitoring,	Unit V (7hrs)	17		--	17

	chemical and biological markers in standardization of herbal medicinal products, comparison of various Herbal pharmacopoeias.					
Total marks of assessment			105	15	15	75

PCO-BP806ET: QUALITY CONTROL AND STANDARDIZATION OF HERBALS

(Theory)

Course Content **45hrs**

Unit I **10hrs**

Basic tests for drugs – Pharmaceutical substances, Medicinal plant materials and dosage forms

WHO guidelines for quality control of herbal drugs. Evaluation of commercial crude drugs intended for use

Unit II **10hrs**

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.

Unit III **10hrs**

EU and ICH guidelines for quality control of herbal drugs.

Research Guidelines for Evaluating the Safety and Efficacy of Herbal Medicines

Unit IV **8hrs**

Stability testing of herbal medicines. Application of various chromatographic techniques in standardization of herbal products.

Preparation of documents for new drug application and export registration, GMP requirements and Drugs & Cosmetics Act provisions.

Unit V **7hrs**

Regulatory requirements for herbal medicines.

WHO guidelines on safety monitoring of herbal medicines in pharmacovigilance systems.

Comparison of various Herbal Pharmacopoeias.

Role of chemical and biological markers in standardization of herbal products.

Recommended Books: (Latest Editions)

1. Pharmacognosy by Trease and Evans
2. Pharmacognosy by Kokate, Purohit and Gokhale
3. Rangari, V.D., Text book of Pharmacognosy and Phytochemistry Vol. I , Carrier Pub., 2006.
4. Agrawal, S.S., Herbal Drug Technology. Universities Press, 2002.
5. EMEA. Guidelines on Quality of Herbal Medicinal Products/Traditional Medicinal Products,
6. Mukherjee, P.W. Quality Control of Herbal Drugs: An Approach to Evaluation of Botanicals. Business Horizons Publishers, New Delhi, India, 2002.
7. Shinde M.V., Dhalwal K., Potdar K., Mahadik K. Application of quality control principles to herbal drugs. International Journal of Phytomedicine 1(2009); p. 4-8. 8.
8. WHO. Quality Control Methods for Medicinal Plant Materials, World Health Organization, Geneva, 1998.

   WHO. Guidelines for the Appropriate Use of Herbal Medicines. WHO Regional Publications, Western Pacific Series No 3, WHO Regional office for the Western Pacific, Manila, 1998.
9. WHO. The International Pharmacopoeia, Vol. 2: Quality Specifications, 3rd edn . World Health Organization, Geneva, 1981.
10. WHO. Quality Control Methods for Medicinal Plant Materials. World Health Organization, Geneva, 1999.
11. WHO. WHO Global Atlas of Traditional, Complementary and Alternative Medicine. 2 vol. set. Vol. 1 contains text and Vol. 2, maps. World Health Organization, Geneva, 2005.
12. WHO. Guidelines on Good Agricultural and Collection Practices (GACP) for Medicinal Plants. World Health Organization, Geneva, 2004.

BPharm - Semester VIII

COURSE CODE	**PCH-BP807ET**
COURSE TITLE	**COMPUTER AIDED DRUG DESIGN (Theory)**

SCOPE/SYNOPSIS	OBJECTIVES/COs
This subject is designed to provide detailed knowledge of rational drug design process and various computational techniques used in rational drug design process	Upon completion of this course the student shall be able to understand: 1. Drug discovery and development and discovery of lead molecules 2. The concept of QSAR and its role in drug design. 3. Virtual screening, Pharmacophore modelling , molecular docking and *De novo* drug design. 4. Analog based drug design, conformational analysis and introduction to chemo-informatics.

Course Content and Assessment Plan

Sl No.	Course Content	Syllabus (Chapters or Units with hours)	Marks of assessment	Distribution of marks of assessment		
				Sessional exam (*30% of marks of assessment)*		End Sem exam (*70% of marks of assessment)*
				S1	S2	
1	Student will learn about stages of drug discovery and development, Lead discovery strategies, Analog Based Drug Design,	Unit I (10hrs)	23	8		15
2	Student will learn the concept of Quantitative Structure Activity Relationship (QSAR), types of physicochemical parameters, experimental and theoretical approaches for the determination of physicochemical parameters	Unit II (10hrs)	23	7		16
3	Student will learn about concept of pharmacophore mapping and pharmacophore based Screening, molecular docking techniques, De novo drug design.	Unit III (10hrs)	23		8	15
4	Student will learn about Bioinformatics,Cheminformatics ADME databases and their utility in drug discovery.	Unit IV (8hrs)	19		4	15
5	Student will learn the concept of molecular mechanics, quantum mechanics energy minimization methods and conformational analysis	Unit V (7hrs)	17		3	14
Total marks of assessment			105	15	15	75

PCH-BP807ET: COMPUTER AIDED DRUG DESIGN (Theory)

Course Content **45hrs**

UNIT-I **10hrs**

Introduction to Drug Discovery and Development

Stages of drug discovery and development

Lead discovery and Analog Based Drug Design

Rational approaches to lead discovery based on traditional medicine, Random screening, Non-random screening, serendipitous drug discovery, lead discovery based on drug metabolism, lead discovery based on clinical observation.

UNIT-II **10hrs**

Quantitative Structure Activity Relationship (QSAR)

SAR versus QSAR, History and development of QSAR, Types of physicochemical parameters, experimental and theoretical approaches for the determination of physicochemical parameters such as Partition coefficient, Hammet's substituent constant and Tafts steric constant. Hansch analysis, Free Wilson analysis, 3D-QSAR approaches like COMFA and COMSIA.

UNIT-III **12hrs**

Molecular Modeling and virtual screening techniques

Virtual Screening techniques: Drug likeness screening, Concept of pharmacophore mapping and pharmacophore based Screening,

Molecular docking: Rigid docking, flexible docking, manual docking, Docking based screening. *De novo* drug design.

UNIT-IV **7 hrs**

Analog Based Drug Design: Bioisosterism, Classification, Bioisosteric replacement and case studies

UNIT-V **6 hrs**

Molecular Geometry and Informatics: Introduction to chemoinformatics. Energy Minimization methods and Conformational Analysis.

Recommended Books (Latest Editions)

1. Robert GCK, ed., "Drug Action at the Molecular Level" University Prak Press Baltimore.
2. Martin YC. "Quantitative Drug Design" Dekker, New York.
3. Delgado JN, Remers WA eds "Wilson & Gisvolds's Text Book of Organic Medicinal & Pharmaceutical Chemistry" Lippincott, New York.
4. Foye WO "Principles of Medicinal chemistry 'Lea & Febiger.
5. Koro lkovas A, Burckhalter JH. "Essentials of Medicinal Chemistry" Wiley Interscience.
6. Wolf ME, ed "The Basis of Medicinal Chemistry, Burger's Medicinal Chemistry" John Wiley & Sons, New York.
7. Patrick Graham, L., An Introduction to Medicinal Chemistry, Oxford University Press.
8. Smith HJ, Williams H, eds, "Introduction to the principles of Drug Design" Wright Boston.
9. Silverman R.B. "The Organic Chemistry of Drug Design and Drug Action" Academic Press New York.

BPharm - Semester VIII

COURSE CODE	**PBT-BP808ET**
COURSE TITLE	**CELL AND MOLECULAR BIOLOGY (Theory)**

SCOPE/SYNOPSIS	OBJECTIVES/COs
Cell biology deals with physiological properties of cells, their structure, organelles they contain, interactions with their life cycle, division, death and cell function. Molecular biology involves the study of structure and functions of macromolecules	Upon completion of this course, the student shall be able to: 1. Understand the basics of cell biology and cellular structures 2. Develop a good foundation in molecular biology 3. Know the basic components of proteins and protein therapeutics 4. Gain knowledge of pharmacogenomics and personalized medicine 5. Explore advanced biotechnology and therapeutics

Course Content and Assessment Plan

Sl No.	Course Content	Syllabus (Chapters or Units with hours)	Marks of assessment	Distribution of marks of assessment		
				Sessional exam (*30% of marks of assessment)*		End Sem exam (*70% of marks of assessment)*
				S1	S2	
1	Student will learn fundamentals of cell biology	Unit I (10hrs)	23	6		17
2	Student will understand the basics of molecular biology	Unit II (10hrs)	23	7		16
3	Student will understand the structure and protein therapeutics	Unit III (10hrs)	23	2	5	16
4	Student will learn the basics of Pharmacogenomics	Unit IV (7hrs)	17		4	13
5	Student will understand the recent advancements in Pharmaceutical biotechnology	Unit V (8hrs)	19		6	13
Total marks of assessment			105	15	15	75

PBT-BP808ET: CELL AND MOLECULAR BIOLOGY (Theory)

Course Content **45hrs**

Unit I: Cell Biology **10hrs**

a) Prokaryotic and eukaryotic cell membrane structure, cell composition, organization and transport

b) Cell division (Mitosis and Meiosis)

c) Cellular activities and checkpoints

d) Cell signaling pathways, cell death and cellular diseases

Unit II: Molecular Biology **10hrs**

a) Genome organization, structure and complexity

b) DNA replication, mutations and repair mechanisms

c) Transcription and translation

d) Regulation of gene expression

Unit III: Protein structure and therapeutics **10hrs**

a) Amino acids and proteins

b) Protein structure

c) Protein isolation, purification and fractionation methods

d) Basics of protein therapeutics, protein formulation and delivery

Unit IV: Pharmacogenomics and drug actions **7hrs**

a) Introduction to pharmacogenomics and personalized medicine

b) Genetic variation and drug responses

c) Drug metabolism and pharmacokinetics

d) New gene editing tools

Unit V: Advanced biotechnology and therapeutics **8hrs**

a) Nucleic acid therapeutics

b) Gene therapy: Current advances and challenges

c) Nano-Biotechnology: Introduction, advances and applications

d) Biosimilars: Concept and importance

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, CBS Publishers & Distributors, Delhi.
3. Pelczar, Chan, Kreig, Microbiology, Tata McGraw Hill edn.
4. Malcolm Harris, Balliere Tindall and Cox: Pharmaceutical Microbiology., *Bailliere*, *Tindall* & *Cox*
5. Rose: Industrial Microbiology, Academic Press.
6. Probisher, Hinsdill et al: Fundamentals of Microbiology, 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.

BPharm - Semester VIII

COURSE CODE	**PCE-BP809ET**
COURSE TITLE	**COSMETIC SCIENCE (Theory)**

SCOPE/SYNOPSIS	OBJECTIVES/COs
This course is designed to impart knowledge and skills necessary for the fundamental need for cosmetic and cosmeceutical products	Upon completion of this course, student will be able to: 1. Understand the key ingredients used in cosmetics and cosmeceuticals 2. Understand the key building blocks for various formulations 3. Understand the current technologies in the market 4. Understand the various key ingredients and basic science to develop cosmetics and cosmeceuticals 5. Understand the scientific knowledge to develop cosmetics and cosmeceuticals with desired safety, stability and efficacy

Course Content and Assessment Plan

Sl No.	Course Content	Syllabus (Chapters or Units with hours)	Marks of assessment	Distribution of marks of assessment		
				Sessional exam (*30% of marks of assessment)*		End Sem exam (*70% of marks of assessment)*
				S1	S2	
1	Student will learn the classification and uses of Cosmetics. Will also know the various excipients used in cosmetics preparations for Skin, Hair and oral cavity.	Unit I (10hrs)	23	8		15
2	Student will know and learn various skin care products and the principle involved in their preparation.	Unit II (10hrs)	23	7		16
3	Student will know how to protect skin from sun exposure and various herbs used in these preparations.	Unit III (10hrs)	23		10	13
4	Student will know few analytical techniques to evaluate few cosmetic preparations.	Unit IV (8hrs)	19		5	14
5	Student will ill know about the specific skin problems and how to handle them with cosmetics.	Unit V (7hrs)	17		-	17
	Total marks of assessment		105	15	15	75

PCE-BP809ET: COSMETIC SCIENCE (Theory)

Course Content **45hrs**

UNIT I **10hrs**

Classification of cosmetic and cosmeceutical products

Definition of cosmetics as per Indian and EU regulations, Evolution of cosmeceuticals from cosmetics, cosmetics as quasi and OTC drugs

Cosmetic excipients: Surfactants, rheology modifiers, humectants, emollients, preservatives. Classification and application

Skin: Basic structure and function of skin.

Hair: Basic structure of hair. Hair growth cycle.

Oral Cavity: Common problem associated with teeth and gums**.**

UNIT II **10hrs**

Principles of formulation and building blocks of skin care products:

Face wash, Moisturizing cream, Cold Cream, Vanishing cream and their advantages and disadvantages.Application of these products in formulation of cosmecuticals.

Antiperspants & deodorants- Actives & mechanism of action.

Principles of formulation and building blocks of Hair care products: Conditioning shampoo, Hair conditioner,anti-dandruff shampoo.

Hair oils. Chemistry and formulation of Para-phylene diamine based hair dye.

Principles of formulation and building blocks of oral care products:

Toothpaste for bleeding gums, sensitive teeth. Teeth whitening, Mouthwash.

UNIT III **10hrs**

Sun protection, Classification of Sunscreens and SPF.

Role of herbs in cosmetics:

Skin Care: Aloe and turmeric

Hair care: Henna and amla.

Oral care: Neem and clove

Analytical cosmetics: BIS specification and analytical methods for shampoo, skin- cream and toothpaste**.**

UNIT IV **8hrs**

Principles of Cosmetic Evaluation: Principles of sebumeter, corneometer. Measurement of TEWL, Skin Color, Hair tensile strength, Hair combing properties

Soaps, and syndet bars. Evolution and skin benfits.

UNIT V **7hrs**

Oily and dry skin, causes leading to dry skin, skin moisturisation. Basic understanding of the terms - Comedogenic, dermatitis.

Cosmetic problems associated with Hair and scalp: Dandruff, Hair fall causes

Cosmetic problems associated with skin: blemishes, wrinkles, acne, prickly heat and body odor.

Antiperspirants and Deodorants- Actives and mechanism of action

References

1) Harry's Cosmeticology, Wilkinson, Moore, Seventh Edition, George Godwin.
2) Cosmetics – Formulations, Manufacturing and Quality Control, P.P. Sharma, 4th Edition, Vandana Publications Pvt. Ltd., Delhi.
3) Text book of Cosmelicology by Sanju Nanda & Roop K. Khar, Tata Publishers

BPharm - Semester VIII

COURSE CODE	**PHA-BP810ET**
COURSE TITLE	**PHARMACOLOGICAL SCREENING METHODS (Theory)**

SCOPE/SYNOPSIS	OBJECTIVES/COs
This subject is designed to impart basic knowledge on preclinical studies that includes design, conduct and interpretation of results.	Upon completion of this course the student shall be able to: 1. Appreciate the applications of various commonly used laboratory animals. 2. Appreciate and demonstrate the various screening methods used in preclinical research 3. Design and execute a research hypothesis independently

Course Content and Assessment Plan

Sl No.	Course Content	Syllabus (Chapters or Units with hours)	Marks of assessment	Distribution of marks of assessment		
				Sessional exam (*30% of marks of assessment)*		End Sem exam (*70% of marks of assessment)*
				S1	S2	
1	The students will study the production, maintenance, application, anesthesia, euthanasia, blood withdrawal techniques of common laboratory and transgenic animals, as per regulatory guidelines.	Unit I (10hrs)	22	07		15
2	Students will learn to solve the problems associated with dose calculation and preparations: study design and rationales. Besides, learn general principles and preclinical methods to test drugs acting on CNS.	Unit II (12hrs)	25	08		17
3	Students will learn general principles and preclinical methods to test drugs acting on ANS. The students will also study preclinical techniques to test local anaesthetics and drugs acting on eye.	Unit III (8hrs)	20		9	11
4	Students will learn general principles and preclinical methods to test drugs acting on cardiovascular system	Unit IV (5hrs)	16		6	10
5	Students will learn the principle and applications of appropriate animal model related to antiulcer, antidiabetic, anticancer and anti-asthmatic drugs.	Unit V (10hrs)	22		--	22
		Total marks of assessment	105	15	15	75

PHA-BP810ET: PHARMACOLOGICAL SCREENING METHODS (Theory)

Course Content **45hrs**

Unit –I **10hrs**

Laboratory Animals:

Study of CPCSEA and OECD guidelines. 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. Common routes of drug administration in laboratory animals, techniques of blood collection and euthanasia.

Unit –II **12hrs**

Preclinical screening models

a. Introduction: Dose selection, calculation and conversions, preparation of drug solution/suspensions, grouping of animals and importance of sham negative and positive control groups. Rationale for selection of animal species and sex for the study.

Preclinical screening models: for CNS activity- analgesics, antipyretics, anti-inflammatory, general anaesthetics, sedative and hypnotics, antipsychotic, antidepressant, antiepileptic, antiparkinsonian, anti-Alzheimer's drugs

Unit – III **8hrs**

Preclinical screening models for ANS activity: sympathomimetics, sympatholytics, parasympathomimetics, parasympatholytics, skeletal muscle relaxants, drugs acting on eye, local anaesthetics

Unit – IV **5hrs**

Preclinical screening models for CVS activity: antihypertensives, diuretics, antiarrhythmic, anti-dyslipidaemic, anti-aggregatory, coagulants, and anticoagulants

Unit – V **10hrs**

Preclinical screening models for other important drugs like antiulcer, antidiabetic, anticancer and antiasthmatics.

Recommended Books (latest edition):

1. Fundamentals of experimental Pharmacology-by M. N. Ghosh.
2. Hand book of Experimental Pharmacology- S. K. Kulkarni
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

COURSE CODE	**PQA-BP811ET**
COURSE TITLE	**ADVANCED INSTRUMENTATION TECHNIQUES (Theory)**

SCOPE/SYNOPSIS	OBJECTIVES/COs
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 development and testing.	Upon completion of the course the student shall be able to understand: 1. Principle, instrumentation & applications of NMR spectroscopy & Mass spectrometry. 2. Principle, instrumentation & applications of thermal methods & X-Ray diffraction. 3. The concepts of Calibration & Validation of selected analytical instruments. 4. Importance of immunological techniques in analysis (RIA) and Extraction of analytes from complex matrices. 5. Importance, principle & applications of hyphenated techniques in chromatography.

Course Content and Assessment Plan

Sl No.	Course Content	Syllabus (Chapters or Units with hours)	Marks of assessment	Distribution of marks of assessment		
				Sessional exam (*30% of marks of assessment)*		End Sem exam (*70% of marks of assessment)*
				S1	S2	
1	Student will learn the principle, instrumentation and applications of Nuclear Magnetic Resonance Spectroscopy and mass spectroscopy	Unit I (10hrs)	23	8		15
2	Student will learn the principle, instrumentation and applications of Thermogravimetric analysis and X ray diffraction	Unit II (10hrs)	23	7		16
3	Student will understand principles of calibration and validation and procedure for validation of selected instruments.	Unit III (10hrs)	23		7	16
4	Student will understand the principle and procedure of radio immune assay and extraction techniques.	Unit IV (8hrs)	19		5	14
5	Student will learn about selected hyphenated techniques.	Unit V (7hrs)	17		3	14
	Total marks of assessment		105	15	15	75

PQA-BP811ET: ADVANCED INSTRUMENTATION TECHNIQUES (Theory)

Course Content **45hrs**

UNIT-I **10hrs**

Nuclear Magnetic Resonance spectroscopy

Principles of H-NMR and C-NMR, chemical shift, factors affecting chemical shift, coupling constant, spin - spin coupling, relaxation, instrumentation and applications

Mass Spectrometry- Principles, Fragmentation, Ionization techniques – Electron impact, chemical ionization, MALDI, FAB, Analyzers-Time of flight and Quadrupole, instrumentation, applications

UNIT-II **10hrs**

Thermal Methods of Analysis: Principles, instrumentation and applications of Thermogravimetric Analysis (TGA), Differential Thermal Analysis (DTA),

Differential Scanning Calorimetry (DSC)

X-Ray Diffraction Methods: Origin of X-rays, basic aspects of crystals, X- ray Crystallography, rotating crystal technique, single crystal diffraction, powder diffraction, structural elucidation and applications.

UNIT-III **10hrs**

Calibration and validation-as per ICH and USFDA guidelines

Calibration of following Instruments

Electronic balance, UV-Visible spectrophotometer, IR spectrophotometer, Fluorimeter, Flame Photometer, HPLC and GC

UNIT-IV **8hrs**

Radio immuno assay: Importance, various components, Principle, different methods, Limitation and Applications of Radio immuno assay

Extraction techniques: General principle and procedure involved in the solid phase extraction and liquid-liquid extraction

UNIT-V **7hrs**

Hyphenated techniques - LC-MS/MS, GC-MS/MS, HPTLC-MS.

Recommended Books (Latest Editions)

1. Instrumental Methods of Chemical Analysis by B.K Sharma
2. Organic spectroscopy by Y.R Sharma
3. Text book of Pharmaceutical Analysis by Kenneth A. Connors
4. Vogel's Text book of Quantitative Chemical Analysis by A.I. Vogel
5. Practical Pharmaceutical Chemistry by A.H. Beckett and J.B. Stenlake
6. Organic Chemistry by I. L. Finar
7. Organic spectroscopy by William Kemp
8. Quantitative Analysis of Drugs by D. C. Garrett
9. Quantitative Analysis of Drugs in Pharmaceutical Formulations by P. D. Sethi
10. Spectrophotometric identification of Organic Compounds by Silverstein

BPharm - Semester VIII

COURSE CODE	**PCE-BP812ET**
COURSE TITLE	**DIETARY SUPPLEMENTS AND NUTRACEUTICALS (Theory)**

SCOPE/SYNOPSIS	OBJECTIVES/COs
This subject covers the foundational topics that are important for understanding the need and requirements of dietary supplements for the different groups in the population.	By the end of the course, students shall be able to: 1. Understand the need of supplements by the different group of people to maintain healthy life. 2. Understand the outcome of deficiencies in dietary supplements. 3. Appreciate the components in dietary supplements and the application. 4. Appreciate the regulatory and commercial aspects of dietary supplements including health claims.

Course Content and Assessment Plan

Sl No.	Course Content	Syllabus (chapters or Units with hours)	Marks of assessment	Distribution of marks of assessment		
				Sessional exam (*30% of marks of assessment)*		End Sem exam (*70% of marks of assessment)*
				S1	S2	
1	Student will learn about Nutraceuticals, Dietary supplements and their importance along with the impact on public health.	Unit I (7hrs)	16	5		11
2	Student will know about various phytochemicals, their chemical nature and medical benefits.	Unit II (15hrs)	35	10		25
3	Student will know about free radicals and their production in cells, their effect on lipids, proteins etc.,	Unit III (7hrs)	16		6	10
4	Student will know the role of free radicals in few diseases and the role of antioxidants.	Unit IV (10hrs)	23		9	14
5	Student will learn the regulatory aspects for food, safety and pharmacopoeial specifications for dietary supplements and nutraceuticals.	Unit V (6hrs)	15		-	15
	Total marks of assessment		105	15	15	75

PCE-BP812ET: DIETARY SUPPLEMENTS AND NUTRACEUTICALS (Theory)

Course Content **45hrs**

UNIT I **7hrs**

a. Definitions of Functional foods, Nutraceuticals and Dietary supplements. Classification of nutraceuticals, health problems and diseases that can be prevented or cured by nutraceuticals i.e. weight control, diabetes, cancer, heart disease, stress, osteoarthritis, hypertension etc.

b. Public health nutrition, maternal and child nutrition, nutrition and ageing, nutrition education in community.

c. Name of marker compounds, their chemical nature and source, medicinal uses and health benefits of following things used as nutraceuticals/ functional foods: Spirulina, Soyabean, Ginseng, Garlic, Broccoli, Gingko and Flaxseeds.

UNIT II **15hrs**

Phytochemicals as nutraceuticals: Occurrence and characteristic features (chemical nature and medicinal benefits) of the following things:

a) Carotenoids- α and β-Carotene, Lycopene, Xanthophylls, Leutin

b) Sulfides: Diallyl sulfides, Allyl trisulfide.

c) Polyphenolics: Reservetrol

d) Flavonoids- Rutin , Naringin, Quercitin, Anthocyanidins, catechins, Flavones

e) Prebiotics / Probiotics.: Fructo oligosaccharides, Lacto bacillum

f) Phyto estrogens : Isoflavones, Daidzein, Geebustin, Lignans

g) Tocopherols

h) Proteins, vitamins, minerals, cereal, vegetables and beverages as functional foods: oats, wheat bran, rice bran, sea foods, coffee, tea and the like substances.

UNIT III **7hrs**

a) Introduction to free radicals: Free radicals, reactive oxygen species, production of free radicals in the cells, damaging reactions of free radicals on lipids, proteins, carbohydrates and nucleic acids

b) Dietary fibres and complex carbohydrates as functional food ingredients.

UNIT IV **10hrs**

a) Free radicals in Diabetes mellitus, Inflammation, Ischemic reperfusion injury, Cancer, Atherosclerosis, Brain metabolism and pathology, Kidney damage and Muscle damage. Involvement of free radicals in other disorders, Free radicals theory of ageing.

b) Antioxidants: Endogenous antioxidants – enzymatic and non-enzymatic antioxidant defense, superoxide dismutase, catalase, glutathione peroxidase, glutathione, vitamin C, vitamin E, α-lipoic acid, melatonin. Synthetic antioxidants: Butylated hydroxy toluene, Butylated hydroxy anisole.

c) Functional foods for chronic disease prevention

UNIT V **6hrs**

a) Effect of processing, storage and interactions of various environmental factors on the potential of nutraceuticals.

b) Regulatory aspects; FSSAI, FDA, FPO, MPO, AGMARK. HACCP and GMPs on Food Safety. Adulteration of foods.

c) Pharmacopoeial specifications for dietary supplements and nutraceuticals.

References:

1. Dietetics by Sri Lakshmi, New Age International Publishers
2. Role of dietary fibres and nutraceuticals in preventing diseases by K.T. Agusti and P. Faizal: BS Publication.
3. Advanced Nutritional Therapies by Cooper. K.A. (1996).
4. The Food Pharmacy by Jean Carper, Simon & Schuster, UK Ltd. (1988).
5. Prescription for Nutritional Healing by James F. Balch and Phyllis A. Balch 2nd Edn., Avery Publishing Group, NY (1997).
6. G. Gibson and C. Williams, Editors; *2000 Functional foods,* Woodhead Publ. Co. London.
7. Goldberg, I. *Functional Foods*. 1994. Chapman and Hall, New York.
8. Labuza, T.P. 2000 Functional Foods and Dietary Supplements: Safety, Good manufacturing practice (GMPs) and Shelf-life testing in *Essentials of Functional Foods*, M.K. Sachmidl and T.P. Labuza Eds., Aspen Press.
9. Handbook of Nutraceuticals and Functional Foods, Third Edition (Modern Nutrition)
10. Shils, ME, Olson, JA, Shike, M. 1994, *Modern Nutrition in Health and Disease*. Eighth edition. Lea and Febiger.

BPharm - Semester VIII

COURSE CODE	**BP813PW**
COURSE TITLE	**PROJECT WORK (Practical)**

SCOPE/SYNOPSIS	**OBJECTIVES/COs**
The aim of group project work is to enable the students to undertake comprehensive projects for deeper learning. This is achieved through the combined talents of group members contributing knowledge, skills, and ideas. .	Upon completion of this course the student shall be able to: 1. Gather, organize and review literature to formulate research hypothesis and justify it. 2. Conduct feasibility analysis for execution of research. 3. Appreciate the ethical issues, international scientific standards, hazards and its management associated with the research. 4. Design experiments to validate the hypothesis. 5. Work independently and collaborate with peers to execute the projects, and employ experimental tools, analyse data and interpret research findings. 6. Report research findings in the form of research report and scientific presentations.