REGULATIONS 2017

SYLLABUS

For Courses affiliated to the

KERALA UNIVERSITY OF HEALTH SCIENCES

Thrissur 680596

BACHELOR OF PHARMACY

Course Code: 009

BACHELOR OF PHARMACY (B. Pharm)

(2017-18 Academic year onwards)

2017

2. COURSE CONTENT

2.1. Title of course:

Bachelor of Pharmacy − B. Pharm

2.2. Objectives of course

The objective of the course is to mold the student to suit the varied requirements of

1. Pharmaceutical industry –Research & Development, Manufacturing, Formulation, Quality Control, Quality assurance, Packaging, Marketing.
2. Practice settings in −Hospital Pharmacy, Clinical Pharmacy and Community Pharmacy.
3. Academics.
4. Regulatory affairs.
5. Clinical Research.
6. Drug discovery and development

2.3. Medium of instruction:

Medium of instruction and examinations shall be English

2.4. Course Outline

Program/Course credit structure

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

2.4.1. Theory and Laboratory courses

a. Credit assignment

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

b. Minimum credit requirements

The minimum credit points required for award of a B. Pharm degree is 210. These credits are divided into Theory courses, Tutorials, Practical, Practice School and Project over the duration of eight semesters. The credits are distributed semester− wise as shown in Table IX. Courses generally progress in sequences, building competencies and their positioning indicates certain academic maturity on the part of the learners. Learners are expected to follow the semester−wise schedule of courses given in the syllabus. The lateral entry students shall get 52 credit points transferred from their D. Pharm program. Such students shall take up additional remedial courses of 'Communication Skills' (Theory and Practical) and 'Computer

Applications in Pharmacy' (Theory and Practical) equivalent to 3 and 4 credit points respectively, a total of 7 credit points to attain 59 credit points, the maximum of I and II semesters.

2.4.2. Academic work

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

2.4.3. Course of study

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

Table-I: Course of study for semester I

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

Table-II: Course of study for semester II

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

*****Non University Examination (NUE)

Table-III: Course of study for semester III

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

Table-IV: Course of study for semester IV

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

Table-V: Course of study for semester V

Course	Name of the Course	No. of hours	Tutorial	Credit points
BP501T	Medicinal Chemistry II – Theory	3	1	4
BP502T	Formulative Pharmacy– Theory	3	1	4
BP503T	Pharmacology II – Theory	3	1	4
BP504T	Pharmacognosy and Phytochemistry II– Theory	3	1	4
BP505T	Pharmaceutical Jurisprudence – Theory	3	1	4
BP506P	Formulative Pharmacy – Practical	4	-	2
BP507P	Pharmacology II – Practical	4	-	2
BP508P	Pharmacognosy and Phytochemistry II – Practical	4	-	2
	Total	**27**	**5**	**26**

Table-VI: Course of study for semester VI

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

Table-VII: Course of study for semester VII

Course	Name of the Course	No. of hours	Tutorial	Credit points
BP701T	Instrumental Methods of Analysis – Theory	3	1	4
BP702T	Industrial Pharmacy – Theory	3	1	4
BP703T	Pharmacy Practice – Theory	3	1	4
BP704T	Novel Drug Delivery System – Theory	3	1	4
BP705P	Instrumental Methods of Analysis – Practical	4	-	2
BP706PS	Practice School*	12	-	6
	Total	**28**	**4**	**24**

* Non University Examination (NUE)

Table-VIII: Course of study for semester VIII

Course	Name of the Course	No. of hours	Tutorial	Credit points
BP801T	Biostatistics and Research Methodology	3	1	4
BP802T	Social and Preventive Pharmacy	3	1	4
BP803ET	Pharmaceutical Marketing	3 +3 =6	1 +1 =2	4 + 4 = 8
BP804ET	Pharmaceutical Regulatory Science			
BP805ET	Pharmacovigilance			
BP806ET	Quality Control and Standardization of Herbs			
BP807ET	Computer Aided Drug Designing			
BP808ET	Cell and Molecular Biology			
BP809ET	Cosmetic Science			
BP810ET	Experimental Pharmacology			
BP811ET	Advanced Instrumentation Techniques			
BP812PW	Project work	12	-	6
	Total	**24**	**4**	**22**

Table-IX: Semester wise credits distribution

Semester	Credit Points
I	27/29[$]/30[#]
II	29
III	24
IV	28
V	26
VI	30
VII	24
VIII	22
Extracurricular/ Co curricular activities	01*
Total credit points for the program	**211/213[$]/214[#]**

* The credit points assigned for extracurricular and or co-curricular activities shall be given by the Principals of the colleges and the same shall be submitted to the University. The criteria to acquire this credit point shall be defined by the colleges from time to time.

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

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

2.4.4. Examinations/Assessments

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

2.4.5. End semester examinations

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 and II for which examinations shall be conducted by the subject experts at college level and the marks/grades shall be submitted to the university.

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

Semester I

Course code	Name of the course	Internal Assessment				End Semester Exams		Total Marks
		Continuous Mode	Sessional Exams		Total	Marks	Duration	
			Marks	Duration				
BP101T	Human Anatomy and Physiology I− Theory	10	15	1Hr	25	75	3Hrs	100
BP102T	Pharmaceutical Analysis I−Theory	10	15	1Hr	25	75	3Hrs	100
BP103T	Pharmaceutics I− Theory	10	15	1Hr	25	75	3Hrs	100
BP104T	Pharmaceutical Inorganic Chemistry−Theory	10	15	1Hr	25	75	3Hrs	100
BP105T	Communication skills−Theory*	5	10	1Hr	15	35	1.5Hrs	50
BP106RBT BP106RMT	Remedial Biology/ Mathematics−Theory*	5	10	1Hr	15	35	1.5Hrs	50
BP107P	Human Anatomy and Physiology−Practical	5	10	4Hrs	15	35	4Hrs	50
BP108P	Pharmaceutical Analysis I−Practical	5	10	4Hrs	15	35	4Hrs	50
BP109P	Pharmaceutics I−Practical	5	10	4Hrs	15	35	4Hrs	50
BP110P	Pharmaceutical Inorganic Chemistry−Practical	5	10	4Hrs	15	35	4Hrs	50
BP111P	Communication skills−Practical*	5	5	2Hrs	10	15	2Hrs	25
BP112RBP	Remedial Biology−Practical*	5	5	2Hrs	10	15	2Hrs	25
Total		**70/75$/80#**	**115/125$ /130#**	**23/24$/26# Hrs.**	**185/200$/ 210#**	**490/525$/ 540#**	**31.5/33$/ 35#Hrs**	**675/725$/ 750#**

Semester II

Course code	Name of the course	Internal Assessment				End Semester Exams		Total Marks
		Continuous Mode	Sessional Exams		Total	Marks	Duration	
			Marks	Duration				
BP201T	Human Anatomy and Physiology II –Theory	10	15	1Hr	25	75	3Hrs	100
BP202T	Pharmaceutical Organic Chemistry I – Theory	10	15	1Hr	25	75	3Hrs	100
BP203T	Biochemistry –Theory	10	15	1Hr	25	75	3Hrs	100
BP204T	Pathophysiology −Theory	10	15	1Hr	25	75	3Hrs	100
BP205T	Computer Applications in Pharmacy− Theory*	10	15	1Hr	25	50	2Hrs	75
BP206T	Environmental sciences −Theory*	10	15	1Hr	25	50	2Hrs	75
BP207P	Human Anatomy and Physiology II –Practical	5	10	4Hrs	15	35	4Hrs	50
BP208P	Pharmaceutical Organic Chemistry I− Practical	5	10	4Hrs	15	35	4Hrs	50
BP209P	Biochemistry – Practical	5	10	4Hrs	15	35	4Hrs	50
BP210P	Computer Applications in Pharmacy− Practical*	5	5	2Hrs	10	15	2Hrs	25
Total		**80**	**125**	**20Hrs**	**205**	**520**	**30Hrs**	**725**

***** The subject experts at college level shall conduct examinations

Semester III

Course	Name of the course	Internal Assessment				End Semester Exams		Total Marks
		Continuous Mode	Sessional Exams		Total	Marks	Duration	
			Marks	Duration				
BP301T	Pharmaceutical Organic Chemistry II − Theory	10	15	1Hr	25	75	3Hrs	100
BP302T	Physical Pharmaceutics I − Theory	10	15	1Hr	25	75	3Hrs	100
BP303T	Pharmaceutical Microbiology – Theory	10	15	1Hr	25	75	3Hrs	100
BP304T	Pharmaceutical Engineering − Theory	10	15	1Hr	25	75	3Hrs	100
BP305P	Pharmaceutical Organic Chemistry II − Practical	5	10	4Hr	15	35	4Hrs	50
BP306P	Physical Pharmaceutics I − Practical	5	10	4Hr	15	35	4Hrs	50
BP307P	Pharmaceutical Microbiology – Practical	5	10	4Hr	15	35	4Hrs	50
BP308P	Pharmaceutical Engineering – Practical	5	10	4Hr	15	35	4Hrs	50
Total		**60**	**100**	**20**	**160**	**440**	**28Hrs**	**600**

Semester IV

Course	Name of the course	Internal Assessment				End Semester Exams		Total Marks
		Continuous Mode	Sessional Exams		Total	Marks	Duration	
			Marks	Duration				
BP401T	Pharmaceutical Organic Chemistry III−Theory	10	15	1Hr	25	75	3Hrs	100
BP402T	Medicinal Chemistry I−Theory	10	15	1Hr	25	75	3Hrs	100
BP403T	Physical Pharmaceutics II−Theory	10	15	1Hr	25	75	3Hrs	100
BP404T	Pharmacology I−Theory	10	15	1Hr	25	75	3Hrs	100
BP405T	Pharmacognosy I−Theory	10	15	1Hr	25	75	3Hrs	100
BP406P	Medicinal Chemistry I−Practical	5	10	4Hr	15	35	4Hrs	50
BP407P	Physical Pharmaceutics II−Practical	5	10	4Hrs	15	35	4Hrs	50
BP408P	Pharmacology I−Practical	5	10	4Hrs	15	35	4Hrs	50
BP409P	Pharmacognosy I−Practical	5	10	4Hrs	15	35	4Hrs	50
Total		**70**	**115**	**21Hrs**	**185**	**515**	**31Hrs**	**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				
BP501T	Medicinal Chemistry II−Theory	10	15	1Hr	25	75	3Hrs	100
BP502T	Formulative Pharmacy−Theory	10	15	1Hr	25	75	3Hrs	100
BP503T	Pharmacology II−Theory	10	15	1Hr	25	75	3Hrs	100
BP504T	Pharmacognosy II−Theory	10	15	1Hr	25	75	3Hrs	100
BP505T	Pharmaceutical Jurisprudence – Theory	10	15	1Hr	25	75	3Hrs	100
BP506P	Formulative Pharmacy −Practical	5	10	4Hr	15	35	4Hrs	50
BP507P	Pharmacology II−Practical	5	10	4Hr	15	35	4Hrs	50
BP508P	Pharmacognosy II−Practical	5	10	4Hr	15	35	4Hrs	50
Total		**65**	**105**	**17Hr**	**170**	**480**	**27Hrs**	**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				
BP601T	Medicinal Chemistry III−Theory	10	15	1Hr	25	75	3Hrs	100
BP602T	Pharmacology III−Theory	10	15	1Hr	25	75	3Hrs	100
BP603T	Herbal Drug Technology −Theory	10	15	1Hr	25	75	3Hrs	100
BP604T	Biopharmaceutics and Pharmacokinetics−Theory	10	15	1Hr	25	75	3Hrs	100
BP605T	Pharmaceutical Biotechnology− Theory	10	15	1Hr	25	75	3Hrs	100
BP606T	Quality Assurance−Theory	10	15	1Hr	25	75	3Hrs	100
BP607P	Medicinal chemistry III −Practical	5	10	4Hrs	15	35	4Hrs	50
BP608P	Pharmacology III−Practical	5	10	4Hrs	15	35	4Hrs	50
BP609P	Herbal Drug Technology − Practical	5	10	4Hrs	15	35	4Hrs	50
Total		**75**	**120**	**18Hrs**	**195**	**555**	**30Hrs**	**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				
BP701T	Instrumental Methods of Analysis −Theory	10	15	1Hr	25	75	3Hrs	100
BP702T	Industrial Pharmacy −Theory	10	15	1Hr	25	75	3Hrs	100
BP703T	Pharmacy Practice −Theory	10	15	1Hr	25	75	3Hrs	100
BP704T	Novel Drug Delivery System−Theory	10	15	1Hr	25	75	3Hrs	100
BP705P	Instrumental Methods of Analysis −Practical	5	10	4Hrs	15	35	4Hrs	50
BP706PS	Practice School*	25	-	-	25	125	5Hrs	150
Total		**70**	**70**	**8Hrs**	**140**	**460**	**21Hrs**	**600**

***** The subject experts at college level shall conduct examinations

Semester VIII

Course code	Name of the course	Internal Assessment				End Semester Exams		Total Marks
		Continuous Mode	Sessional Exams		Total	Marks	Duration	
			Marks	Duration				
BP801T	Biostatistics and Research Methodology −Theory	10	15	1Hr	25	75	3Hrs	100
BP802T	Social and Preventive Pharmacy− Theory	10	15	1Hr	25	75	3Hrs	100
BP803ET	Pharmaceutical Marketing− Theory	10+10 =20	15+15= 30	1 +1= 2 Hrs	25+25= 50	75+75 =150	3+3=6 Hrs	100+ 100= 200
BP804ET	Pharmaceutical Regulatory Science −Theory							
BP805ET	Pharmacovigilance−Theory							
BP806ET	Quality Control and Standardizations of Herbals− Theory							
BP807ET	Computer Aided Drug Design−Theory							
BP808ET	Cell and Molecular Biology −Theory							
BP809ET	Cosmetic Science−Theory							
BP810ET	Experimental Pharmacology−Theory							
BP811ET	Advanced Instrumentation Techniques−Theory							
BP812PW	Project Work	-	-	-	-	150	4Hrs	150
Total		40	60	4hrs	100	450	16	550

2.4.6. Internal assessment: Continuous mode

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

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

Theory		
Criteria	**Maximum Marks**	
Attendance (Refer Table−XII)	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 (Refer Table−XII)	2	
Based on Practical Records, Regular viva voce, etc.	3	
Total	**5**	

Table- XII: 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

2.4.7. Sessional Exams

Two Sessional exams shall be conducted for each theory/practical course as per the schedule fixed by the college(s). 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 tables−X. Sessional exam shall be conducted for 30 marks for theory and shall be computed for15marks. 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

(Answer all the questions)

I. Long Answers		=	01 x 10 = 10
II. Short Answers		=	02 x 05 = 10
III. Objective type questions		=	05 x 02 = 10
	Total	=	30 Marks

For subject shaving Non University Examination

I.	Long Answers	=	01 x 10 = 10
II.	Short Answers	=	04 x 05 = 20
	Total	=	30 Marks

Question paper pattern for practical Sessional examinations

I.	Synopsis	=	10
II.	Experiments	=	25
III.	Viva voce	=	05
	Total	=	40 Marks

2.4.8. Promotion and award of grades

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

2.4.9. Carry forward of marks

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

2.4.10. 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.

2.4.11. Re-examination of end semester examinations

Re−examination of end semester examination shall be conducted as per the schedule given in table XIII. The exact dates of examinations shall be notified from time to time.

Table-XIII: Tentative schedule of end semester examinations

Semester	For Regular Candidates	For Failed Candidates
I, III, V and VII	November/ December	May/June
II, IV, VI and VIII	May/June	November/ December

Question paper pattern for end semester theory examinations

For 75 marks paper

(Answer all the questions)

I.	Long Answers	=	02 x 10 = 20
II.	Short Answers	=	07 x 05 = 35
III.	Objective type questions	=	10 x 02 = 20
	Total	=	75 Marks

For 50 marks paper

I.	Long Answers	=	02 x 10 = 20
II.	Short Answers	=	06 x 05 = 30
	Total	=	50 Marks

For 35 marks paper

I.	Long Answers	=	01 x 10 = 10
II.	Short Answers	=	05 x 05 = 25
	Total	=	35 Marks

Question paper pattern for end semester practical examinations

I.	Synopsis	=	05
II.	Experiments	=	25
III.	Viva voce	=	05
	Total	=	35 Marks

2.4.12. Academic Progression:

No student shall be admitted to any examination unless he/she fulfills the norms given. 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 success fully 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 semesters till the VII semester examinations. However, he/she shall not be eligible to get the course completion certificate

Until all the courses of I to VIII 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 semesters till the VII semester examinations. However, he/she shall not be eligible to get the course completion certificate until all the courses of all semesters are successfully completed.

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

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

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

2.4.13. Grading of performances

Letter grades and grade points allocations:

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

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

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

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

2.4.14. The Semester grade point average (SGPA)

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

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

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 ABS grade awarded in that semester. For example, if a learner has a For ABS grade in course 4, the SGPA shall then be computed as:

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

2.4.15. 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:

$$\text{CGPA} = \frac{C_1S_1 + C_2S_2 + C_3S_3 + C_4S_4 + C_5S_5 + C_6S_6 + C_7S_7 + C_8S_8}{C_1 + C_2 + C_3 + C_4 + C_5 + C_6 + C_7 + C_8}$$

Where C_1, C_2, C_3,….. is the total number of credits for semester I, II, III,….. and S_1,S_2,S_3,….is the SGPA of semester I,II,III,…. .

2.4.16. 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

2.4.17. 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.

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

Total	**75Marks**

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

Total	**75Marks**

Explanation: The75 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.

2.4.18. Industrial training

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

2.4.19. Practice School

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

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

2.4.20. Award of Ranks

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

2.4.21. Award of degree

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

2.5. Duration of the program

The course of study for B. Pharm shall extend over a period of eight semesters (four academic years) and six semesters (three academic years) for lateral entry students. The curricula and syllabi for the program shall be prescribed from time to time by Pharmacy Council of India, New Delhi.

2.5.1. 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.

2.5.2. 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.

2.6. SYLLABUS

Semester-I

BP101T. HUMAN ANATOMY AND PHYSIOLOGY-I (Theory) 45 Hours

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

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

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

Course Content:

Unit I **10 Hours**

- **Introduction to human body**

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

- **Cellular level of organization**

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

- **Tissue level of organization**

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

Unit II **10 Hours**

- **Integumentary system**

  Structure and functions of skin

- **Skeletal system**

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

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

- **Joints**

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

Unit III **10 Hours**

Body fluids and blood

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

- **Lymphatic system**

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

Unit IV **08 Hours**

Peripheral nervous system:

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

Origin and functions of spinal and cranial nerves.

Special senses

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

Unit V **07 Hours**

Cardiovascular system

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

BP107P. HUMAN ANATOMY AND PHYSIOLOGY (Practical) **4 Hours/week**

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

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

Recommended Books (Latest Editions)

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

Reference Books (Latest Editions)

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

BP102T. PHARMACEUTICAL ANALYSIS (Theory) **45 Hours**

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

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

1. understand the principles of volumetric and electro chemical analysis
2. Carryout various volumetric and electrochemical titrations
3. develop analytical skills

Course Content:

UNIT-I **10 Hours**

(a) **Pharmaceutical analysis** − Definition and scope

i) Different techniques of analysis
ii) Methods of expressing concentration
iii) Primary and secondary standards.
iv) Preparation and standardization of various molar and normal solutions− Oxalic acid, sodium hydroxide, hydrochloric acid, sodium thiosulphate, sulphuric acid, potassium permanganate and cerric ammonium sulphate

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

UNIT-II **10 Hours**

- **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 **10 Hours**

- **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 **08 Hours**

Redox titrations

(a) Concepts of oxidation and reduction

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

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

UNIT-V **07 Hours**

Electrochemical methods of analysis

- **Conductometry**− Introduction, Conductivity cell, Conductometric titrations, applications.
- **Potentiometry** - Electrochemical cell, construction and working of reference (Standard hydrogen, silver chloride electrode and calomel electrode) and indicator electrodes (metal electrodes and glass electrode), methods to determine end point of potentiometric titration and applications.
- **Polarography** − Principle, Ilkovic equation, construction and working of dropping mercury electrode and rotating platinum electrode, applications

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BP108P. PHARMACEUTICAL ANALYSIS (Practical) **4 Hours / Week**

I Limit test of the following

(1) Chloride (2) Sulphate (3) Iron (4) Arsenic

II Preparation and standardization of

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

III Assay of the following compounds along with Standardization of Titrant

(1) Ammonium chloride by acid base titration
(2) Ferrous sulphate by Cerimetry
(3) Copper sulphate by Iodometry
(4) Calcium gluconate by complexometry

(5) Hydrogen peroxide by Permanganometry
(6) Sodium benzoate by non−aqueous titration
(7) Sodium Chloride by precipitation titration

IV Determination of Normality by electro-analytical methods

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

Recommended Books: (Latest Editions)

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

BP103T. PHARMACEUTICS- I (Theory) 45 Hours

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

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

1. Know the history of profession of pharmacy
2. Understand the basics of different dosage forms, pharmaceutical incompatibilities and pharmaceutical calculations
3. Understand the professional way of handling the prescription
4. Preparation of various conventional dosage forms

Course Content:

UNIT – I 10 Hours

- **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 10 Hours

- **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, effervescent, efflorescent and hygroscopic powders, eutectic mixtures. Geometric dilutions.
- **Liquid dosage forms:** Advantages and disadvantages of liquid dosage forms. Excipients used in formulation of liquid dosage forms. Solubility enhancement techniques

UNIT – III **10 Hours**

- **Monophasic liquids:** Definitions and preparations of Gargles, Mouthwashes, Throat Paint, Eardrops, Nasal drops, Enemas, Syrups, Elixirs, Liniments and Lotions.
- **Biphasic liquids:**
- **Suspensions:** Definition, advantages and disadvantages, classifications, Preparation of suspensions; Flocculated and Deflocculated suspension & stability problems and methods to overcome.
- **Emulsions:** Definition, classification, emulsifying agent, test for the identification of type of Emulsion, Methods of preparation & stability problems and methods to overcome.

UNIT – IV **08 Hours**

- **Suppositories**: Definition, types, advantages and disadvantages, types of bases, methods of preparations. Displacement value & its calculations, evaluation of suppositories.
- **Pharmaceutical incompatibilities**: Definition, classification, physical, chemical and therapeutic incompatibilities with examples.

UNIT– V **07 Hours**

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

BP109P. PHARMACEUTICS I (Practical) **3 Hours / week**

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) Terpine hydrate Linctus I P'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) Aluminium 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. Cocoa butter suppository
c. Zinc oxide suppository

9. Semisolids

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

10. Gargles and Mouthwashes

a. Iodine Gargle
b. Chlorhexidine mouthwash

Recommended Books: (Latest Editions)

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

BP104T. PHARMACEUTICAL INORGANIC CHEMISTRY (Theory) 45 Hours

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

Objectives: 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

Course Content:

UNIT I **10 Hours**

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

UNIT II **10 Hours**

- **Acids, Bases and Buffers:** Buffer equations 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 **10 Hours**

- **Gastrointestinal agents Acidifiers:** Ammonium chloride* and Dil. HCl

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

Cathartics: Magnesium sulphate, Sodium orthophosphate**, Pharmaceutical Aid** Kaolin and Bentonite

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

UNIT IV **08 Hours**

- **Miscellaneous compounds**

  Expectorants: Potassium iodide, Ammonium chloride*. **Emetics**: Copper sulphate*, Antimony potassium tartarate **Haematinics:** Ferrous sulphate*, Ferrous gluconate
  Poison and Antidote: Sodium thiosulphate*, Activated charcoal, Sodium nitrite333

  Astringents: Zinc Sulphate, Potash Alum

UNIT V **07 Hours**

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

BP110P. PHARMACEUTICAL INORGANIC CHEMISTRY (Practical) 4Hours / Week

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
Neutralizing capacity of aluminum hydroxide gel
Determination of potassium iodate and iodine in potassium Iodide

IV **Preparation ofinorganic pharmaceuticals**

Boric acid Potashalum 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

BP105T.COMMUNICATION SKILLS (Theory) 30 Hours

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

Objectives:

Upon completion of the 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:

UNIT – I **07 Hours**

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

- **Barriers to communication:** Physiological Barriers, Physical Barriers, 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 **07 Hours**

- **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 **07 Hours**

- **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
- W**riting Effectively:** Subject Lines, Put the Main Point First, Know Your Audience, Organization of the Message

UNIT – IV **05 Hours**

- **Interview Skills:** Purpose of an interview, Do's and Dont's of an interview
- **Giving Presentations:** Dealing with Fears, Planning your Presentation, Structuring Your Presentation, Delivering Your Presentation, Techniques of Delivery

UNIT – V **04 Hours**

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

BP111P. COMMUNICATION SKILLS (Practical) **2 Hours / week**

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 Dont's

Pronunciations covering the following topics

Pronunciation (Consonant Sounds) Pronunciation and
Nouns
Pronunciation (Vowel Sounds)

Advanced Learning

Listening Comprehension / Direct and Indirect Speech
Figures of Speech Effective Communication Writing Skills
Effective Writing Interview Handling Skills E−Mail etiquette Presentation Skills

Recommended Books: (Latest Edition)

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

BP 106RBT.REMEDIAL BIOLOGY (Theory) 30 Hours

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

Objectives: Upon completion of the 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 understand the basic components of anatomy & physiology animal with special reference to human

UNIT I 07 Hours

Living world:

- Definition and characters of living organisms
- Diversity in the living world
- Binomial nomenclature

- Five kingdoms of life and basis of classification. Salient features of Monera, Potista, Fungi, Animalia and Plantae, Virus,

Morphology of Flowering plants

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

UNIT II **07 Hours**

Body fluids and circulation

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

Digestion and Absorption

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

Breathing and respiration

- Human respiratory system
- Mechanism of breathing and its regulation
- Exchange of gases, transport of gases and regulation of respiration
- Respiratory volumes

UNIT III **07 Hours**

Excretory products and their elimination

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

Neural control and coordination

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

Chemical coordination and regulation

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

Human reproduction

- Parts of female reproductive system
- Parts of male reproductive system

- Spermatogenesis and Oogenesis
- Menstrual cycle

UNIT IV **05 Hours**

Plants and mineral nutrition:

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

Photosynthesis

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

UNIT V **04 Hours**

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

Plant growth and development

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

a. A Text book of Biology by B.V. Sreenivasa Naidu
b. A Text book of Biology by Naidu and Murthy
c. Botany for Degree students By A.C.Dutta.
d. Outlines of Zoology by M. Ekambaranatha ayyer and T. N. Ananthakrishnan.
e. A manual for pharmaceutical biology practical by S.B. Gokhale and C. K. Kokate

BP112RBP.REMEDIAL BIOLOGY (Practical) **30 Hours**

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 and its 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

BP 106RMT.REMEDIAL MATHEMATICS (Theory) 30 Hours

Scope: 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.

Objectives: Upon completion of the course the student shall be able to:−

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

Course Content:

UNIT – I 06 Hours

- **Partial fraction**

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

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

  Real Valued function, Classification of real valued functions,
- **Limits and continuity**:

  Introduction , Limit of a function, Definition of limit of a function (-definition) ,

$\lim_{x\to a}\frac{x^n-a^n}{x-a}=na^{n-1}$, $\lim_{8\to 0}\frac{\sin 8}{8}=1$

UNIT –II 06 hours

- **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 **06 Hours**

- **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 *xn w.r.t*x,where *n* is any rational number, Derivative of *ex*,, Derivative of loge *x* , Derivative of *ax* ,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 **06 Hours**

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 **06 Hours**

- **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

Semester II

BP 201T. HUMAN ANATOMY AND PHYSIOLOGY-II (Theory) 45 Hours

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

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

1. Explain the gross morphology, structure and functions of various organs of the human body.
2. Describe the various homeostatic mechanisms and their imbalances.
3. Identify the various tissues and organs of different systems of human body.
4. Perform the hematological tests like blood cell counts, hemoglobin estimation, bleeding/ clotting time etc. and also record blood pressure, heart rate, pulse and respiratory volume.
5. Appreciate coordinated working pattern of different organs of each system
6. Appreciate the interlinked mechanisms in the maintenance of normal functioning (homeostasis) of human body.

Course Content:

Unit I **10 hours**

- **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, and cerebellum), spinal cord (gross structure, functions of afferent and efferent nerve tracts, reflex activity)

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Unit II **06 hours**

- **Digestive system**

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

- **Energetics**

Formation and role of ATP, Creatinine Phosphate and BMR.

Unit III **10 hours**

- **Respiratory system**

Anatomy of respiratory system with special reference to anatomy of Lungs, Mechanism of respiration, regulation of respiration

Lung Volumes and capacities transport of respiratory gases, artificial respiration, and resuscitation methods.

- **Urinary system**

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

Unit IV **10 Hours**

- **Endocrine system**

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

Unit V **09 hours**

- **Reproductive system**

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

- **Introduction to genetics**

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

BP 207 P. HUMAN ANATOMY AND PHYSIOLOGY (Practical) **4 Hours/week**

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

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

Recommended Books (Latest Editions)

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

BP202T. PHARMACEUTICAL ORGANIC CHEMISTRY –I (Theory) 45 Hours

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

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

1. write the structure, name and the type of isomerism of the organic compound
2. write the reaction, name the reaction and orientation of reactions
3. account for reactivity/stability of compounds,
4. identify/confirm the identification of organic compound

Course Content:

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

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

UNIT-I 07 Hours

- **Classification, nomenclature and isomerism**

Classification of Organic Compounds

Common and IUPAC systems of nomenclature of organic compounds

(up to 10 Carbons open chain and carbocyclic compounds) Structural isomerisms in organic compounds

UNIT-II **10 Hours**

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

SP^3 hybridization in alkanes, Halogenation of alkanes, uses of paraffins. Stabilities of alkenes, SP^2 hybridization in alkenes

E_1 and E_2 reactions − kinetics, order of reactivity of alkyl halides, rearrangement of carbocations, Saytzeffs orientation and evidences. E_1 verses E_2 reactions, Factors affecting E_1 and E_2 reactions. Ozonolysis, electrophilic addition reactions of alkenes, Markownikoff's orientation, free radical addition reactions of alkenes, Anti Markownikoff's orientation. Stability of conjugated dienes, Diel−Alder, electrophilic addition, free radical addition reactions of conjugated dienes, allylic rearrangement

UNIT-III **10 Hours**

- **Alkyl halides***

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

SN_1 versus SN_2 reactions, Factors affecting SN_1 and SN_2 reactions

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

- **Alcohols*-** Qualitative tests, Distinguishing tests between 10 Structure and uses of Ethyl alcohol, Methyl alcohol, chlorobutanol, Cetosteryl alcohol, Benzyl alcohol, Glycerol, Propylene glycol

UNIT-IV **10 Hours**

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

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

UNIT-V **08 Hours**

- **Carboxylic acids***

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

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

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

BP208P. PHARMACEUTICAL ORGANIC CHEMISTRY -I (Practical) 4 Hours / week

I. Systematic qualitative analysis of unknown organic compounds like

1. Preliminary test: Color, odour, aliphatic/aromatic compounds, saturation and unsaturation, etc. Detection of elements like Nitrogen, Sulphur and Halogen by Lassaigne's test
2. Solubility test
3. Functional group test like Phenols, Amides/ Urea, Carbohydrates, Amines, Carboxylic acids, Aldehydes and Ketones, Alcohols, Esters, Aromatic and Halogenated Hydrocarbons, Nitro compounds and Anilides.
4. Melting point/Boiling point of organic compounds
5. Identification of the unknown compound from the literature using melting point/ boiling point.
6. Preparation of the derivatives and confirmation of the unknown compound by melting point/ boiling point.Urea Nitrate,Urea Oxalate, Glucoxazone
7. Minimum 5 unknown organic compounds to be analysed systematically.

II. Preparation of suitable solid derivatives from organic compounds

III. 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.

BP203 T. BIOCHEMISTRY (Theory) 45 Hours

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

Objectives: Upon completion of course student shall able to

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

Course Content:

UNIT I **07 Hours**

Enzymes

Introduction, properties, nomenclature and IUB classification of enzymes, Enzyme kinetics (Michaelis plot, Line Weaver Burke plot), Enzyme inhibitors with examples. Regulation of enzymes: enzyme induction and repression, allosteric enzymes, regulation, therapeutic and diagnostic applications of enzymes and isoenzymes. Coenzymes −Structure and biochemical functions.

UNIT II **08 Hours**

- **Biomolecules**

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

- **Bioenergetics**

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

Unit III **10 Hours**

- **Carbohydrate metabolism**

Glycolysis-Pathway, energetics and significance, Citric acid cycle-Pathway, energetics and significance.
HMP shunt and its significance; Glucose−6−Phosphate dehydrogenase (G6PD) deficiency
Glycogen metabolism Pathways and glycogen storage diseases (GSD) Gluconeogenesis− Pathway and its significance.
Hormonal regulation of blood glucose level and Diabetes mellitus.

- **Biological oxidation**

Electron transport chain (ETC) and its mechanism. Oxidative phosphorylation & its mechanism and substrate level phosphorylation.
Inhibitors, ETC and oxidative phosphorylation/Uncouplers.

UNIT IV **10 Hours**

- **Lipid metabolism**

β-Oxidation of saturated fatty acid (Palmitic acid)
Formation and utilization of ketone bodies; ketoacidosis
De novo synthesis of fatty acids (Palmitic acid)
Biological significance of cholesterol and conversion of cholesterol into bile acids, steroid hormones 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, adrenaline
Catabolism of heme; hyperbilirubinemia and jaundice

UNIT V **10 Hours**

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

Biosynthesis of purine and pyrimidine nucleotides
Catabolism of purine nucleotides and Hyperuricemia and Gout disease
Organization of mammalian genome
Structure of DNA and RNA and their functions
DNA replication (semi conservative model)
Transcription or RNA synthesis
Genetic code, Translation or Protein synthesis and inhibitors of protein synthesis.

BP 209 P. BIOCHEMISTRY (Practical) **4 Hours / Week**

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 blood 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 the effect of Temperature on Salivary amylase activity.
12. Study the effect of substrate concentration on salivary amylase activity

Recommended Books (Latest Editions)

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

BP 204T.PATHOPHYSIOLOGY (THEORY) **45 Hours**

Scope: Pathophysiology is the study of causes of diseases and reactions of the body to such disease producing causes. This course is designed to impart a thorough knowledge of the relevant aspects of

pathology of various conditions with reference to its pharmacological applications, and understanding of basic pathophysiological mechanisms. Hence it will not only help to study the syllabus of pathology, but also to get baseline knowledge required to practice medicine safely, confidently, rationally and effectively.

Objectives: Upon completion of the subject student shall be able to –

1.Describe the etiology and pathogenesis of the selected disease states;
2.Name the signs and symptoms of the diseases; and

3.Mention the complications of the diseases.

Course content:

Unit I **10 Hours**

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

Introduction, definitions, Homeostasis, Components and Types of Feedback systems, Causes of cellular injury**,**Pathogenesis (Cell membrane damage, Mitochondrial damage,Ribosome damage, Nuclear damage)**,**Morphology of cell injury − Adaptive changes (Atrophy, Hypertrophy, hyperplasia, Metaplasia, Dysplasia)**,**Cell swelling, Intra cellular accumulation, Calcification, Enzyme leakage and Cell Death Acidosis &Alkalosis,Electrolyte imbalance

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

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

Unit II **10 Hours**

- **Cardiovascular System:**

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

- **Respiratory system:** Asthma, Chronic obstructive airways diseases.
- **Renal system:** Acute and chronic renal failure .

Unit III **10 Hours**

- **Haematological Diseases:**
  Iron deficiency, megaloblastic anemia (Vit B12 and folic acid), sickle cell anemia, thalasemia, hereditary acquired anemia, hemophilia
- **Endocrine system:** Diabetes, thyroid diseases, disorders of sex hormones
- **Nervous system:** Epilepsy, Parkinson's disease, stroke, psychiatric disorders: depression, schizophrenia and Alzheimer's disease.
- **Gastrointestinal system:** Peptic Ulcer

Unit IV **8 Hours**

- Inflammatory bowel diseases, jaundice, hepatitis (A,B,C,D,E,F) alcoholic liver disease.
- **Disease of bones and joints:** Rheumatoid arthritis, osteoporosis and gout
- **Principles of cancer:** classification, etiology and pathogenesis of cancer

Unit V **7 Hours**

- **Infectious diseases:** Meningitis, Typhoid, Leprosy, Tuberculosis Urinary tract infections
- **Sexually transmitted diseases:** AIDS, Syphilis, Gonorrhea

Recommended Books (Latest Editions)

1. Vinay Kumar, Abul K. Abas, Jon C. Aster; Robbins &Cotran Pathologic Basis of Disease; South Asia edition; India; Elsevier; 2014.
2. Harsh Mohan; Text book of Pathology; 6th edition; India; Jaypee Publications; 2010. Laurence B, Bruce C, Bjorn K. ; Goodman Gilman's The Pharmacological Basis of Therapeutics; 12th edition; New York; McGraw-Hill; 2011.
3. 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;
4. William and Wilkins, Baltimore;1991 [1990 printing].
5. Nicki R. Colledge, Brian R. Walker, Stuart H. Ralston;Davidson's Principles and Practice of Medicine; 21st edition; London; ELBS/Churchill Livingstone; 2010.
6. Guyton A, John .E Hall; Textbook of Medical Physiology; 12th edition; WB Saunders Company; 2010.
7. Joseph DiPiro, Robert L. Talbert, Gary Yee, Barbara Wells, L. Michael Posey; Pharmacotherapy: A Pathophysiological Approach; 9th edition; London; McGraw- Hill Medical; 2014.
8. V. Kumar, R. S. Cotran and S. L. Robbins; Basic Pathology; 6th edition; Philadelphia; WB Saunders Company; 1997.
9. 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.

BP205 T. COMPUTER APPLICATIONS IN PHARMACY (Theory) 30 Hrs (2 Hrs/Week)

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

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

1. know the various types of application of computers in pharmacy
2. know the various types of databases
3. know the various applications of databases in pharmacy

Course content:

UNIT – I 06 Hours

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 **06 Hours**

Web technologies:

Introduction to HTML, XML,CSS and Programming languages, introduction to web servers and Server Products Introduction to databases, MYSQL, MS ACCESS, Pharmacy Drug database

UNIT – III **06 Hours**

Application of computers in Pharmacy – Drug information storage 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 **06 Hours**

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

UNIT-V **06 Hours**

Computers as data analysis in Preclinical development:

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

BP210P. COMPUTER APPLICATIONS IN PHARMACY (Practical) (2 hours/week)

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

BP 206 T. ENVIRONMENTAL SCIENCES (Theory) 30 hours

Scope: 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.

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

1. Create the awareness about environmental problems among learners.
2. Impart basic knowledge about the environment and its allied problems.
3. Develop an attitude of concern for the environment.
4. Motivate learner to participate in environment protection and environment improvement.
5. Acquire skills to help the concerned individuals in identifying and solving environmental problems.
6. Strive to attain harmony with Nature.

Course content:

Unit-I 10 hours

The Multidisciplinary nature of environmental studies

Natural Resources

Renewable and non-renewable resources: Natural resources and associated problems

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

Unit-II 10 hours

- Ecosystems
- Concept of an ecosystem.
- Structure and function of an ecosystem.

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

Unit- III 10 hours

Environmental Pollution: Air pollution; Water pollution; Soil pollution

Recommended Books (Latest edition):

1. Y.K. Sing, Environmental Science, New Age International Pvt, Publishers, Bangalore
2. Agarwal, K.C. 2001 Environmental Biology, Nidi Publ. Ltd. Bikaner.
3. Bharucha Erach, The Biodiversity of India, Mapin Pu blishing Pvt. Ltd., Ahmedabad 013, India,
4. Brunner R.C., 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480p

5. Clark R.S., Marine Pollution, Clanderson Press Oxford
Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T. 2001,
6. Environmental Encyclopedia, Jaico Publ. House, Mumbai, 1196p
7. De A.K., Environmental Chemistry, Wiley Eastern Ltd.
8. Down of Earth, Centre for Science and Environment

Semester- III

BP301T. PHARMACEUTICAL ORGANIC CHEMISTRY - II (Theory) 45 Hours

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

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

1. write the structure, name and the type of isomerism of the organic compound
2. write the reaction, name the reaction and orientation of reactions
3. account for reactivity/stability of compounds,
4. prepare organic compounds

Course Content:

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

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

UNIT I 10 Hours

- **Benzene and its derivatives**

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

B. Reactions of benzene - nitration, sulphonation, halogenation- reactivity, 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 10 Hours

- **Phenols*** - Acidity of phenols, effect of substituents on acidity, qualitative tests, Structure and uses of phenol, cresols, resorcinol, naphthols
- **Aromatic Amines* -** Basicity of amines, effect of substituents on basicity, and synthetic uses of aryl diazonium salts

UNIT III 10 Hours

- **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 08 Hours

Polynuclear hydrocarbons: Synthesis, Reactions and Structure of Naphthalene, Phenanthrene, Anthracene, Diphenyl methane, Triphenyl methane and medicinal uses of their derivatives.

UNIT V **07 Hours**

Cyclo alkanes*

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

BP305P. PHARMACEUTICAL ORGANIC CHEMISTRY – II (Practical) **4 Hrs/week**

I. Experiments involving laboratory techniques

- Recrystalisation
- 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/parabromo acetanilide from aniline/acetanilide by halogenation (Bromination reaction)
- 5–nitro salicylic acid/meta dinitro benzene from salicylic acid/ Nitrobenzene by nitration reaction
- Benzoic acid from benzoyl chloride by oxidation reaction
- Benzoic acid/ Salicylic acid from alkyl benzoate/ Alkyl salicylate by hydrolyses reaction
- 1-phenyl-azo-2-naphtho aniline by diazotization and coupling reaction
- Benzil from benzoin by oxidation reaction.
- Dibenzal acetone from benzaldehyde by Claisen Schmidt reaction
- Cinnamic 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, Vol.I
3. Text book of organic chemistry by B.S.Bahl and 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.57
8. Introduction to Organic Laboratory techniques by Pavia, Lampman and Kriz.

BP302T. PHYSICAL PHARMACEUTICS-I (Theory) **45 Hours**

Scope: The course deals with the various physical, physicochemical properties and principle involved in dosage forms, formulations. Theory and practical components of the subject help the student to get a better insight in to various areas of formulation research and development and stability studies of pharmaceuticals.

Objectives.: upon the completion of the course student shall be able to

Understand various physicochemical properties of drug molecules in the designing the dosage form

1. Demonstrate use of physicochemical properties in evaluation of dosage forms.
2. Appreciate physicochemical properties of drug molecules in formulation research and development

Course Content:

UNIT-I **10 Hours**

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

UNIT-II **10 Hours**

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

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

UNIT-III **10 Hours**

Micromeretics: Particle size and distribution, average 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-IV **08 Hours**

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

UNIT – V **07 Hours**

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

BP306P. PHYSICAL PHARMACEUTICS – I (Practical) 4 Hrs/week

1. Determination the solubility of drug at room t e m p e rature
2. Determination of pKa value by Half Neutralization/ Henderson Hassel Balch 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 particle size, particle size distribution using sieving method
7. Determination of particle size, particle size distribution using Microscopic method
8. Determination of bulk density, true density and porosity
9. Determine the angle of repose and influence of lubricant on angle of repose
10. Determination of stability constant and donor acceptor ratio of PABA−Caffeine complex by solubility method
11. Determination of stability constant and donor acceptor ratio of Cupric−Glycine complex by pH titration method

Recommended Books: (Latest Editions)

1. Physical pharmacy by Alfred Martin 2.Experimental pharmaceutics by Eugene, Parott.
3. Tutorial pharmacy by Cooper and Gunn.
4. Stocklosam J. Pharmaceutical calculations, Lea &Febiger, Philadelphia.
5. Liberman H.A, Lachman C., Pharmaceutical Dosage forms, Tablets, Volume−1 to 3, 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 ManavalanR.
8. Laboratory manual of physical pharmaceutics, C.V.S. Subramanyam, J. Thimma settee

BP 303 T. PHARMACEUTICAL MICROBIOLOGY (Theory) 45Hours

Scope:

In the broadest sense, scope of microbiology is the study of all organisms that are invisible to the naked eye− that is the study of microorganisms. Microorganisms are necessary for the production of bread, cheese, beer, antibiotics, vaccines, vitamins, enzymes etc. Microbiology has an impact on medicine, agriculture, food science, ecology, genetics, biochemistry, immunology etc.

Objectives: Upon completion of the subject student shall be able to;

1. Understand methods of identification, cultivation and preservation of various microorganisms
2. Importance of sterilization in microbiology. and pharmaceutical industry
3. Learn sterility testing of pharmaceutical products.
4. Microbiological standardization of Pharmaceuticals.
5. Understand the cell culture technology and its applications in pharmaceutical industries.

Course content:

UNIT I **10 Hours**

Introduction, history of microbiology, its branches, scope and its importance. Introduction to Prokaryotes and Eukaryotes

Study of ultra−structure and morphological classification of bacteria, nutritional
Requirements, raw materials used for culture media and physical parameters for growth, growth curve, isolation and preservation methods for pure cultures, cultivation of anaerobes, and quantitative measurement of bacterial growth (total & viable count).
Study of different types of phase contrast microscopy, dark field microscopy and electron microscopy.

UNIT II **10 Hours**

Identification of bacteria using staining techniques (simple, Gram's &Acid fast staining) and biochemical tests (IMViC).
Study of principle, procedure, merits, demerits and applications of Physical, chemical and mechanical method of sterilization.
Evaluation of the efficiency of sterilization methods.

UNIT III **10 Hours**

Study of morphology, classification, reproduction/replication and cultivation of Fungi and Virus.
Classification and mode of action of disinfectants
Factors influencing disinfection, antiseptics and their evaluation for bacteriostatic and bactericidal actions
Evaluation of bactericidal & Bacteriostatic.
Sterility testing of products (solids, liquids, ophthalmic and other sterile products) according to IP.

UNIT IV 08 **Hours**

Designing of aseptic area, laminar flow equipments; study of different sources of contamination in an aseptic area and methods of prevention, clean area classification.

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

UNIT V **07 Hours**

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

BP 307P. PHARMACEUTICAL MICROBIOLOGY (Practical) **04 Hrs. /week**

1. Introduction and study of different equipments and processing, e.g., B.O.D. incubator, laminar flow, aseptic hood, autoclave, hot air sterilizer, deep freezer, refrigerator, microscopes used in experimental microbiology.

2. Sterilization of glassware, preparation and sterilization of media.
3. Sub culturing of bacteria and fungus. Nutrient stabs and slants preparations.
4. Staining methods− Simple, Grams staining and acid fast staining (Demonstration with practical).
5. Isolation of pure culture of micro−organisms by multiple streak plate technique and other techniques.
6. Microbiological assay of antibiotics by cup plate method and other methods
7. Motility determination by Hanging drop method.
8. Sterility testing of pharmaceuticals.
9. Bacteriological analysis of water
10. Biochemical test (IMViC reactions)
11. Revision Practical Class

Recommended Books (Latest edition)

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

BP304T. PHARMACEUTICAL ENGINEERING (Theory) 45 Hours

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

Objectives: Upon completion of the course student shall be able:

1. To know various unit operations used in Pharmaceutical industries.
2. To understand the material handling techniques.
3. To perform various processes involved in pharmaceutical manufacturing process.
4. To carry out various test to prevent environmental pollution.
5. To appreciate and comprehend significance of plant lay out design for optimum use of resources.
6. To appreciate the various preventive methods used for corrosion control in Pharmaceutical industries.

Course content:

UNIT-I 10 Hours

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

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

- **Size Separation:** Objectives, applications & mechanism of size separation, official standards of powders, sieves, size separation Principles, construction, working, uses, merits and demerits of Sieve shaker, cyclone separator, Air separator, Bag filter & elutriation tank.

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

UNIT-II **10 Hours**

- **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.

- **Heat Transfer:** Objectives, applications & Heat transfer mechanisms. Fourier's law, Heat transfer by conduction, convection & radiation. Heat interchangers & heat exchangers.

UNIT- III **10 Hours**

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

- **Distillation:** Objectives, applications & types of distillation. principles, construction, working, uses, merits and demerits of (lab scale and industrial scale) Simple distillation, preparation of purified water and water for injection BP by distillation, flash distillation, fractional distillation, distillation under reduced pressure, steam distillation & molecular distillation

UNIT-IV **08 Hours**

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

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

UNIT- V **7 Hours**

- **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 non-metals.

- **Material handling systems:** Objectives & applications of Material handling systems, different types of conveyors such as belt, screw and pneumatic conveyors.

Recommended Books: (Latest Editions)

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

BP308P - PHARMACEUTICAL ENGINEERING (Practical) 4 Hours/week

I. Particle size determination by beaker decantation method.

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

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

IV. Determination of moisture content and loss on drying.

V. Determination of humidity of air −From wet and dry bulb temperatures (use of Dew point method).

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

VII. Size analysis by sieving − To evaluate size distribution of tablet granulations− Construction of various size frequency curves including arithmetic and Logarithmic probability plots.

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

IX. Demonstration of colloid mill, planetary mixer, fluidized bed dryer, freeze dryer and such other major equipment.

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

XI. To calculate the mixing index for given sample by using Double Cone Blender.

Semester-IV

BP401T. PHARMACEUTICAL ORGANIC CHEMISTRY –III (Theory) 45 Hours

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

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

1. understand the methods of preparation and properties of organic compounds
2. explain the stereo chemical aspects of organic compounds and stereo chemical reaction
3. know the medicinal uses and other applications of organic compounds

Course Content:

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

UNIT-I **10 Hours**

10 Hours

Stereo isomerism

Optical isomerism −

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

UNIT-II **10 Hours**

Geometrical isomerism

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

UNIT-III **10 Hours**

Heterocyclic Compounds

Nomenclature and classification

Synthesis, reactions and medicinal uses of following compounds/derivatives

Pyrrole, Furan, and Thiophene − Relative aromaticity, reactivity and Basicity of pyrrole

UNIT-IV **8 Hours**

Synthesis, reactions and medicinal uses of following compounds/derivatives

- Pyrazole, Imidazole, Oxazole and Thiazole. Pyridine, Quinoline, Isoquinoline, Acridine and Indole.
- Basicity of pyridine
- Synthesis and medicinal uses of Pyrimidine, Purine, azepines and their derivatives

UNIT-V **7 Hours**

Reactions of synthetic importance

Metal hydride reduction ($NaBH_4$ and $LiAlH_4$), Clemmensen reduction,

Birch reduction, Wolff Kishner reduction.

Oppenauer oxidation Dakin reaction.

Beckmanns rearrangement 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

BP402T. MEDICINAL CHEMISTRY – I (Theory) **45 Hours**

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

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

1. understand the chemistry of drugs with respect to their pharmacological activity
2. understand the drug metabolic pathways, adverse effect and therapeutic value of drugs
3. know the Structural Activity Relationship (SAR) of different class of drugs
4. write the chemical synthesis of some drugs

Course Content:

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

UNIT- I **10 hours**

- Introduction to Medicinal Chemistry
- History and development of medicinal chemistry
- Physicochemical properties in relation to biological action
- Ionization, Solubility, Partition Coefficient, Hydrogen bonding, Protein binding, Chelation, Bioisosterism, Optical and Geometrical isomerism.

Drug metabolism:

Principles - Phase I and Phase II.

Factors affecting drug metabolism including stereo chemical aspects.

UNIT- II **10 hours**

Drugs acting on Autonomic Nervous System Sympathomimetic agents:

SAR of Sympathomimetic agents

Direct acting: Nor-epinephrine, Epinephrine, Phenylephrine*, Dopamine, Methyldopa, Clonidine, Isoproterenol, Terbutaline, Salbutamol*, Naphazoline, Oxymetazoline and Xylometazoline.

Indirect acting agents: Hydroxyamphetamine, Pseudoephedrine,

Agents with mixed mechanism: Ephedrine.

Adrenergic Antagonists:

- Alpha adrenergic blockers**:** Tolazoline*, Phentolamine, Prazosin.
- Beta adrenergic blockers**:** SAR of beta blockers, Propranolol*, Atenolol, , Esmolol, Metoprolol, Labetolol, Carvedilol.

UNIT-III **10 hours**

Cholinergic neurotransmitters:

Biosynthesis and catabolism of acetylcholine.

Cholinergic receptors (Muscarinic & Nicotinic) and their distribution.

Parasympathomimetic agents: SAR of Parasympathomimetic agents

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

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

Cholinesterase reactivator: Pralidoxime chloride.

Cholinergic Blocking agents: SAR of cholinolytic agents

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

Synthetic cholinergic blocking agents: Tropicamide, Cyclopentolate hydrochloride, Clidinium bromide, Dicyclomine hydrochloride*, Glycopyrrolate, , Propantheline bromide, Benztropine mesylate, Orphenadrine citrate, Biperidine hydrochloride, Procyclidine hydrochloride*, Ethopropazine hydrochloride.

UNIT- IV **8 Hours**

Drugs acting on Central Nervous System

A. Sedative and Hypnotics

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

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

Miscelleneous:

Amides & imides: Glutethmide.

Alcohol & their carbamate derivatives: Meprobomate.

Aldehyde & their derivatives: Triclofos sodium, Paraldehyde.

B. Antipsychotics

Phenothiazeines: SAR of Phenothiazeines − Promazine hydrochloride, Chlorpromazine hydrochloride*, Triflupromazine, Thioridazine hydrochloride,, Prochlorperazine maleate, Trifluoperazine hydrochloride.
Ring Analogues of Phenothiazeines: Chlorprothixene, Thiothixene, Loxapine succinate, Clozapine.
Fluro buterophenones: Haloperidol, Droperidol, Risperidone.
Beta amino ketones: Molindone hydrochloride.
Benzamides: Sulpieride.

C. Anticonvulsants: SAR of Anticonvulsants**,** mechanism of anticonvulsant action
Barbiturates: Phenobarbitone,
Hydantoins: Phenytoin*.
Oxazolidine diones: Trimethadione, Paramethadione Succinimides: Phensuximide, Methsuximide, Ethosuximide* Urea and monoacylureas: Carbamazepine*
Benzodiazepines: Clonazepam
Miscellaneous: Primidone, Valproic acid , Gabapentin, Felbamate

UNIT – V **7 Hours**

Drugs acting on Central Nervous System

General Anesthetics:

Inhalation anesthetics: Halothane*, Methoxyflurane, Enflurane, Sevoflurane, Isoflurane, Desflurane.
Ultra-short acting barbitutrates: Methohexital 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, Anilerdine hydrochloride, Diphenoxylate hydrochloride, Loperamide hydrochloride, Fentanyl citrate*, Methadone hydrochloride*, Propoxyphene hydrochloride, Pentazocine.
Narcotic antagonists**:** Nalorphine hydrochloride, Naloxone hydrochloride.

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

BP406P. MEDICINAL CHEMISTRY – I (Practical) **4 Hours/Week**

I. Preparation of drugs/ intermediates

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

II. Assay of drugs

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

III. Determination of Partition coefficient for any two drugs

Recommended Books (Latest Editions)

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

BP 403 T. PHYSICAL PHARMACEUTICS-II (Theory) 45Hours

Scope: The course deals with the various physical, physicochemical properties and principle involved in dosage forms, formulations. Theory and practical components of the subject help the student to get a better insight in to various areas of formulation research and development and stability studies of pharmaceuticals.

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

1. Understand various physicochemical properties of drug molecules in the designing the dosage form
2. Know the principles of chemical kinetics & to use them in assigning expiry date for Formulation
3. Demonstrate use of physicochemical properties in evaluation of dosage forms
4. Appreciate physicochemical properties of drug molecules in formulation research and Development

Course Content:

UNIT-I 10 hours

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

UNIT-II 10 hours

Rheology: Newtonian systems, law of flow, kinematic viscosity, effect of temperature, non− Newtonian systems, pseudoplastic, dilatants, plastic, thixotropy, thixotropy in formulation, determination of viscosity,

capillary, falling Sphere, rotational viscometers

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

UNIT-III **10 hours**

Coarse dispersion: Suspension, interfacial properties of suspended particles, settling in suspensions, formulation of suspensions. Emulsions and theories of emulsification, microemulsion and multiple emulsions; Physical stability of emulsions, preservation of emulsions, rheological properties of emulsions.

UNIT-IV **8 hours**

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

UNIT-V **7 hours**

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.

BP 407P. PHYSICAL PHARMACEUTICS- II (Practical) **4 Hrs/week**

1. Determination of surface tension of given liquids by drop count and drop weight method
2. Determination of HLB number of a surfactant by saponification method
3. Determination of Freundlich and Langmuir constants using activated char coal
4. Determination of critical micellar concentration of surfactants
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.

BP 404 T. PHARMACOLOGY-I (Theory) **45 Hours**

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

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

1. Understand the pharmacological actions of different categories of drugs
2. Explain the mechanism of drug action at organ system/sub cellular/ macromolecular levels.
3. Apply the basic pharmacological knowledge in the prevention and treatment of various diseases.
4. Observe the effect of drugs on animals by simulated experiments
5. Appreciate correlation of pharmacology with other bio medical sciences

Course Content:

UNIT-I **5 Hours**

General Pharmacology

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

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

UNIT-II **15 Hours**

General Pharmacology

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

b. Adverse drug reactions.

c. Drug interactions (pharmacokinetic and pharmacodynamic)

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

e. Principles of toxicology - Definition and basic knowledge of acute, subacute and chronic toxicity. Definition and basic knowledge of genotoxicity, carcinogenicity, teratogenicity and mutagenicity General principles of treatment of poisoning.

f. Chronopharmacology - Definition of rhythm and cycles. Biological clock and their significance leading to chronotherapy.

UNIT-III **10 Hours**

Pharmacology of peripheral nervous system

a. Organization and function of ANS.
b. Neurohumoral transmission,co−transmission and classification of neurotransmitters.
c. Parasympathomimetics; Clinical symptoms and management of organophosphorus poisoning; Parasympatholytics, Sympathomimetics, sympatholytics.
d. Neuromuscular blocking agents and skeletal muscle relaxants (peripheral).
e. Local anesthetic agents.
f. Drugs used in myasthenia gravis and glaucoma

UNIT-IV **8 Hours**

Pharmacology of central nervous system

a. Neurohumoral transmission in the C.N.S.special emphasis on importance of various neuro transmitters like with GABA, Glutamate, Glycine, serotonin, dopamine.
b. General anesthetics and pre-anesthetics**.**
c. Sedatives, hypnotics and centrally acting muscle relaxants.
d. Anti-epileptics;
e. Clinical symptoms and management of barbiturates poisoning
f. Alcohols and disulfiram

UNIT-V **07 Hours**

Pharmacology of central nervous system

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

BP 408 P.PHARMACOLOGY-I (Practical) **4Hrs/Week**

1. Introduction to experimental pharmacology.
   a. Commonly used instruments in experimental pharmacology.
   b. Study of common laboratory animals.
   c. Maintenance of laboratory animals as per CPCSEA guidelines.
   d. Common laboratory techniques. Blood withdrawal, serum and plasma separation, anesthetics and euthanasia used for animal studies.
2. Dose calculation in pharmacological experiments
3. Study of different routes of drugs administration in mice/rats.
4. Introduction to in-vitro pharmacology and physiological salt solutions.
5. DRC of acetylcholine using isolated chicken ileum.
6. Effect of spasmogens and spasmolytics using isolated chicken ileum (eg- physostigmine , atropine)
7. Determination of PA2 value of Atropine using isolated chicken ileum (by Schilds plot method).
8. Study of effect of drugs on gastrointestinal motility

9. Determination of acute oral toxicity (LD50) of a drug from a given data
10. Determination of acute skin irritation / corrosion of a test substance
11. Determination of acute eye irritation / corrosion of a test substance
12. Calculation of pharmacokinetic parameters from a given data

Note: **Wherever wet laboratory experiments are not feasible**, simulated experiments by software /videos may be used.

Recommended Books (Latest Editions)

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

BP 405 T.PHARMACOGNOSY AND PHYTOCHEMISTRY I (Theory) 45 Hours

Scope: 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. To study production of plants and phytochemicals through plant tissue culture.

Objectives: Upon completion of the course, the student shall be able

1. To know the techniques in the cultivation and production of crude drugs
2. To know the crude drugs, their uses and chemical nature
3. To know the evaluation techniques for the herbal drugs
4. To carry out the microscopic and morphological evaluation of crude drugs

Course Content

UNIT-I 10 Hours

Introduction to Pharmacognosy:

a. Definition, History, scope and development of Pharmacognosy.
b. Sources of Drugs – Plants, Animals, Marine & Tissue culture
c. Organized drugs,(seed, leaf, bark, wood, root, rhizome, flower, fruit and entire drug) unorganized drugs, (dried latex, dried juices, dried extracts, gums, mucilages, oleoresins and oleo- gum -resins).

Classification of drugs:

Alphabetical, morphological, taxonomical, chemical, pharmacological, chemo and serotaxonomical 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.

Quantitative microscopy of crude drugs including lycopodium spore method, leaf constants, Camera Lucida, and calibration of eye piece micrometer using stage micrometer.

UNIT-II **10 Hours**

Cultivation, Collection, Processing and storage of drugs of natural origin: **General aspects on cultivation and collection, processing and storage 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: In situ and ex situ conservation of medicinal plants.

UNIT-III **07 Hours**

Plant tissue culture: Historical development of plant tissue culture, types of cultures, nutritional requirements, growth and their maintenance. Applications of plant tissue culture in Pharmacognosy. Edible vaccines

UNIT IV **10 Hours**

Pharmacognosy in various systems of medicine:

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

Introduction to secondary metabolites:

Definition, classification, properties and general tests for identification of Alkaloids, Glycosides, Flavonoids, Tannins, Volatile oil and Resins.

UNIT V **08 Hours**

Study of biological source, chemical constituents and uses of drugs of natural origin containing following Plant drugs /Products:

Fibers - Cotton, Jute, Hemp
Hallucinogen- Cannabis,
Teratogens- Tobacco, Colchicum, Veratrum
Natural allergens-Classification, Preparation and standardization of allergenic extract.

Primary metabolites:

General introduction, detailed study with respect to chemical constituents, sources, preparation, evaluation, preservation, storage, therapeutic uses and commercial utility as Pharmaceutical Aids and/or Medicines for the following Primary metabolites:

Carbohydrates: Acacia, Agar, Starch, Tragacanth, Honey.

Proteins and Enzymes: Gelatin, Casein, Proteolytic enzymes (Papain, Bromelain, Serratiopeptidase, Urokinase, Streptokinase, Pepsin).

Lipids (Waxes, fats, fixed oils): Castor oil, Chaulmoogra oil, Wool Fat, Bees wax.

Marine Drugs: Novel medicinal agents from marine sources: Antiviral, Antimicrobial, Anticancer and Cardiovascular agents.

BP409 P. PHARMACOGNOSY AND PHYTOCHEMISTRY I (Practical) **4 Hours/week**

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 index
3. Determination of vein islet number, vein termination number and palisade ratio.
4. Determination of size of starch grains, calcium oxalate crystals by eye piece micrometer
5. Determination of Fiber length and width by eye piece micrometer.
6. Determination of number of starch grains by Lycopodium spore method
7. Determination of Ash values.
8. Determination of Extractive values of crude drugs.
9. Determination of moisture content of crude drugs
10. Determination of swelling index and foaming index. Recommended Books: (Latest Editions)

1. W.C.Evans, Trease and Evans Pharmacognosy, 16th edition, W.B. Saunders & Co., London, 2009.
2. Tyler, V.E., Brady, L.R. and Robbers, J.E., Pharmacognosy, 9th Edition., 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, Gokhale
9. Anatomy of Crude Drugs by M.A. Iyengar
10. Biren Shah ,A.K.Seth,Text Book of Pharmacognosy and phytochemistry, second edition ,Elsevier publications.

Semester-V

BP501T. MEDICINAL CHEMISTRY – II (Theory) **45 Hours**

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

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

1. Understand the chemistry of drugs with respect to their pharmacological activity
2. Understand the drug metabolic pathways, adverse effect and therapeutic value of drugs
3. Know the Structure Activity Relationship of different class of drugs
4. Study the chemical synthesis of selected drugs

Course Content:

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

UNIT- I **10 Hours**

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

H_1–antagonists: Diphenhydramine hydrochloride*, Dimenhydrinate, Tripelennamine hydrochloride, Chlorcyclizine hydrochloride, Meclizine hydrochloride, Buclizine hydrochloride, Chlorpheniramine maleate, Triprolidine hydrochloride*, Promethazine hydrochloride*, Cyproheptadine hydrochloride, Azatidine maleate, Astemizole, Loratadine, Cetirizine, 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, Cytarabine, Methotrexate*, Azathioprine

Antibiotics: Dactinomycin, Daunorubicin, Doxorubicin, Bleomycin

Plant products: Etoposide, Vinblastin sulphate, Vincristin sulphate

Miscellaneous: Cisplatin, Mitotane.

UNIT – II **10 Hours**

Anti-anginal:

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

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

Diuretics:

Carbonic anhydrase inhibitors: Acetazolamide*, Methazolamide,
Thiazides:Chlorthiazide*, Hydrochlorothiazide,
Loop diuretics: Furosemide*, Bumetanide, Ethacrynic acid.
Potassium sparing Diuretics: Spironolactone, Triamterene, Amiloride.
Osmotic Diuretics: Mannitol

Anti-hypertensive Agents: Timolol, Captopril, Lisinopril, Enalapril, Benazepril hydrochloride, Clonidine hydrochloride, Sodium nitroprusside, Diazoxide, Minoxidil, Hydralazine hydrochloride.

UNIT- III **10 Hours**

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

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

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

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

UNIT- IV **08 Hours**

Drugs acting on Endocrine system

Nomenclature, Stereochemistry and metabolism of steroids

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

Drugs for erectile dysfunction: Sildenafil, Tadalafil.

Oral contraceptives: Mifepristone, Norgestrel, Levonorgestrel

Corticosteroids : Cortisone, Hydrocortisone, Prednisolone, Betamethasone, Dexamethasone

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

UNIT – V **07 Hours**

Antidiabetic agents:

Insulin and its preparations

Sulfonyl ureas: Tolbutamide*, Chlorpropamide, Glipizide, Glimepiride. Biguanides: Metformin. Thiazolidinediones: Pioglitazone, Rosiglitazone. Meglitinides: Repaglinide, Nateglinide. Glucosidase inhibitors: Acarbose, Voglibose.

Local Anesthetics: SAR of Local anesthetics

Benzoic Acid derivatives: Cocaine, Cyclomethycaine, Piperocaine.

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

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

Miscellaneous: Phenacaine, Dibucaine.*

Recommended Books (Latest Editions)

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

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

BP 502 T. FORMULATIVE PHARMACY (Theory) 45 Hours

Scope: 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.

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

1. Know the various pharmaceutical dosage forms and their manufacturing techniques.
2. Know various considerations in development of pharmaceutical dosage forms
3. Formulate solid, liquid and semisolid dosage forms and evaluate them for their quality

Course content: **3 hours/ week**

UNIT-I **07 Hours**

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

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

UNIT-II **10 Hours**

Tablets:

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

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

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

UNIT-III **08 Hours**

Capsules:

a. **Hard gelatin capsules:** Introduction, Extraction of gelatin and production of hard gelatin capsule shells. size of capsules, Filling, finishing and special techniques of formulation of hard gelatin capsules. 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 minimum/gram factors, production, in process and final product quality control tests. Packing, storage and stability testing of soft gelatin capsules

Pellets: Introduction, formulation requirements, pelletization process, equipments for manufacture of pellets

UNIT-IV **10 Hours**

Parenteral Products:

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

b. Production procedure, production facilities and controls.

c. Formulation of injections, sterile powders, emulsions, suspensions, large volume parenterals and lyophilized products, Sterilization.

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

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 **10 Hours**

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

Pharmaceutical Aerosols: Definition, propellants, containers, valves, types of 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.

BP 506 P. FORMULATIVEPHARMACY (Practical) **4Hours/week**

1. Preformulation study for prepared granules
2. Preparation and evaluation of Paracetamol tablets
3. Preparation and evaluation of Aspirin tablets
4. Coating of tablets
5. Preparation and evaluation of Tetracycline capsules
6. Preparation of Calcium Gluconate injection
7. Preparation of Ascorbic Acid injection
8. Preparation of Paracetamol Syrup
9. Preparation of Eye drops
10. Preparation of Pellets by extrusion spheronization technique
11. Preparation of Creams (cold / vanishing cream)
12. Evaluation of Glass containers

Recommended Books: (Latest Editions)

1. Pharmaceutical dosage forms − Tablets, volume 1 −3 by H.A. Liberman, Leon Lachman &J.B.Schwartz
2. Pharmaceutical dosage form − Parenteral medication vol− 1&2 by Liberman & Lachman
3. Pharmaceutical dosage form disperse system VOL−1 by Liberman & Lachman
4. Modern Pharmaceutics by Gilbert S. Banker & C.T. Rhodes, 3rd Edition Remington: The Science and Practice of Pharmacy, 20th edition Pharmaceutical Science (RPS)
5. Theory and Practice of Industrial Pharmacy by Liberman & Lachman
6. Pharmaceutics− The science of dosage form design by M.E.Aulton, Churchill livingstone, Latest edition
7. Introduction to Pharmaceutical Dosage Forms by H. C.Ansel, Lea &Febiger, Philadelphia, 5th edition, 2005
8. Drug stability − Principles and practice by Cartensen & C.J. Rhodes, 3rd Edition, Marcel Dekker Series, Vol 107.

BP503.T. PHARMACOLOGY-II (Theory) **45 Hours**

Scope: 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.

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

1. Understand the mechanism of drug action and its relevance in the treatment of different diseases
2. Demonstrate isolation of different organs/tissues from the laboratory animals by simulated experiments
3. Demonstrate the various receptor actions using isolated tissue preparation
4. Appreciate correlation of pharmacology with related medical sciences

Course content

UNIT-I **10 Hours**

1. Pharmacology of drugs acting on cardio vascular system

a) Introduction to hemodynamic and electrophysiology of heart.
b) Drugs used in congestive heart failure
c) Anti−hypertensive drugs.
d) Anti−anginal drugs.
e) Anti−arrhythmic drugs.
f) Anti−hyperlipidemic drugs.

UNIT-II **10 Hours**

Pharmacology of drugs acting on blood and blood forming organs.

a) Drug used in the therapy of shock.
b) Hematinics, coagulants and anticoagulants.
c) Fibrinolytics and anti−platelet drugs
d) Plasma volume expanders

Pharmacology of drugs acting on urinary system

e) Diuretics
f) Anti−diuretics.

UNIT-III **10 Hours**

Autocoids and related drugs

a. Introduction to autacoids and classification
b. Histamine, 5−HT and their antagonists.
c. Prostaglandins, Thromboxanes and Leukotrienes.
d. Angiotensin, Bradykinin and Substance P.
e. Non−steroidal anti−inflammatory agents, Clinical symptoms and management of Aspirin poisoning, Paracetamol poisoning.
f. Anti-gout drugs
g. Antiheumatic drugs

UNIT-IV **08 Hours**

Pharmacology of drugs acting on endocrine system

a. Basic concepts in endocrine pharmacology.
b. Anterior Pituitary hormones− analogues and their inhibitors.
c. Thyroid hormones− analogues and their inhibitors.
d. Hormones regulating plasma calcium level− Parathormone, Calcitonin and Vitamin−D.
e. Insulin, Oral Hypoglycemic agents and glucagon.
f. ACTH and corticosteroids.

UNIT-V **07hours**

Pharmacology of drugs acting on endocrine system

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

Bioassay

a) Principles and applications of bioassay.
b) Types of bioassay
c) Bioassay of insulin, oxytocin, vasopressin, ACTH,d−tubocurarine,digitalis, histamine, Heparin sodium, Antirabies vaccine, Diphtheria antitoxin

BP 507 P. PHARMACOLOGY-II (Practical) **4Hrs/Week**

1. Effect of drugs on ciliary motility of frog oesophagus
2. Effect of drugs on rabbit eye.
3. Study of local anesthetics by different methods .
4. Effect of saline purgative on frog intestine
5. Insulin hypoglycemic effect in rabbit
6. Test for pyrogens (Rabbit method)

7. Study of effect of hepatic microsomal enzyme inducers on the phenobarbitone sleeping time in mice.
8. Effect of drugs on isolated frog heart.
9. Effect of drugs on blood pressure and heart rate of dog.
10. Study of diuretic activity of drugs using rats/mice.
11. Bioassay of agonist, eg .Acetyl choline on chicken ileum by matching method.
12. Bioassay of agonist, eg.Acetyl choline on chicken ileum by Bracketing method
13. Bioassay of agonist, eg.Acetyl choline on chicken ileum by interpolation method.
14. Bioassay of agonist, eg.Acetyl choline on chicken ileum by three point bioassay.
15. Bioassay of agonist, eg.Acetyl choline on chicken ileum by four point bioassay. (Demonstration only)

Note: **Wherever wet laboratory experiments are not feasible**, simulated experiments by software /videos may be used.

Recommended Books (Latest Editions)

1. Rang H. P., Dale M. M., Ritter J. M., Flower R. J., Rang and Dale's Pharmacology, Churchil Livingstone Elsevier
2. Katzung B. G., Masters S. B., Trevor A. J., Basic and clinical pharmacology, Tata Mc Graw−Hill.
3. Goodman and Gilmans, 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. Lippincotts Illustrated Reviews-Pharmacology.
6. K.D.Tripathi. Essentials of Medical Pharmacology, JAYPEE Brothers Medical Publishers (P) Ltd, New Delhi.
7. Sharma H. L., Sharma K. K., Principles of Pharmacology, Paras medical publisher
8. Modern Pharmacology with clinical Applications, by Charles R.Craig& Robert.
9. Ghosh MN. Fundamentals of Experimental Pharmacology. Hilton & Company, Kolkata.
10. Kulkarni SK. Handbook of experimental pharmacology. Vallabh Prakashan.

BP504 T. PHARMACOGNOSY AND PHYTOCHEMISTRY II (Theory) 45 Hours

Scope: The main purpose of subject is to impart the students the knowledge of how the secondary metabolites are produced in the crude drugs, how to isolate and identify and produce them industrially.

Objectives: Upon completion of the course, the student shall be able

1. to know basic metabolic pathways and formation of different secondary metabolites
2. to know various medicinally important secondary metabolites
3. to know the modern extraction techniques, characterization and identification of the herbal drugs and phytoconstituents
4. to carryout isolation and identification of phytoconstituents

Course Content:

UNIT-I 7 Hours

Metabolic pathways in higher plants and their determination

a) Brief study of basic metabolic pathways and formation of different secondary metabolites through these pathways- Shikimic acid pathway, Acetate pathways and Amino acid pathway.
b) Study of utilization of radioactive isotopes in the investigation of Biogenetic studies.

UNIT-II **20 Hours**

Study of the biological source, cultivation (*marked only), commercial varieties, chemical constituents, chemistry & chemical classes, substitutes, adulterants, Diagnostic, macroscopic and microscopic (# marked only) features, specific chemical tests , general methods of extraction & analysis, therapeutic uses and commercial applications of following secondary metabolites:

Alkaloids: Vinca, Rauwolfia*#, Belladonna, Opium*, Ephedra, Cinchona#

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 **10 Hours**

Industrial production, estimation and utilization of the following phytoconstituents:
Forskolin, Sennoside, Artemisinin, Diosgenin, Digoxin, Atropine, Podophyllotoxin, Caffeine, Taxol, Vincristine and Vinblastine

UNIT IV **8 Hours**

Basics of Phytochemistry Modern methods of extraction, application of latest techniques

Like Spectroscopy, chromatography and electrophoresis in the isolation, purification and identification

Of crude drugs.

BP 508 P. PHARMACOGNOSY AND PHYTOCHEMISTRY II (Practical) **4 Hours/Week**

1. Morphology, histology and powder characteristics : Cinchona, Cinnamon, Senna, Clove, Ephedra, Fennel and Coriander
2. Exercise involving isolation & detection of active principles
   a. Caffeine - from tea dust.
   b. Starch from Potato
   c. Calcium citrate from lemon juice
   d. Pectin from lemon peel
   e. Casein from milk
   f. Lawsone from Henna
   g. Curcumin from turmeric
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, 16_{th} edition, W.B. Saunders & Co., London, 2009.
2. Mohammad Ali. Pharmacognosy and Phytochemistry, CBS Publishers & Distribution, New Delhi.
3. Text book of Pharmacognosy by C.K. Kokate, Purohit, Gokhale (2007), 37_{th} Edition, Nirali Prakashan, New Delhi.
4. Herbal drug industry by R.D. Choudhary (1996), 1^{st} 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. Louis Appell, The formulation and preparation of cosmetic, fragrances and flavours, Micelle Press 1994.
11. Remington's Pharmaceutical sciences.
12. Text Book of Biotechnology by Vyas and Dixit.
13. Text Book of Biotechnology by R.C. Dubey.

BP 505 T. PHARMACEUTICAL JURISPRUDENCE (Theory) 45 Hours

Scope: This course is designed to impart basic knowledge on several important legislations related to the profession of pharmacy in India.

Objectives: Upon completion of the course, the student shall be able to understand:

1. The Pharmaceutical legislations and their implications in the development and marketing
2. Various Indian pharmaceutical Acts and Laws
3. The regulatory authorities and agencies governing the manufacture and sale of pharmaceuticals
4. The code of ethics during the pharmaceutical practice

Course Content:

UNIT-I 10 Hours

Drugs and Cosmetics Act, 1940 and its rules 1945:

Objectives, Definitions, Legal definitions of schedules to the act and rules

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

Manufacture of drugs Prohibition of manufacture and sale of certain drugs, Conditions for grant of license and conditions of license for manufacture of drugs,

Manufacture of drugs for test, examination and analysis, manufacture of new drug, loan license and repacking license.

UNIT-II 10 Hours

Drugs and Cosmetics Act, 1940 and its rules 1945.

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

Wholesale, Retail sale and Restricted license. Offences and penalties Labeling & Packing of drugs- General labeling requirements and specimen labels for drugs and cosmetics, List of permitted colors. Offences and penalties.
Administration of the act and rules Drugs Technical Advisory Board, Central drugs Laboratory, Drugs Consultative Committee, Government drug analysts, licensing authorities, controlling authorities, Drugs Inspectors

UNIT-III **10 Hours**

Pharmacy Act 1948: Objectives, Definitions, Pharmacy Council of India; its constitution and functions, Education Regulations, State and Joint state pharmacy councils; its 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 **08 Hours**

- **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, Breeding and Stocking of Animals, Performance of Experiments, Transfer and acquisition of animals for experiment, Records, Power to suspend or revoke registration, Offences and Penalties

- **National Pharmaceutical Pricing Authority:** Drugs Price Control Order (DPCO)2013. Objectives, Definitions, Sale prices of bulk drugs, Retail price of formulations, Retail price and ceiling price of scheduled formulations, National List of Essential Medicines (NLEM)

UNIT-V **07 Hours**

- **Pharmaceutical Legislations** A brief review, Introduction, Study of drugs 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)**

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)

Semester-VI

BP601T. MEDICINAL CHEMISTRY III (Theory) 45 Hours

Scope: 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.

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

1. Understand the importance of drug design and different techniques of drug design.
2. Understand the chemistry of drugs with respect to their biological activity.
3. Know the metabolism, adverse effects and therapeutic value of drugs.
4. Know the importance of SAR of drugs.

Course Content:

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

UNIT I 10 Hours

Antibiotics

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

β-Lactam antibiotics: Penicillin, Cepholosporins, - Lactamase inhibitors, Monobactams

Aminoglycosides: Streptomycin, Neomycin, Kanamycin

Tetracyclines: Tetracycline, Oxytetracycline, Chlortetracycline, Minocycline, Doxycycline

UNIT II 10 Hours

Antibiotics

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

Macrolide: Erythromycin, Clarithromycin, Azithromycin.

Miscellaneous: Chloramphenicol*, Clindamycin.

Prodrugs: Basic concepts and application of prodrugs design.

Antimalarials: Etiology of malaria.

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

Biguanides and dihydro triazines: Cycloguanil pamoate, Proguanil.

Miscellaneous: Pyrimethamine, Artesunate, Artemether, Atovaquone.

UNIT – III **10 Hours**

Anti-tubercular Agents

Synthetic anti tubercular agents: Isoniazid*, 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**:** Furazolidone, Nitrofurantoin*, Methenamine.

Antiviral agents:

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

UNIT – IV **08 Hours**

Antifungal agents:

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

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

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

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

Sulphonamides and Sulfones

Historical development, chemistry, classification and SAR of Sulfonamides:

Sulphamethizole, Sulfisoxazole, Sulphamethazine, Sulfacetamide*, Sulphapyridine, Sulfamethoxazole*, Sulphadiazine, Mefenide acetate, Sulfasalazine.

Folate reductase inhibitors: Trimethoprim*, Cotrimoxazole.

Sulfones: Dapsone*.

UNIT – V **07 Hours**

Introduction to Drug Design

Various approaches used in drug design. Physicochemical parameters used in quantitative structure activity relationship (QSAR) such as partition coefficient, Hammett'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.

BP607P. MEDICINAL CHEMISTRY- III (Practical) **4 Hours / week**

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 (Lipinski's 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.

BP602 T. PHARMACOLOGY-III (Theory) 45 Hours

Scope: 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 and chronopharmacology.

Objectives: Upon completion of this course the student should 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 poisoningsand
3. appreciate correlation of pharmacology with related medical sciences.

Course Content:

UNIT-I 10hours

1. Pharmacology of drugs acting on Respiratory system

a. Anti -asthmatic drugs
b. Drugs used in the management of COPD
c. Expectorants and antitussives

d. Nasal decongestants
e. Respiratory stimulants

2. Pharmacology of drugs acting on the Gastrointestinal Tract

a. Antiulcer agents.
b. Drugs for constipation and diarrhea
c. Appetite stimulants and suppressants.
d. Digestants and carminatives.
e. Emetics and anti-emetics.
f. Drugs on skin - melanising and demelanising agents, drugs used in psoriasis, acne

UNIT-II **10hours**

3. Chemotherapy

a. General principles of chemotherapy. including classification of chemotherapeutic agents, microbial resistance, chemoprophylaxis
b. Sulfonamides and cotrimoxazole. Urinary antiseptics
c. Antibiotics- Penicillins, cephalosporins, monobactam, carbapenem chloramphenicol, macrolides Lincosamides, quinolones and fluoroquinolones, tetracycline and aminoglycosides, oxazolidinediones

UNIT-III **10 hours**

3. Chemotherapy

a. Antitubercular agents
b. Antileprotic agents
c. Antifungal agents
d. Antiviral drugs including anti HIV drugs
e. Anthelmintics
f. Antimalarial drugs
g. Antiamoebic agents

UNIT-IV **08 hours**

3. Chemotherapy

Drugs used in UTI and STDs.

Anticancer agents

4. Immunopharmacology

Immunostimulants, Immunosuppressant

Protein drugs, monoclonal antibodies, target drugs to antigen, biosimilars

UNIT-V **07 hours**

Gene therapy- concepts, approaches, gene transfer techniques and application Stem cell therapy -an overview

BP 608 P. PHARMACOLOGY-III (Practical) **4Hrs/Week**

1. Anti allergic activity by mast cell stabilization assay
2. Study of anti-ulcer activity of a drug using pylorus ligand (SHAY) rat model and NSAIDS induced ulcer model.

3. Estimation of serum biochemical parameters .
4. Effects of skeletal muscle relaxants using rota-rod apparatus.
5. Effect of drugs on locomotor activity using actophotometer.
6. Anticonvulsant effect of drugs by MES and PTZ method.
7. Study of stereotype and anti-catatonic activity of drugs on rats/mice.
8. Study of anxiolytic activity of drugs using rats/mice.
9. Anti-inflammatory activity of drugs using carrageenan induced paw-edema model.
10. Analgesic activity of drug using central and peripheral methods
11. Biostatistics methods in experimental pharmacology (student s t test, ANOVA)
12. Biostatistics methods in experimental pharmacology (Chi square test, Wilcoxon Signed Rank test)

Note: Wherever **wet laboratory experiments are not feasible**, simulated experiments bysoftware /videos may be used.

Recommended Books (Latest Editions)

1. Rang H. P., Dale M. M., Ritter J. M., Flower R. J., Rang and Dale s Pharmacology, Churchil Livingstone Elsevier
2. Katzung B. G., Masters S. B., Trevor A. J., Basic and clinical pharmacology, Tata McGraw-Hill
3. Goodman and Gilmans, 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. Lippincotts Illustrated Reviews- Pharmacology
6. K.D.Tripathi. Essentials of Medical Pharmacology, , JAYPEE Brothers Medical Publishers (P) Ltd, New Delhi.
7. Sharma H. L., Sharma K. K., Principles of Pharmacology, Paras medical publisher Modern Pharmacology with clinical Applications, by Charles R.Craig& Robert,
8. Ghosh MN. Fundamentals of Experimental Pharmacology. Hilton & Company, Kolkata,
9. Kulkarni SK. Handbook of experimental pharmacology. VallabhPrakashan,
10. N.Udupa and P.D. Gupta, Concepts in Chronopharmacology.

BP 603 T. HERBAL DRUG TECHNOLOGY (Theory) 45 hours

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

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

1. understand raw material as source of herbal drugs from cultivation to herbal drug product
2. know the WHO and ICH guidelines for evaluation of herbal drugs
3. know the herbal cosmetics, natural sweeteners, nutraceuticals
4. appreciate patenting of herbal drugs, GMP .
5. To understand the preparation and development of herbal formulation
6. To understand the herbal drug interactions.

Course content:

UNIT-I **06 Hours**

Herbs as raw materials

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

UNIT-II **05 Hours**

a) Basic principles involved in Ayurveda, Siddha, Unani and Homeopathy
b) Preparation and standardization of Ayurvedic formulations viz; Aristas and Asawas, Ghutika,Churna, Lehya and Bhasma.

UNIT-III **07 Hours**

Nutraceuticals

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

Study of following herbs as health food: 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 and their possible side effects and interactions: Hypericum, Kava-kava, Ginkobiloba, Ginseng, Garlic, Pepper & Ephedra.

UNIT-IV **10 Hours**

Herbal Cosmetics

Sources and description of raw materials of herbal origin used in herbal cosmetics such as

a) Fixed oils: Almond oil ,Arachis oil, castor oil ,olive oil, coconut oil
b) Waxes: Bees wax, Carnauba wax, Paraffin wax, Spermaceti
c) Gums: Guar gum, Sodium Alginate, Tragacanth
d) Colours: Cochineal, Saffron, Indigo, Henna
e) Perfumes: Rose oil, Jasmine oil, Lavender oil.
f) Protective agents: Neem, Cucumber, Aloe
g) Bleaching agents: Lemon, Turmeric
h) Antioxidants: Green tea, Sesame oil in products such as skin care, hair care and oral hygiene products.

Herbal excipients:

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

Herbal formulations:

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

UNIT- V **10 Hours**

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, Breeders 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-VI **07 Hours**

General Introduction to Herbal Industry

Herbal drugs industry: Present scope and future prospects.

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

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

BP 609 P. HERBAL DRUG TECHNOLOGY (Practical) **4 hours/ week**

1. To perform preliminary phytochemical screening of crude drugs.
2. Determination of Ash values
3. Determination of moisture content of crude drugs
4. Determination of Extractive values of crude drugs
5. Determination of the alcohol content of Asava and Arista
6. Preparation of herbal cosmetics
7. Preparation and standardization of herbal formulation
8. Determination of swelling index and foaming index
9. Monograph analysis of herbal drugs from recent Pharmacopoeias
10. Analysis of fixed oils

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.

BP 604 T. BIOPHARMACEUTICS AND PHARMACOKINETICS (Theory) 45 Hours

Scope: This subject is designed to impart knowledge and skills necessary for dose calculations, dose

Adjustments and to apply Biopharmaceutics theories in practical problem solving. Basic theoretical discussions of the principles of Biopharmaceutics and pharmacokinetics are provided to help the students to clarify the concepts.

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

1. Understand the basic concepts in biopharmaceutics and pharmacokinetics.
2. Use plasma data and derive the pharmacokinetic parameters to describe the process of drug absorption, distribution, metabolism and elimination.
3. Critically evaluate biopharmaceutic studies involving drug product equivalency
4. Design and evaluate dosage regimens of the drugs using pharmacokinetic and biopharmaceutic parameters.
5. Detect potential clinical pharmacokinetic problems and apply basic pharmacokinetic principles to solve them

Course Content:

UNIT-I 10 Hours

Introduction to Biopharmaceutics

Absorption; Mechanisms of drug absorption through GIT, factors influencing drug absorption though GIT, absorption of drug from Non per oral extra-vascular routes, Distribution of drugs Tissue permeability of drugs, binding of drugs, apparent, volume of drug distribution, protein binding of drugs, factors affecting protein-drug binding. Kinetics of protein binding, Clinical significance of protein binding of drugs

UNIT- II 10 Hours

Biotransformation Phase I and Phase II reactions.

Drug Elimination: Renal excretion of drugs, factors affecting renal excretion of drugs, renal clearance, Non renal routes of drug excretion of drugs

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

UNIT- III 10 Hours

Pharmacokinetics: Introduction to Pharmacokinetics models, Compartment models, Non compartment models, physiological models, One compartment open model. a. Intravenous Injection (Bolus) b. Intravenous infusion, extra vascular administrations, calculations of Ka and KE. From plasma and urinary excretion data

UNIT- IV 08 Hours

Multicompartment models: Two compartment open model. IV bolus Multiple Dosage Regimens:

a). Repititive Intravenous injections- One Compartment Open Model

b). Repititive Extravascular dosing- One Compartment Open model

UNIT- V **07 Hours**

Nonlinear Pharmacokinetics: Introduction, Factors causing Non-linearity, Michaelis-menton method of estimating parameters,

Recommended Books: (Latest Editions)

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

BP 605 T. PHARMACEUTICAL BIOTECHNOLOGY (Theory) **45 Hours**

Scope:

Biotechnology has a long promise to revolutionize the biological sciences and technology. Scientific application of biotechnology in the field of genetic engineering, medicine and fermentation technology makes the subject interesting. Biotechnology is leading to new biological revolutions in diagnosis, prevention and cure of diseases, new and cheaper pharmaceutical drugs. Biotechnology has already produced transgenic crops and animals and the future promises lot more. It is basically a research-based subject.

Objectives: Upon completion of the subject student shall be able to;

1. Understanding the importance of Immobilized enzymes in Pharmaceutical Industries
2. Genetic engineering applications in relation to production of pharmaceuticals
3. Importance of Monoclonal antibodies in Industries
4. Appreciate the use of microorganisms in fermentation technology

UNIT I **10 Hours**

a) Brief introduction to Biotechnology with reference to Pharmaceutical Sciences.
b) Enzyme Biotechnology- Methods of enzyme immobilization and applications.
c) Biosensors- Working and applications of biosensors in Pharmaceutical Industries.
d) Brief introduction to Protein Engineering.
e) Use of microbes in industry. Production of Enzymes- General consideration - Amylase, Catalase, Peroxidase, Lipase, Protease, Penicillinase.
Basic principles of genetic engineering.

UNIT II **10 Hours**

a) Study of cloning vectors, restriction endonucleases and DNA ligase.
b) Recombinant DNA technology. Application of genetic engineering in medicine.
c) Application of r DNA technology and genetic engineering in the products: i) Interferon ii) hepatitis- B vaccine iii) Insulin hormone.
d) Brief introduction to PCR
e) Types of immunity- humoral immunity, cellular immunity

UNIT III **10 Hours**

a) Structure of Immunoglobulins
b) Structure and Function of MHC
c) Hypersensitivity reactions, Immune stimulation and Immune suppressions.
d) General method of the preparation of bacterial vaccines, toxoids, viral vaccines, antitoxins, serum-immuno blood derivatives and other products relative to immunity.
e) Storage conditions and stability of official vaccines
f) Hybridoma technology- Production, Purification and Applications

UNIT IV **08 Hours**

a) Immuno blotting techniques- ELISA, Western blotting, Southern blotting.
b) Microbial genetics including transformation, transduction, conjugation, plasmids and transposons.
c) Introduction to Microbial biotransformation and applications.

UNIT V **07 Hours**

a) Mutation --Types of mutation/mutants
b) Fermentation methods and general requirements, study of media, equipments, sterilization methods, aeration process, stirring.
c) Large scale production fermenter design and its various controls.
d) Study of the production of - penicillins, citric acid, Vitamin B12, Glutamic acid, Griseofulvin,
e) Blood products: Collection, Processing and Storage of whole human blood, dried plasma, 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.
3. J.W. Goding: Monoclonal Antibodies.
4. J.M. Walker and E.B. Gingold: Molecular Biology and Biotechnology by Royal Society of Chemistry.
5. Zaborsky: Immobilized Enzymes, CRC Press, Degraland, Ohio.
6. S.B. Primrose: Molecular Biotechnology (Second Edition) Blackwell Scientific Publication.
7. Stanbury F., P., Whitakar A., and Hall J., S., Principles of fermentation technology, 2nd edition, Aditya books Ltd., New Delhi

BP606 T PHARMACEUTICAL QUALITY ASSURANCE (Theory) 45 Hours

Scope: This course deals with the various aspects of quality control and quality assurance aspects of pharmaceutical industries. It covers the important aspects like cGMP, QC tests, documentation, quality certifications and regulatory affairs.

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

1. understand the CGMP aspects in a pharmaceutical industry appreciate the importance of documentation
2. understand the scope of quality certifications applicable to pharmaceutical industries
3. understand the responsibilities of QA & QC departments

Course content:

UNIT I 10 Hours

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, tools

ISO 9000 & ISO 14000: Overview, Benefits, Elements, steps for registration

NABL accreditation : Principles and procedures.

UNIT – II 10 Hours

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

Premises: Design, construction and plant layout, maintenance, sanitation, environmental control, utilities and maintenance of sterile areas, control of contamination.

Equipments and raw materials: Equipments selection, purchase specifications, maintenance, purchase specifications and maintenance of stores for raw materials.

Warehousing: Good warehousing practice, materials management

UNIT III 10 Hours

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

Good Laboratory Practices: General Provisions, Organization and Personnel, Facilities, Equipment, Testing Facilities Operation, Test and Control Articles, Protocol for Conduct of a Nonclinical Laboratory Study, Records and Reports, Disqualification of Testing Facilities

UNIT IV 08 Hours

Complaints: Complaints and evaluation of complaints, Handling of return good, recalling 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 07 Hours

Calibration and Validation: Introduction, definition and general principles of calibration, qualification and validation, importance and scope of validation, types of validation, validation master plan.

Calibration of pH meter, Qualification of UV-Visible spectrophotometer, General principles of Analytical method Validation.

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 GMPs 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.

Semester-VII

BP701T. INSTRUMENTAL METHODS OF ANALYSIS (Theory) 45 Hours

Scope: This subject deals with the application of instrumental methods in qualitative and quantitative analysis of drugs. This subject is designed to impart a fundamental knowledge on the principles and instrumentation of spectroscopic and chromatographic technique. This also emphasizes on theoretical and practical knowledge on modern analytical instruments that are used for drug testing.

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

1. Understand the interaction of matter with electromagnetic radiations and its applications in drug analysis
2. Understand the chromatographic separation and analysis of drugs.
3. Perform quantitative & qualitative analysis of drugs using various analytical instruments.

Course Content:

UNIT –I 10 Hours

UV Visible spectroscopy

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

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

Applications - Spectrophotometric titrations, Single component and multi component analysis

Fluorimetry

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

UNIT –II 10 Hours

IR spectroscopy

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

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

Flame Photometry-Principle, interferences, instrumentation and applications

Atomic absorption spectroscopy- Principle, interferences, instrumentation and applications

Nepheloturbidometry- Principle, instrumentation and applications

UNIT –III 10 Hours

Introduction to chromatography

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

Thin layer chromatography &High performance thin layer chromatography: Introduction, Principle, Methodology, Rf values, advantages, disadvantages and applications.

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

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

UNIT –IV **08 Hours**

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

High performance liquid chromatography (HPLC)-Introduction, theory, instrumentation, advantages and applications.

UNIT –V **07 Hours**

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

Gel filtration chromatography- Introduction, theory, instrumentation and applications

Affinity chromatography- Introduction, theory, instrumentation and applications

BP705P. INSTRUMENTAL METHODS OF ANALYSIS (Practical) **4 Hours/Week**

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

Recommended Books (Latest Editions)

1. Instrumental Methods of Chemical Analysis by B.K Sharma
2. Organic spectroscopy by Y.R Sharma
3. Text book of Pharmaceutical Analysis by Kenneth A. Connors
4. Vogel's Text book of Quantitative Chemical Analysis by A.I. Vogel
5. Practical Pharmaceutical Chemistry by A.H. Beckett and J.B. Stenlake
6. Organic Chemistry by I. L. Finar

7. Organic spectroscopy by William Kemp
8. Quantitative Analysis of Drugs by D. C. Garrett
9. Quantitative Analysis of Drugs in Pharmaceutical Formulations by P. D. Sethi
10. Spectrophotometric identification of Organic Compounds by Silverstein

BP702T. INDUSTRIAL PHARMACY(Theory) 45 Hours

Scope: This course is designed to impart fundamental knowledge on pharmaceutical product commercialization from laboratory to market

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

1. Know the process of pilot plant and scale up of pharmaceutical dosage forms
2. Understand the process of technology transfer from lab scale to commercial batch
3. Know different laws and acts that regulate pharmaceutical industry in India and US
4. Understand the approval process and regulatory requirements for drug products

Course Content:

UNIT-I 10 Hours

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 10 Hours

Technology development and transfer: WHO guidelines for Technology Transfer(TT): Terminology, Technology transfer protocol, Quality risk management, Transfer from R & D to production (Process, packaging and cleaning), Granularity of TT Process (API, excipients, finished products, packing materials) Documentation, Premises and equipments, qualification and validation, quality control, analytical method transfer, Approved regulatory bodies and agencies, Commercialization - practical aspects and problems(case studies)

TT agencies in India - APCTT, NRDC, TIFAC, BCIL, TBSE / SIDBI; TT or Technology of Transfer (ToT) related documentation - confidentiality agreements, licensing, MoUs, legal issues

UNIT-III 10 Hours

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, General considerations of Investigational New Drug (IND) Application, Investigator's Brochure (IB) and New Drug Application(NDA), Data Presentation for FDA Submissions.

UNIT-IV 08 Hours

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

UNIT-V 07 Hours

Industrial Safety: Plant Location & layout, utility services, Mechanical hazards, Chemical hazards, Electrical hazards, Fire Hazards, Pharmaceutical hazards and their safety. Accident records

Recommended Books: (Latest Editions)

1. Regulatory Affairs from Wikipedia, the free encyclopedia modified on 7th April available at http,//en.wikipedia.org/wiki/Regulatory_ Affairs.
2. International Regulatory Affairs Updates,2005.available at http://www.iraup.com/about.php
3. Douglas J Pisano and David S. Mantus. Text book of FDA Regulatory Affairs A Guide for Prescription Drugs, Medical Devices, and Biologics' Second Edition.
4. Regulatory Affairs brought by learning plus, inc. available at http.//www.cgmp.com/ra.htm
5. A concise textbook of Drug Regulatory Affairs: N Uduppa, Krishnamurthy Bhat
6. Drug regulatory Affairs: Singh G
7. Drug Regulatory Affairs: Dr. N S Vyawahare
8. The pharmaceutical regulatory process, 2nd Edition: Bylra R Berry, Robert P Martin

BP 703T. PHARMACY PRACTICE (Theory) 45 Hours

Scope: In the changing scenario of pharmacy practice in India, for 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 will be learning various skills such as dispensing of drugs, responding to minor ailments by providing suitable safe medication, patient counseling for improved patient care in the community set up.

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

1. Know various drug distribution methods in a hospital.
2. Appreciate the pharmacy stores management and inventory control.
3. Monitor drug therapy of patient through medication chart review and clinical review.
4. Obtain medication history interview and counsel the patients.
5. Identify drug related problems.
6. Detect and assess adverse drug reactions.
7. Interpret selected laboratory results (as monitoring parameters in therapeutics) of specific disease states.
8. Know pharmaceutical care services.
9. Do patient counseling in community pharmacy .
10. Appreciate the concept of rational drug therapy.

Unit - I 10 Hours

a) Hospital and it's organization

Definition, Classification of hospital- Primary, Secondary and Tertiary hospitals, Classification based on clinical and non- clinical basis, Organization Structure of a Hospital, and Medical staff involved in the hospital and their functions.

b) Hospital pharmacy and its organization

Definition, functions of hospital pharmacy, Organization structure, Location, Layout and staff requirements, and Responsibilities and functions of hospital pharmacists.

c) 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.

d) Hospital formulary

Definition, contents of hospital formulary, Differentiation of hospital formulary and Drug list, preparation and revision, and addition and deletion of drug from hospital formulary.

Unit -II **8 Hours**

a) Pharmacy and therapeutic committee

Organization, functions, Policies of the pharmacy and therapeutic committee in including drugs into formulary, inpatient and outpatient prescription, automatic stop order, and emergency drug list preparation.

b) Clinical Pharmacy

Introduction to Clinical Pharmacy, Concept of clinical pharmacy, functions and responsibilities of clinical pharmacist, Drug therapy monitoring - medication chart review, pharmacist intervention, Ward round participation, Medication history and Pharmaceutical care.

c) Patient medication history interview

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

d) Therapeutic drug monitoring

Need for Therapeutic Drug Monitoring, Factors to be considered during the Therapeutic Drug Monitoring

e) Medication adherence

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

Unit - III **8 Hours**

a) Adverse drug reaction - Classification, reporting and management.
b) Drug interactions - Pharmacokinetic and Pharmacodynamic interactions with examples.
c) Drug information services
   Drug and Poison information center, Sources of drug information, computerized services, and storage and retrieval of information.
d) Patient counseling
   Definition of patient counseling; steps involved in patient counseling.
e) Communication skill , communication skill with prescribers and patients

Unit - IV **12 Hours**

a) Rational use of drugs- rational use of injections, antibiotics and over the counter drugs, sale of over the counter drugs.
b) Pharmacotherapeutics : Drug therapy and management aspect of following disorders
   Diabetes, Hypertension, congestive cardiac failure, myocardial infarction, Asthma, Epilepsy, Peptic ulcer, rheumatoid arthritis and tuberculosis.
c) Interpretation of Clinical Laboratory Tests.
   Hematology, liver function test, renal function test, pulmonary function test.

Unit - V **07 Hours**

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) 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, Economic order quantity, Reorder quantity level, and Methods used for the analysis of the drug expenditure.

Recommended Books (Latest Edition):

1. Merchant S.H. and Dr. J.S.Quadry. A textbook of hospital pharmacy, 4th ed. Ahmadabad: B.S. Shah Prakakshan; 2001.
2. Parthasarathi G, Karin Nyfort-Hansen, Milap C Nahata. A textbook of Clinical Pharmacy Practice-essential concepts and skills, 1st ed. Chennai: Orient Longman Private Limited; 2004.
3. William E. Hassan. Hospital pharmacy, 5th ed. Philadelphia: Lea & Febiger; 1986.
4. Tipnis Bajaj. Hospital Pharmacy, 1st ed. Maharashtra: Career Publications; 2008.
5. Scott LT. Basic skills in interpreting laboratory data, 4thed. American Society of Health System Pharmacists Inc; 2009.
6. Parmar N.S. Health Education and Community Pharmacy, 18th ed. India: CBS Publishers & Distributers; 2008.(can be deleted –health education not included in the syllabus)
7. Clinical pharmacy and therapeutics by Roger walker-clivie Edwards (Churchill livingstone) –to be included for therapeutics)

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)

BP 704T: NOVEL DRUG DELIVERY SYSTEMS (Theory) 45 Hours

Scope: This subject is designed to impart basic knowledge on the area of novel drug delivery systems

Objectives: Upon completion of the course student shall be able

1. To understand various approaches for development of novel drug delivery systems.
2. To understand the criteria for selection of drugs and polymers for the development of Novel drug delivery systems, their formulation and evaluation

Course content:

Unit-I 10 Hours

Controlled drug delivery systems: Introduction, terminology/definitions and rationale, advantages, disadvantages, selection of drug candidates. Approaches to design controlled release formulations based on diffusion, dissolution and ion exchange principles.

Polymers: Introduction, classification, properties, advantages and application of polymers in formulation of controlled release drug delivery systems.

Unit-II10 Hours

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

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

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

Unit-III **10 Hours**

Transdermal Drug Delivery Systems: Introduction, Permeation through skin, factors affecting permeation, permeation enhancers, basic components of TDDS, formulation approaches

Gastroretentive drug delivery systems: Introduction, advantages, disadvantages, approaches for GRDDS – Floating, high density systems, inflatable and gastroadhesive systems and their applications

Nasopulmonary drug delivery system: Introduction to Nasal and Pulmonary routes of drug delivery, Formulation of Inhalers (dry powder and metered dose), nasal sprays, nebulizers

Unit-IV **08 Hours**

Nanotechnology and its Concepts: Concepts and approaches for targeted drug delivery systems, advantages and disadvantages, introduction to liposomes, niosomes, nanoparticles, monoclonal antibodies and their applications

Unit-V **07 Hours**

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

Recommended Books: (Latest Editions)

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

Journals

1. Indian Journal of Pharmaceutical Sciences (IPA)
2. Indian Drugs (IDMA)
3. Journal of Controlled Release (Elsevier Sciences)
4. Drug Development and Industrial Pharmacy (Marcel & Decker)
5. International Journal of Pharmaceutics (Elsevier Sciences)

SEMESTER VIII

BP801T- RESEARCH METHODOLOGY AND BIOSTATISTICS 45 Hours

Scope: To understand the applications of Biostatics in Pharmacy. This subject deals with descriptive statistics, Graphics, Correlation, Regression, logistic regression Probability theory, Sampling technique, Parametric tests, Non Parametric tests, ANOVA, Introduction to Design of Experiments, Phases of Clinical trials and Observational and Experimental studies, SPSS, R and MINITAB statistical software's, analyzing the statistical data using Excel**.**

Objectives: Upon completion of course the student shall be able to understand:

1. How to select a research topic in his/her areas of interest.
2. The fundamentals of collecting, analyzing and interpreting the relevant data.
3. Different computational methods and software's facilitating research

Course content:

Unit-I 10 Hours

An Introduction to Research: Definition and characteristics of Research, Types of Research, Criteria of good research, Research Process, Review of literature and Research gap, Formulating and defining the research problem. Research methods v/s methodology. Format for Research Protocol. Research ethics and importance of Institutional Review Boards. Significance of research in Pharmaceutical Sciences

Unit-II 6 Hours

Different types of data: Different methods for data collection. Experimental and observational studies. Questionnaires and rating scales. Primary and secondary data. Different types of data distribution. Coding and tabulation of data. Graphical representation of data.

Unit-III 8 Hours

Introduction to Epidemiological methods: Types of epidemiology studies. Standard measures in epidemiological studies. Measures of disease frequency, Measures of association. Study designs in epidemiology studies. Intervention studies, Controlled clinical trials. Errors in Epidemiological studies. Validity and Reliability. Bias and confounding.

Unit-IV 8 Hours

Biostatistics: Definition and application. Various terms in statistics, Descriptive statistics: Measures of central tendency. Measures of dispersion. Inferential statistics: Different areas of inferential statistics. Sampling Fundamentals: Need for sampling. Probability and nonprobability samplings. Sample size, criteria for inclusion and exclusion, dropouts.

Unit-V 13 Hours

Research question and Hypothesis: Characteristics of good Hypothesis, Testing of Hypothesis. Procedure for hypothesis testing, Tests for significance. P value, Type I and Type II errors, Different Parametric and Nonparametric tests and their applications. Interpretation of results. Computer software's in Bio statistical Analysis

Thesis writing: Components of Thesis. Paraphrasing and Plagiarism. References and Bibliography. Research publication, Impact factor, and Publication ethics.

Recommended Books:

1. Research Methodology; Methods and Techniques. C.R.Kothari. New Age International (P) Limited
2. Fundamentals of Statistics. S.C. Gupta. Himalaya Publishing House
3. Mahajan's Methods in Biostatistics for Medical Students and Research workers.Jaypee Publishers

BP 802T SOCIAL AND PREVENTIVE PHARMACY 45 Hours

Scope: The purpose of this course is to introduce to students a number of health issues and their challenges. This course also introduced a number of national health programmes. The roles of the pharmacist in these contexts are also discussed.

Objectives: After the successful completion of this course, the student shall be able to:

1. Acquire high consciousness/realization of current issues related to health and pharmaceutical problems within the country and worldwide.
2. Have a critical way of thinking based on current health care development.
3. Evaluate alternative ways of solving problems related to health and pharmaceutical issues

Course content:

Unit I: 10 Hours

Concept of health and disease: Definition, concepts and evaluation of public health. Understanding the concept of prevention and control of disease, social causes of diseases and social problems of the sick.

Social and health education: Food in relation to nutrition and health, Balanced diet, Nutritional deficiencies, Vitamin deficiencies, Malnutrition and its prevention.

Sociology and health: Socio cultural factors related to health and disease, Impact of urbanization on health and disease, Poverty and health

Hygiene and health: personal hygiene and health care; avoidable habits

Unit II: 10 Hours

Preventive medicine: General principles of prevention and control of diseases such as cholera, SARS , Ebola virus, influenza, acute respiratory infections, malaria, chicken guinea, dengue, lymphatic filariasis, pneumonia, hypertension, diabetes mellitus, cancer, drug addiction-drug substance abuse

Unit III: 10 Hours

National health programs, its objectives, functioning and outcome of the following: HIV AND 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 IV: 08 Hours

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.

Unit V: **07 Hours**

Community services in rural, urban and school health: Functions of PHC, Improvement in rural sanitation, national urban health mission, Health promotion and education in school

ecommended 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, 4thEdition, 2013, ISBN: 9789350901878, JAYPEE Publications
3. Review of Preventive and Social Medicine (Including Biostatistics), Jain Vivek, 6th Edition, 2014, ISBN: 9789351522331, JAYPEE Publications
4. Essentials of Community Medicine—A Practical Approach, Hiremath Lalita D, Hiremath Dhananjaya A, 2nd Edition, 2012, ISBN: 9789350250440, JAYPEE Publications
5. Park Textbook of Preventive and Social Medicine, K Park, 21st Edition, 2011, ISBN-14: 9788190128285, BANARSIDAS BHANOT PUBLISHERS.
6. Community Pharmacy Practice, Ramesh Adepu, BSP publishers, Hyderabad

Recommended Journals:

1. Research in Social and Administrative Pharmacy, Elsevier, Ireland

BP803ET. PHARMACEUTICAL MARKETING (Theory) **45 Hours**

Scope: The pharmaceutical industry not only needs highly qualified researchers, chemist, 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. Sales & Marketing which grooms the people for taking a challenging role in Sales and Product management. The career in product management starts from having hands on experience in sales and marketing only.

Objectives: The course aim is to provide an understanding of marketing concepts and techniques and the application of the same in the pharmaceutical industry.

Course content:

Unit I **10 Hours**

Marketing: Definition, general concepts, and scope of marketing; Distinction between marketing & selling; Marketing environment; Industry and competitive analysis; Analyzing consumer buying behavior; industrial buying behavior.

Pharmaceutical market: Quantitative and qualitative aspects; size and composition of the market; demographic descriptions and socio-psychological characteristics of the consumer; market segmentation & targeting. Consumer profile; Motivation and prescribing habits of the physician; patients' choice of physician and retail pharmacist. Analyzing the Market; Role of market research.

Unit II **10 Hours**

Product decision: Meaning, 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 **07 Hours**

Promotion: Meaning and methods, determinants of promotional mix, promotional budget; An overview of personal selling, advertising, direct mail, journals, sampling, retailing, medical exhibition, public relations, online promotional techniques for OTC Products.

Unit IV **10 Hours**

Pharmaceutical marketing channels: Designing channel, channel members, selecting the appropriate channel, conflict in channels, physical distribution management: Strategic importance, tasks in physical distribution management.

Professional sales representative (PSR): Duties of PSR, purpose of detailing, selection and training, supervising, norms for customer calls, motivating, evaluating, compensation and future prospects of the PSR.

Unit V **08 Hours**

Pricing: Meaning, importance, objectives, determinants of price; pricing methods and strategies, issues in price management in pharmaceutical industry. An overview of DPCO (Drug Price Control Order) and NPPA (National Pharmaceutical Pricing Authority).

Emerging concepts in marketing: Vertical & Horizontal Marketing; 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.

BP804 ET: PHARMACEUTICAL REGULATORY SCIENCE (Theory) **45 Hours**

Scope: This course is designed to impart the fundamental knowledge on the regulatory requirements for approval of new drugs, drug products in regulated countries like US, EU, Japan, Australia and Canada. It prepares the students to learn in detail on the regulatory requirements, documentation requirements, and registration procedures for marketing the drug products in regulated countries.

Objectives: Upon completion of the subject 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:

Unit I **10Hours**

New Drug Discovery and development: Stages of drug discovery, Drug development process, pre-clinical studies, non-clinical activities, clinical studies, Innovator and generics, Concept of generics, Generic drug product development.

Unit II **10Hours**

Regulatory Approval Process: Approval processes and time lines involved in Investigational New Drug

(IND), New Drug Application (NDA), Abbreviated New Drug Application (ANDA) in US. Changes to an approved NDA / ANDA.

Regulatory authorities and agencies: Overview of regulatory authorities of United States, European Union, Australia, Japan, Canada (Organization structure and types of applications only)

Unit III **10 Hours**

Registration of Indian drug product in overseas market

Procedure for export of pharmaceutical products, Technical documentation, Drug Master Files (DMF), Common Technical Document (CTD), electronic Common Technical Document (eCTD), ASEAN Common Technical Document (ACTD) research.

Unit IV **08 Hours**

Clinical trials

Developing clinical trial protocols, Institutional Review Board / Independent Ethics committee - formation and working procedures, Informed consent process and procedures, GCP obligations of Investigators, sponsors & Monitors, Managing and Monitoring clinical trials, Pharmacovigilance - safety monitoring in clinical trials

Unit V **07 Hours**

Regulatory Concepts

Basic terminologies, guidance, guidelines, regulations, laws and acts, Orange book, Federal Register, Code of Federal Regulatory, Purple book

Recommended books (Latest edition):

1. Drug Regulatory Affairs by Sachin Itkar, Dr. N.S. Vyawahare, Nirali Prakashan.
2. The Pharmaceutical Regulatory Process, Second Edition Edited by Ira R. Berry and Robert P. Martin, Drugs and the Pharmaceutical Sciences, Vol.185. Informa Health care Publishers.
3. New Drug Approval Process: Accelerating Global Registrations By Richard A Guarino, MD, 5th edition, Drugs and the Pharmaceutical Sciences, Vol.190.
4. Guidebook for drug regulatory submissions / Sandy Weinberg. By John Wiley & Sons. Inc.
5. FDA Regulatory Affairs: a guide for prescription drugs, medical devices, and biologics /edited by Douglas J. Pisano, David Mantus.
6. Generic Drug Product Development, Solid Oral Dosage forms, Leon Shargel and Isader Kaufer, Marcel Dekker series, Vol.143

7. Clinical Trials and Human Research: A Practical Guide to Regulatory Compliance By Fay A. Rozovsky and Rodney K. Adams
8. Principles and Practices of Clinical Research, Second Edition Edited by John I. Gallin and Frederick P. Ognibene
9. Drugs: From Discovery to Approval, Second Edition By Rick Ng

BP 805T: PHARMACOVIGILANCE (Theory) 45 hours

Scope: This paper will provide an opportunity for the student to learn about development of pharmacovigilance as a science, basic terminologies used in pharmacovigilance, global scenario of Pharmacovigilance, train students on establishing pharmacovigilance programme in an organization, various methods that can be used to generate safety data and signal detection. This paper also develops the skills of classifying drugs, diseases and adverse drug reactions.

Objectives:

1. Why drug safety monitoring is important?
2. History and development of pharmacovigilance.
3. National and international scenario of pharmacovigilance.
4. Dictionaries, coding and terminologies used in pharmacovigilance.
5. Detection of new adverse drug reactions and their assessment.
6. International standards for classification of diseases and drugs.
7. Adverse drug reaction reporting systems and communication in pharmacovigilance.
8. Methods to generate safety data during pre clinical, clinical and post approval phases of drugs' life cycle.
9. Drug safety evaluation in paediatrics, geriatrics, pregnancy and lactation.
10. Pharmacovigilance Program of India (PvPI).
11. ICH guidelines for ICSR, PSUR, expedited reporting, pharmacovigilance planning.
12. CIOMS requirements for ADR reporting.
13. Writing case narratives of adverse events and their quality.

Course Content

Unit I 10 Hours

Introduction to Pharmacovigilance

History and development of Pharmacovigilance, Importance of safety monitoring of Medicine, WHO international drug monitoring programme, Pharmacovigilance Program of India(PvPI).

Introduction to adverse drug reactions

Definitions and classification of ADRs, Detection and reporting, Methods in Causality assessment, Severity and seriousness assessment, Predictability and preventability assessment, Management of adverse drug reactions.

Basic terminologies used in pharmacovigilance

Terminologies of adverse medication related events, Regulatory terminologies.

Unit II **10 hours**

Drug and disease classification

Anatomical, therapeutic and chemical classification of drugs, International classification of diseases

Daily defined doses, International Non proprietary Names for drugs.

Drug dictionaries and coding in pharmacovigilance

WHO adverse reaction terminologies, MedDRA and Standardised MedDRA queries, WHO drug dictionary, Eudravigilance medicinal product dictionary.

Information resources in pharmacovigilance

Basic drug information resources, Specialised resources for ADRs.

Establishing pharmacovigilance programme

Establishing in a hospital, Establishment & operation of drug safety department in industry, Contract

Unit III **10 Hours**

Vaccine safety surveillance - Vaccine Pharmacovigilance, Vaccination failure, Adverse events following immunization.

Pharmacovigilance methods

Passive surveillance – Spontaneous reports and case series, Stimulated reporting

Active surveillance – Sentinel sites, drug event monitoring and registries

Comparative observational studies – Cross sectional study, case control study and cohort study

Targeted clinical investigations

Communication in pharmacovigilance

Effective communication in Pharmacovigilance, Communication in Drug Safety Crisis management, Communicating with Regulatory Agencies, Business Partners, Healthcare facilities & Media

Unit IV **8 Hours**

Statistical methods for evaluating medication safety data

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 **7 hours**

Pharmacogenomics of adverse drug reactions

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: S K Gupta, Jaypee Brothers, Medical Publishers.
2. Practical Drug Safety from A to Z By Barton Cobert, Pierre Biron, Jones and Bartlett Publishers.
3. Mann's Pharmacovigilance:Elizabeth B. Andrews, Nicholas, Wiley Publishers.
4. Stephens' Detection of New Adverse Drug Reactions: John Talbot, Patrick Walle, Wiley Publishers.
5. An Introduction to Pharmacovigilance: Patrick Waller,Wiley Publishers.
6. Cobert's Manual of Drug Safety and Pharmacovigilance: Barton Cobert,Jones& Bartlett Publishers.
7. Textbook of Pharmacoepidemiolog edited by Brian L. Strom, Stephen E Kimmel, Sean Hennessy,Wiley Publishers.
8. A Textbook of Clinical Pharmacy Practice -Essential Concepts and Skills:G. Parthasarathi, Karin NyfortHansen,Milap C. Nahata
9. National Formulary of India
10. Text Book of Medicine by Yashpal Munjal
11. Text book of Pharmacovigilance: concept and practice by GP Mohanta and PK Manna
12. http://www.whoumc.org/DynPage.aspx?id=105825&mn1=7347&mn2=7259&mn 3=7297
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/pv_home.html

BP 806 ET. QUALITY CONTROL AND STANDARDIZATION OF HERBALS (Theory)

45 Hours

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

Objectives: Upon completion of the subject student shall be able to;

1. know WHO guidelines for quality control of herbal drugs
2. know Quality assurance in herbal drug industry
3. know the regulatory approval process and their registration in Indian and international markets
4. appreciate EU and ICH guidelines for quality control of herbal drugs

Unit I **10 Hours**

Basic tests for drugs – Pharmaceutical substances, Medicinal plants materials and dosage forms. WHO guidelines for quality control of herbal drugs. Evaluation of commercial crude drugs intended for use.

Unit II **10 Hours**

Quality assurance in herbal drug industry of cGMP, GAP, GMP and GLP 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 **10 Hours**

EU and ICH guidelines for quality control of herbal drugs.

Research Guidelines for evaluating the safety and efficacy of herbal medicines

Unit IV **08 Hours**

Stability testing of herbal medicines. Application of various chromatographic techniques in standardization of herbal products.
Preparation of documents for new drug application and export registration GMP requirements and Drugs & Cosmetics Act provisions.

Unit V **07 Hours**

Regulatory requirements for herbal medicines.

WHO guidelines on safety monitoring of herbal medicines in pharmacovigilance systems comparison of various Herbal Pharmacopoeias.
Role of chemical and biological markers in standardization of herbal products

Recommended Books: (Latest Editions)

1. Pharmacognosy by Trease and Evans
2. Pharmacognosy by Kokate, Purohit and Gokhale
3. Rangari, V.D., Text book of Pharmacognosy and Phytochemistry Vol. I , Carrier Pub.,2006.
4. Aggrawal, S.S., Herbal Drug Technology. Universities Press, 2002.

5. EMEA. Guidelines on Quality of Herbal Medicinal Products/Traditional Medicinal Products,
6. Mukherjee, P.W. Quality Control of Herbal Drugs: An Approach to Evaluation of Botanicals. Business Horizons Publishers, New Delhi, India, 2002.
7. Shinde M.V., Dhalwal K., Potdar K., Mahadik K. Application of quality control principles to herbal drugs. International Journal of Phytomedicine 1(2009); p. 4-8.
8. WHO. Quality Control Methods for Medicinal Plant Materials, World Health Organization, Geneva, 1998. WHO. Guidelines for the Appropriate Use of Herbal Medicines. WHO Regional Publications, Western Pacific Series No 3, WHO Regional office for the Western Pacific, Manila, 1998.
9. WHO. The International Pharmacopeia, Vol. 2: Quality Specifications, 3rd edn. World Health Organization, Geneva, 1981.
10. WHO. Quality Control Methods for Medicinal Plant Materials. World Health Organization, Geneva, 1999.
11. WHO. WHO Global Atlas of Traditional, Complementary and Alternative Medicine. 2 vol. set. Vol. 1 contains text and Vol. 2, maps. World Health Organization, Geneva, 2005.
12. WHO. Guidelines on Good Agricultural and Collection Practices (GACP) for Medicinal Plants. World Health Organization, Geneva, 2004.

BP 807 ET. COMPUTER AIDED DRUG DESIGN (Theory) 45 Hours

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

Objectives: Upon completion of the course, the student shall be able to understand

1. Design and discovery of lead molecules
2. The role of drug design in drug discovery process
3. The concept of QSAR and docking
4. Various strategies to develop new drug like molecules.
5. The design of new drug molecules using molecular modeling software

Course Content:

UNIT-I 08 Hours

Introduction to Drug Discovery and Development

A) History of drug discovery and development

B) Rational Drug Discovery- Different stages involved in rational drug discovery process, methods involved in lead discovery and lead optimization. Role of computer applications in lead discovery and lead optimization. Introduction to ligand and structure based drug design.

UNIT-II 10 Hours

Quantitative Structure Activity Relationship (QSAR)

Qualitative versus Quantitative SAR, Types of physicochemical parameters, Lipophilicity effects: Hansch equation,Electronic effects: Hammett equation, Steric effects: Taft equation. QSAR Methods: Hansch analysis and Free Wilson analysis. 3D-QSARapproaches like COMFA and COMSIA.

UNIT-III 5 Hours

Pharmacophore modeling

Concept of pharmacophore, pharmacophore mapping and pharmacophore based screening. Analog based drug design: Bioisosterism-classification and bioisosteric replacement.

UNIT-IV **17Hours**

Molecular Modeling: Introduction to molecular modeling

A) Molecular mechanics- Introduction, force field, potential free energy surface, energy minimization methods, global and local energy minimum conformations. Molecular docking-Rigid, semi-flexible and flexible docking, Docking components: Binding site identification, search algorithms, scoring functions and binding free energy. Case study on the design of HIV protease inhibitors using docking. Introduction to Molecular dynamic simulations.

B) Quantum mechanics-Introduction, Methods-*ab initio* and semi empirical methods, Applications of quantum mechanics in drug design.

c) Introduction to *de novo* drug design and homology modeling of proteins.

UNIT – V **05 Hours**

Informatics methods in drug design

Introduction to bioinformatics, chemoinformatics. ADME databases, chemical, biochemical and pharmaceutical databases.

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. Cohen C., "Molecular Modelling in Drug Design" Academic Press, New York.
4. Wolf ME., ed "The Basis of Medicinal Chemistry, Burger's Medicinal Chemistry" John Wiley & Sons, New York.
5. GoodmanJM., "Chemical Applications of Molecular modeling", Royal Society of Chemistry, Cambridge, UK.
6. Smith HJ., Williams H, eds, "Introduction to the principles of Drug Design" CRC Press,Boston.
7. Patrick Graham, L., An Introduction to Medicinal Chemistry, Oxford University Press.
8. Silverman RB.,"The organic Chemistry of Drug Design and Drug Action" Academic Press, New York.
9. Foye WO., "Principles of Medicinal chemistry" Williams&Wilkins, Philadelphia, PA.
10. Koro lkovas A, Burckhalter JH. "Essentials of Medicinal Chemistry" Wiley,New York.

BP808ET: CELL AND MOLECULAR BIOLOGY (Elective subject) **45 Hours**

Scope:

Cell biology is a branch of biology that studies cells– their physiological properties, their structure, the organelles they contain, interactions with their environment, their life cycle, division, death and cell function. This is done both on a microscopic and molecular level.Cell biology research encompasses both the great diversity of single-celled organisms like bacteriaand protozoa, as well as the many specialized cells in multi-cellular organisms such as humans, plants, and sponges. The course content will equip the students with adequate knowledge of the molecular process occurring within the cell and possibly pharmacological interventions into those processes

Objectives: Upon completion of the subject student shall be able to;

1. Summarize cell and molecular biology history.
2. Summarize cellular functioning and composition.
3. Describe the chemical foundations of cell biology.
4. Summarize the DNA properties of cell biology.
5. Describe protein structure and function.
6. Describe cellular membrane structure and function.

7. Describe basic molecular genetic mechanisms.
8. Summarize the Cell Cycle

Course content:

Unit I **10 Hours**

a) Cell and Molecular Biology: Definitions theory and basics and Applications.
b) Cell and Molecular Biology: History and Summation.
c) Theory of the Cell. Properties of cells and cell membrane.
d) Prokaryotic versus Eukaryotic
e) Cellular Reproduction
f) Chemical Foundations – An Introduction and Reactions (Types)

Unit II **10 Hours**

a) DNA and the Flow of Molecular Structure
b) DNA Functioning
c) DNA and RNA
d) Types of RNA
e) Transcription and Translation

Unit III **08 Hours**

a) Proteins
b) Protein Structure
c) Regularities in Protein Pathways
d) Cellular Processes
e) Positive Control and significance of Protein Synthesis

Unit IV **10 Hours**

a) Science of Genetics
b) Transgenics and Genomic Analysis
c) Cell Cycle analysis:
d) Mitosis and Meiosis

Unit V **07 Hours**

a) Cell Signals: Introduction
b) Receptors for cell signals
c) Signaling pathways: Overview
d) Misregulation of Signaling Pathways
e) Protein-Kinases:Functioning

Recommended Books (latest edition):

1. W.B. Hugo and A.D. Russel: Pharmaceutical Microbiology, Blackwell Scientific publications, Oxford London.
2. Prescott and Dunn., Industrial Microbiology, 4th edition, CBS Publishers & Distributors, Delhi.
3. Pelczar, Chan Kreig, Microbiology, Tata McGraw Hill edn.
4. Malcolm Harris, Balliere Tindall and Cox: Pharmaceutical Microbiology.
5. Rose: Industrial Microbiology.

6. Probisher, Hinsdill et al: Fundamentals of Microbiology, 9th ed. Japan
7. Cooper and Gunn's: Tutorial Pharmacy, CBS Publisher and Distribution.
8. Peppler: Microbial Technology.
9. Edward: Fundamentals of Microbiology.
10. N.K.Jain: Pharmaceutical Microbiology, Vallabh Prakashan, Delhi
11. Bergeys manual of systematic bacteriology, Williams and Wilkins- A Waverly company
12. B.R. Glick and J.J. Pasternak: Molecular Biotechnology: Principles and Applications of RecombinantDNA: ASM Press Washington D.C.
13. RA Goldshy et. al., : Kuby Immunology.
14. Pelczar, Chan Kreig, Microbiology, Tata McGraw Hill edn.
15. Malcolm Harris, Balliere Tindall and Cox: Pharmaceutical Microbiology.
16. Rose: Industrial Microbiology.
17. Probisher, Hinsdill et al: Fundamentals of Microbiology, 9th ed. Japan
18. Cooper and Gunn's: Tutorial Pharmacy, CBS Publisher and Distribution.
19. Peppler: Microbial Technology.
20. Edward: Fundamentals of Microbiology.
21. N.K.Jain: Pharmaceutical Microbiology, Vallabh Prakashan, Delhi
22. Bergeys manual of systematic bacteriology, Williams and Wilkins- A Waverly company
23. B.R. Glick and J.J. Pasternak: Molecular Biotechnology: Principles and Applications of RecombinantDNA: ASM Press Washington D.C.
24. RA Goldshy et. al., : Kuby Immunology.

BP809ET. COSMETIC SCIENCE (Theory) 45 Hours

Scope: Cosmetic Science is an exciting new applied science that deals with knowledge and understanding of the various disciplines within Cosmetic Science, Cosmetic Formulation Science and the organization and function of the Cosmetic, Toiletry and Perfumery industries. It not only provide knowledge on cosmetics, and related sciences, cosmeceuticals and personal care and hygiene products but also afford multidisciplinary scientific knowledge to gain expertise in the field and to respond the industry challenges effectively.

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

1. Know the cosmetic principles to address the needs of cosmetic industry.
2. Understand formulation science and analytical techniques required to scientifically design and develop cosmetic products.
3. Explain the scientific and technical aspects, high standards of practice and professional ethics within the cosmetic and toiletries industry.

UNIT I 10 Hours

Definition of cosmetics as per Indian regulations Classification of cosmetic and cosmeceutical products

Cosmetic excipients: Surfactants, rheology modifiers, humectants, emollients, preservatives. Classification and application

Skin: Basic structure and function of skin.

Hair: Basic structure of hair. Hair growth cycle.

Oral Cavity: Common problem associated with teeth and gums**.**

UNIT II **10 Hours**

Principles of formulation and building blocks of skin care products: Face wash, Moisturizing cream, Cold Cream, Vanishing cream their relative skin sensory, advantages and disadvantages. Application of these products in formulation of cosmeceuticals.

Principles of formulation and building blocks of Hair care products: Conditioning shampoo, Hair conditioners, anti-dandruff shampoo. Hair oils. Hair dyes

Principles of formulation and building blocks of oral care products: Tooth paste for bleeding gums, sensitive teeth. Teeth whitening, Mouthwash.

UNIT III **10 Hours**

Sun protection, Classification of Sunscreens and SPF.

Role of herbs in cosmetics:

Skin Care: Aloe and turmeric Hair care: Henna and amla. Oral care: Neem and clove

Analysis of cosmetics: BIS specification and analytical methods for shampoo, skin cream and toothpaste**.**

UNIT IV **07 Hours**

Principles of Cosmetic Evaluation: Principles of sebumeter, corneometer. Measurement of TEWL, Skin Color, Hair tensile strength

UNIT V **08 Hours**

Oily and dry skin, causes leading to dry skin, skin moisturisation.

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)

BP 810 ET.EXPERIMENTAL PHARMACOLOGY

(PHARMACOLOGICAL SCREENING METHODS) **45 Hours**

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

Objectives

Upon completion of the 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. Appreciate and demonstrate the importance of biostatistics and research methodology
4. Design and execute a research hypothesis independently

Unit –I **08 Hours**

Laboratory Animals:

Study of CPCSEA and OECD guidelines for maintenance, breeding and conduct of experiments on laboratory animals, Common lab animals: Description and applications of different species and strains of animals. Popular transgenic and mutant animals. Techniques for collection of blood and common routes of drug administration in laboratory animals, Techniques of blood collection and euthanasia.

Unit –II **10 Hours**

Preclinical screening models

a. **Introduction:** Dose selection, calculation and conversions, preparation of drug solution/suspensions, grouping of animals and importance of sham negative and positive control groups. Rationale for selection of animal species and sex for the study.

b. **Study of screening animal models for** Diuretics, nootropics, anti-Parkinson's, antiasthmatics, **Preclinical screening models:** for CNS activity-analgesic, antipyretic, anti-inflammatory,general anaesthetics, sedative and hypnotics, antipsychotic, antidepressant, antiepileptic, antiparkinsonism, alzheimer's disease

Unit –III **10 Hours**

Preclinical screeningmodels: for ANS activity, sympathomimetics, sympatholytics, parasympathomimetics, parasympatholytics, skeletal muscle relaxants, drugs acting on eye, local anaethetics

Unit –IV **12 Hours**

Preclinical screening models: for CVS activity- antihypertensives, diuretics, antiarrhythmic, antidyslepidemic, anti aggregatory, coagulants, and anticoagulants

Preclinical screening models for other important drugs like antiulcer, antidiabetic, anticancer and antiasthmatics.

Unit –V **05 Hours**

Research methodology and Bio-statistics

Selection of research topic, review of literature, research hypothesis and study Design. Pre-clinical data analysis and interpretation using Students 't' test and One-way ANOVA. Graphical representation of data

Recommended Books (latest edition):

1. Fundamentals of experimental Pharmacology-by M.N.Ghosh
2. Hand book of Experimental Pharmacology-S.K.Kulakarni
3. CPCSEA guidelines for laboratory animal facility.
4. Drug discovery and Evaluation by Vogel H.G.
5. Drug Screening Methods by Suresh Kumar Gupta and S. K. Gupta
6. Introduction to biostatistics and research methods by PSS Sundar Rao and J Richard

BP 811 ET. ADVANCED INSTRUMENTATION TECHNIQUES **45 Hours**

Scope: This subject deals with the application of instrumental methods in qualitative and quantitative analysis of drugs. This subject is designed to impart advanced knowledge on the principles and instrumentation of spectroscopic and chromatographic hyphenated techniques. This also emphasizes on theoretical and practical knowledge on modern analytical instruments that are used for drug testing.

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

1. understand the advanced instruments used and its applications in drug analysis
2. understand the chromatographic separation and analysis of drugs.
3. understand the calibration of various analytical instruments know analysis of drugs using various analytical instruments.

Course Content:

UNIT-I **10 Hours**

Nuclear Magnetic Resonance spectroscopy

Principles of H-NMR and C-NMR, chemical shift, factors affecting chemical shift, coupling constant, Spin - spin coupling, relaxation, instrumentation and applications.

Mass Spectrometry- Principles, Fragmentation, Ionization techniques–Electronimpact, chemical ionization, MALDI, FAB, Analyzers-Time of flight and Quadrupole, instrumentation, applications.

UNIT-II **10 Hours**

Thermal Methods of Analysis: Principles, instrumentation and applications of Thermo gravimetric Analysis (TGA), Differential Thermal Analysis (DTA), Differential Scanning Calorimetric (DSC)

X- Ray Diffraction Methods: Origin of X-rays, basic aspects of crystals, X ray Crystallography, rotating crystal technique, single crystal diffraction, powder diffraction, structural elucidation and applications.

UNIT-III **10 Hours**

Calibration and validation-as per ICH and USFDA guidelines

Calibration of following Instruments

Electronic balance, UV-Visible spectrophotometer, IR spectrophotometer, Fluorimeter, Flame Photometer, HPLC and GC

UNIT-IV **08 Hours**

Radio immune assay: Importance, various components, Principle, differentmethods, Limitation and Applications of Radio immuno assay

Extraction techniques: General principle and procedure involved in the solid phase extraction and liquid- liquid extraction

UNIT-V **07Hours**

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

2.7. Total number of hours

As given under course of study 2.4.3

2.8 Branches if any with definition

Not applicable

2.9 Teaching learning methods

As given under the syllabus

2.10 Content of each subject in each year

As given under the syllabus

2.11 Number of hours per subject

As given under the syllabus

2.12 Practical training

As given under the course content

2.13 Records

The students are expected to perform the number of experiments listed in the respective syllabus. Students are required to maintain practical records for each of the practical subjects and should be certified by the faculty in-charge before registering for end semester examination. It should be produced at the time of practical examination and to be certified by both internal and external examiners.

2.14 Dissertation

Not Applicable

2.15 Special Training if any

Not Applicable

2.16 Project work to be done if any

As given under the syllabus

2.17 Any other requirements (CME, Paper publishing etc..)

Not Applicable

2.18 Prescribed/ recommended text books for each subject

As given under the syllabus

2.19 Reference books

As given under the syllabus

2.20 Journals

As given under the course content

2.21 Log book

Not Applicable

2.22 Program Committee

1. The B. Pharm program shall have a **Program Committee c**onstituted by the **Head of the institution** in consultation with all the Heads of the Deparatments.

2. The composition of the Program Committee shall be as follows:

(i) A **senior teacher** shall be the **Chairperson**

(ii) One teacher from each department handling B. Pharm courses;

(iii) 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 sutdents 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 examination (Internal assessment) and before the end semester exam.

3. EXAMINATIONS

3.1 Eligibility to appear for exams

- A candidate is eligible for registering for the examinations only if he/she secures a minimum of 50% marks in internal assessment in theory and practical separately.
- Partial appearance for the examinations : A candidate is allowed partial appearance for the University examinations, including practical examinations, provided he/ she has 80% attendance in all subjects, in theory and practical separately.

3.2 Eligibility for appearance for supplementary examinations: A candidate can register for supplementary examinations if he/she has 80 % attendance in theory and practical separately for that subject/s and has minimum 50% Internal Assessment marks in theory and practical separately in that subject/s.

3.2.1 Schedule of regular/ Supplementary examinations

As given under the course content

3.3 Scheme of examination showing maximum marks and minimum marks

As given under the course content

3.4 Papers in each year

As given under the course content

3.5 Details of theory exams

As given under the course content

3.6 Model question paper for each subject

As given under Annexure 5.1.

3.6.1 Question paper pattern

As given under the course content

3.7 Internal assessment component

As given under the course content

3.8 Details of practical/ clinical practical exams

As given under the course content

3.9 Number of examiners (Internal & External) and the qualifications for theory and practical evaluation

One internal and one external exam iner for practical and viva voce exam inations .Post Graduation in the relevant subject with minimum three years teaching experience after acquiring M.Pharm qualification in a PCI recognized institution

3.10 Details of Viva

As given under the course content.

4. INTERNSHIP

Not Applicable

5. ANNEXURES

5.1 Model question paper for each subject with Question paper pattern

5.2 Check lists for monitoring: Log book, Seminar Assessment etc.
To be formulated by the curriculum committee of the concerned institution

Annexure 5. 1

QP CODE: **Reg. No: . .....**

First Semester B. Pharm Degree Examination
HUMAN ANATOMY AND PHYSIOLOGY I
(2017 Scheme)
MODEL QUESTION PAPER

Time: 3 Hours **Max. Marks: 75**

Answer all questions

Draw diagrams wherever necessary

Essays **(2 x 10 = 20)**

1. Describe the anatomy of ear and explain the mechanism of hearing.
2. Explain the conduction system of heart with a neat labelled diagram.

Short notes **(7 x 5 = 35)**

3. Formation and fate of hemoglobin.
4. Explain about spleen.
5. Write about sympathetic nervous system.
6. Difference between arteries and veins.
7. Write about muscular tissue.
8. Classify joints, explain about types of synovial joints.
9. Structure and functions of connective tissue.

Answer briefly **(10 x 2 = 20)**

10. Write the functions of cell.
11. Write the pulmonary circulation.
12. Write about taste buds.
13. Write about nervous tissue.
14. Define polycythemia and sickle cell anaemia.
15. Write the paracrine intracellular signaling.
16. Name the bones of cranium.
17. Define articulation and arthrology.
18. Write the anatomy of spinal nerve.
19. Functions of skin.

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QP CODE: **Reg. No: .....**

First Semester B. Pharm Degree Examination
PHARMACEUTICAL ANALYSIS I
(2017 Scheme)
MODEL QUESTION PAPER

Time: 3 Hours **Max. Marks: 75**

Answer all questions

Draw diagrams wherever necessary

Essays **(2 x 10 = 20)**

1. Discuss Ostwald's theory of acid base indicators taking examples of phenolphthalein and methyl orange indicators as examples. .
2. What is EDTA and mention the EDTA titrations. Describe in brief the type of indicators used in such titrations and explain its working nature.

Short notes **(7 x 5 = 35)**

3. What are redox titrations? Explain any one type.
4. Discuss the phenomena of surface adsorption and occlusion in gravimetry.
5. Explain the preparation and standardization of ceric ammonium sulphate solution
6. Define precipitation titration and explain in detail Mohr's method.
7. Explain in detail about the solvents used in non-aqueous titration.
8. Estimation of sodium benzoate by non-aqueous titration.
9. Limit test for iron.

Answer briefly **(10 x 2 = 20)**

10. Composition and role of barium sulphate reagent.
11. Why acetic anhydride is used in the preparation of percloric acid.
12. Basic requirement for a primary standard.
13. Masking and demasking agent in complexometric titration.
14. What are ligands.
15. Reaction of hydrogen peroxide with potassium permanganate.
16. Define accuracy.
17. Examples for reference electrode and indicator electrodes.
18. Principle in the assay of ammonium chloride.
19. Titrant and indicator used in volhard's method.

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QP CODE: **Reg. No: .....**

First Semester B. Pharm Degree Examination
PHARMACEUTICS I
(2017 Scheme)
MODEL QUESTION PAPER

Time: 3 Hours **Max. Marks: 75**

- Answer all questions
- Draw diagrams wherever necessary

Essays **(2 x 10 = 20)**

1. Give a detailed account of powders.
2. Classify semisolid dosage forms. Explain the mechanism and the factors influencing dermal penetration of drugs.

Short notes **(7 x 5 = 35)**

3. Errors in prescription.
4. Explain pediatric dose calculation based on age, body weight and body surface area
5. Give the advantages and disadvantages of suspension.
6. Solubility enhancement techniques
7. Explain evaluation of suppositories.
8. Compare and contrast ointment and cream.
9. Define gels and explain the preparation of gels.

Answer briefly **(10 x 2 = 20)**

10. Define synergism with example.
11. What is antagonist effect? Give examples.
12. Define isotonic solution.
13. What is geometric dilution?
14. What is displacement value?
15. Define suspension and give examples
16. List out the suppository bases with examples.
17. Define gargles.
18. Define emulsion and give examples.
19. Differentiate between paste and gels.

****

QP CODE: **Reg. No: .....**

First Semester B. Pharm Degree Examination
PHARMACEUTICAL INORGANIC CHEMISTRY
(2017 Scheme)
MODEL QUESTION PAPER

Time: 3 Hours **Max. Marks: 75**

- Answer all questions
- Draw diagrams wherever necessary

Essays **(2 x 10 = 20)**

1. Define limit test. Explain the principle, procedure and apparatus involved in the limit test of arsenic and sulphate with neat diagram.
2. Explain the properties of alpha, beta and gamma rays. Explain the various methods employed for the measurement of radio activity.

Short notes **(7 x 5= 35)**

3. Give the principle of limit test for heavy metals.
4. Classify topical agents with examples.
5. Acid neutralizing capacity of antacids.
6. The principle of assay of chlorinated lime.
7. What are saline cathartics? Mention the preparation of magnesium sulphate.
8. Explain the principle of assay of boric acid.
9. Explain about physiological acid-base balance.

Answer briefly **(10 x 2 = 20)**

10. What are the reagents used in limit test for iron
11. The test for alkalinity.
12. The official compounds of iron
13. Define normality and molarity.
14. What is covalent bond and mention an example.
15. What is an expectorant? Mention examples.
16. Define radio opaque contrast medium. Mention examples.
17. The preparation of sublimed sulphur.
18. Classify inorganic antidotes.
19. What is normal saline solution? How will you prepare it?

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QP CODE: **Reg. No: .....**

First Semester B. Pharm Degree Examination

COMMUNICATION SKILLS
(2017 Scheme)

MODEL QUESTION PAPER

Time: 1.5 Hours **Max. Marks: 35**

Answer all questions

- Draw diagrams wherever necessary
-

Essays **(1 x 10 = 10 Marks)**

1. Explain written communication. Describe the factors to take into account when deciding when to use and when not to use written communication..

Short notes **(5 x 5 = 25 Marks)**

2. Describe verbal and nonverbal communication.
3. Explain any five barriers of communication
4. Brief audio visual aids used while delivering a presentation.
5. How can one become an active listener?
6. Explain the communication process.

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QP CODE: **Reg. No: .....**

First Semester B. Pharm Degree Examination

REMEDIAL BIOLOGY
(2017 Scheme)

MODEL QUESTION PAPER

Time: 1.5 Hours **Max. Marks: 35**

- Answer all questions
- Draw diagrams wherever necessary

Essays **(1 x 10 = 10)**

1. Describe the structure and function of heart. .

Short notes **(5 x 5 = 25)**

2. Give a short note on different blood products and their uses.
3. What are the different types of venation?
4. Explain the salient features of kingdom Protista.
5. Describe biological nitrogen fixation.
6. Write a note on rennin angiotensin system

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QP CODE: **Reg. No: .....**

First Semester B. Pharm Degree Examination

REMEDIAL MATHEMATICS

MODEL QUESTION PAPER

Time: 1.5 Hours **Max. Marks: 35**

- Answer all questions

Essays **(1 x 10 = 10)**

1. Write an essay on different type of matrices? .

Short notes **(5 x 5 = 25)**

2. Differentiate $Y=3\tan x+5\log x+1/x$

3. If $A = \begin{bmatrix} 1 & 4 & 7 \\ 0 & 8 & 9 \\ 2 & 3 & 1 \end{bmatrix}$

Find 5A

4. Use logarithm table solve the $\frac{520.4\times 8.065}{97.53}$

5. Factorise 3ax-6ay-8by+4bx

6. Find the point of intersection of lines bx + ay = ab and ax + by = ab

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Second Semester B.Pharm Degree Examinations

HUMAN ANATOMY AND PHYSIOLOGY II

(2017 Scheme)

(MODEL QUESTION PAPER)

Time: 3 Hours **Max marks: 75**

- **Answer all questions**
- **Draw diagrams wherever necessary**

Essay **(2x10=20)**

1. Describe the role of adrenal gland in salt, sugar and sex regulation.
2. Explain the anatomy of ovary and explain about various stages of menstrual cycle.

Short notes **(7x5=35)**

3. Structure and functions of liver.
4. Cerebellum
5. Regulation of acid production in stomach
6. Mechanism of respiration
7. Synapse
8. Role of kidneys in acid base balance
9. Lung volume and capacities

Answer briefly **(10x2=20)**

10. Chromosomes
11. Biochemical role of ATP
12. Neat labelled diagram of spinal cord cross section
13. Composition of semen
14. Formation and role of CSF
15. List the anterior pituitary hormones and their functions
16. Structure of sperm
17. Digestion and absorption of proteins
18. Neuroglia
19. Nephrons

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Second Semester B.Pharm Degree Examination

PHARMACEUTICAL ORGANIC CHEMISTRY –I

(2017 Scheme)

(MODEL QUESTION PAPER)

Time: 3 Hours **Max marks: 75**

- **Answer all questions**
- **Draw diagrams wherever necessary**

Essays **(2x 10 = 20)**

1. Discuss the mechanism involved in Perkin's reaction and Cannizaro reaction.

2. Explain nucleophilic aliphatic substitution reactions with suitable examples. Add a note on Walden inversion.

Short notes **(7x5=35)**

3. Define isomerism and elaborate different types with examples
4. Explain SP_2 hybridization
5. Write a note on the stability of conjugated dienes
6. List any three methods for the preparation of carboxylic acids
7. Explain the basicity of amines
8. Discuss the mechanism involved in chlorination of methane
9. Explain E1 mechanism and saytzeff's rule with suitable examples

Answer briefly **(10x2 = 20)**

10. What is hybridization.
11. Why aldehydes are more reactive than ketones in nucleophilic addition reaction
12. The presence of little amount of oxygen retards chlorination of methane. Why?
13. Briefly explain Diel's - Alder reaction
14. Give the chemical structure : (a) Vanillin b. Dimethyl phthalate
15. Write any two uses of: a. Paraldehyde b. Amphetamine
16. Write the structure and uses of Iodoform
17. Write the IUPAC names of the following compounds
    a. CH3 - CH (CH3) - CH2 - COOH b. CH3 - CH= CH -CHO
18. Write structural formulas from names: a. 3 - Hydroxy propanoic acid b. 1,4 - Pentadiene
19. What is Aldol condensation

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Second Semester B.Pharm Degree Examination

BIOCHEMISTRY

(2017 Scheme)

(MODEL QUESTION PAPER)

Time: 3 Hours **Max marks: 75**

- **Answer all questions**
- **Draw diagrams wherever necessary**

Essays **(2x 10 = 20)**

1. Describe the Urea cycle. Add a note on metabolic disorders associated with it.
2. Enumerate the TCA cycle with its energetics

Short Notes **(7 x 5= 35)**

3. IUB classification of enzymes
4. Electron Transport chain
5. Degradation of cholesterol
6. HMP Pathway and its significance
7. Biosynthesis of pyrimidine nucleotides
8. Catabolism of phenylalanine .What are the metabolic disorders.
9. Semiconservative model of DNA replication

Answer Briefly **(10 x 2= 20)**

10. Classification of lipids
11. What are ketone bodies. Mention the conditions causing keto acidosis.
12. Structure and function of tRNA
13. Atherosclerosis.
14. What are essential amino acids? Give examples
15. Genetic code
16. Diabetes Mellitus
17. Transamination
18. Applications of isoenzymes.
19. Albinism

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Second Semester B.Pharm Degree Examination

PATHOPHYSIOLOGY
(2017 Scheme)
(MODEL QUESTION PAPER)

Time: 3 Hours **Max marks: 75**

- **Answer all questions**
- **Draw diagrams wherever necessary**

Essays **(2x 10 = 20)**

1. Discuss the process of acute inflammation in detail.

2. Define hypertension. Give classification. Discuss the pathogenesis of hypertension.

Short Notes **(7 x 5 = 35)**

3. Factors influence wound healing.

4. Etiology of PUD.

5. Pathogenesis of atherosclerosis.

6. Mechanisms of cell injury.

7. Clinical manifestations of Parkinsonism.

8. Pathophysiology of bronchial asthma.

9. Differentiate between benign and malignant tumours.

Answer briefly **(10 x 2 = 20)**

10. Atrophy

11. Clinical features of MI.

12. Megaloblastic anemia.

13. Complications of hypothyroidism

14. Metastasis.

15. Risk factors for gout.

16. Clinical significance of Diabetes mellitus.

17. Causative agent and mode transmission of HIV infection

18. Clinical presentation of depression.

19. Primary prevention of cancer.

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QP CODE: **Reg. No: .....**

Second Semester B. Pharm Degree Examination

COMPUTER APPLICATIONS IN PHARMACY
(2017 Scheme)

MODEL QUESTION PAPER

Time: 2 Hours **Max. Marks: 50**

- Answer all questions
- Draw diagrams wherever necessary

Essays **(2 x 10 = 20 Marks)**

1. Explain the various applications of computer in pharmaceutical field?
2. Explain the process of life cycle in details.

Short Notes **(6 x 5 = 30 Marks)**

3. Explain and differentiate between HTML and XML
4. Electronic prescription and its benefits
5. DBMS
6. Feasibility Analysis
7. How will you convert binary number system into decimal number system and vice versa? Give one example.
8. What is CSS. Explain its advantages?

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QP CODE: **Reg. No: .....**

Second Semester B. Pharm Degree Examination

ENVIRONMENTAL SCIENCES
(2017 Scheme)

MODEL QUESTION PAPER

Time: 2 Hours **Max. Marks: 50**

- Answer all questions
- Draw diagrams wherever necessary

Essays **(2 x 10 = 20)**

1. Define forest Ecosystem. Explain the different components of Ecosysytem.
2. Define environment. Explain the different components of Environment.

Short notes **(6 x 5 = 30)**

3. Write a short note on sustainable water.
4. What are the sources of air pollution?
5. Explain the methods of treatment of sewage.
6. What are the threats associated with land resources.
7. Explain the types of natural resources.
8. Write a short note on renewable energy resources.

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QP Code: **Reg. No.:……**

Third Semester B. Pharm Degree Examination

PHARMACEUTICAL ORGANIC CHEMISTRY II

(2017 Scheme)

(Model Question Paper)

Time: 3 Hours **Max. Marks: 75**

- **Answer all questions**
- **Draw diagrams and structures wherever necessary**

Essays **(2x10=20)**

1. Explain the effect of substituents on orientation of monosubstituted benzene towards electrophilic aromatic substitution
2. Elaborate the method of preparation and chemical properties of anthracene

Short Notes **(7x5=35)**

3. Acidity of phenols
4. Any 5 synthetic uses of aryl diazonium salts
5. Definition, method of assay and significance of saponification value
6. Limitations of Baeyer's strain theory
7. Any three methods of preparation of aromatic amines
8. Chemical reactions of cyclopropane
9. Reactions of phenols due to hydroxyl group

Answer briefly **(10x2=20)**

10. Huckel's rule
11. Friedel-crafts alkylation reaction.
12. Structure and uses of DDT
13. Reichert Meissle Value
14. Why p-nitroaniline is less basic than aniline
15. Reimer Tiemann reaction
16. Define drying oil. Give one example.
17. Give the structure and uses of Resorcinol and Chloramine
18. Significance of Carbylamine reaction
19. Structure and uses of any two naphthalene derivatives

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QP Code: **Reg. No.:……**

Third Semester B. Pharm Degree Examination

PHYSICAL PHARMACEUTICS I

(2017 Scheme)

(Model Question Paper)

Time: 3 Hours **Max. Marks: 75**

- **Answer all questions**
- **Draw diagrams wherever necessary**

Essays **(2 x 10 = 20)**

1. Explain in detail about various derived properties of powders
2. Describe various factors influencing solubility of solids in liquids.

Short notes **(7 x 5 = 35)**

3. State and explain Fick's laws of diffusion.
4. Explain dipole moment and its applications.
5. Explain the kinetics of drug protein binding.
6. Enumerate different methods for determination of particle size. Explain conductivity method in detail.
7. Henderson-Hasselbalch equation and its applications
8. Applications of complexation in pharmacy
9. Explain Nernst distribution Law.

Answer briefly **(10 x 2 = 20)**

10. What are aerosols. Write the importance of propellants in an aerosol.
11. Critical solution temperature.
12. Describe Sorensen's pH scale.
13. What are the applications of bulk density.
14. Explain Henry's law.
15. What is polymorphism. Mention its pharmaceutical importance.
16. Buffer capacity
17. Liquid crystals
18. Dielectric constant and its importance
19. Applications of buffers

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QP Code: **Reg. No.:……**

Third Semester B. Pharm Degree Examination

PHARMACEUTICAL MICROBIOLOGY

(2017 Scheme)

(Model Question Paper)

Time: 3 Hours **Max. Marks: 75**

- **Answer all questions**
- **Draw diagrams wherever necessary**

Essays **(2 x 10 = 20)**

1. Describe the various methods used for the identification of bacteria
2. Explain the different sources and types of microbial contamination in pharmaceutical products.

Short notes **(7 x 5 = 35)**

3. Standardization of antibiotics in brief
4. Sterilization by dry heat
5. Cultivation of viruses
6. Anaerobic methods of cultivation of bacteria
7. Reproduction of fungi
8. Application of cell cultures in Pharmaceutical industry
9. Design of aseptic area

Answer briefly **(10 x 2 = 20)**

10. What are the functions of Pili.
11. Difference between total count and viable count.
12. Name the nutritional requirements of bacteria.
13. What is minimum inhibitory concentration.
14. What is primary cell culture.
15. Name the factors which affect the efficacy of preservatives.
16. What is Lag phase in bacterial growth curve.
17. What is Capsid.
18. What are thermophiles.
19. Principle of Dark field microscopy.

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QP Code: **Reg. No.:……**

Third Semester B. Pharm Degree Examination

PHARMACEUTICAL ENGINEERING

(2017 Scheme)

(Model Question Paper)

Time: 3 Hours **Max. Marks: 75**

- **Answer all questions**
- **Draw diagrams wherever necessary**

Essays **(2x 10 = 20)**

1. Explain the principle, assembly, method and applications of fractional distillation also write in brief on boiling point composition curve.
2. Explain in detail about the various materials used for plant construction.

Short notes **(7 x 5 = 35)**

3. Explain the different laws governing size reduction.
4. Principles, construction, working, uses, merits and demerits of planetary mixer
5. Explain the Fourier's law of heat transfer by conduction
6. Explain the principle, theory & applications of Centrifugal effect
7. Explain the principle, construction, working and uses of Pneumatic conveyor
8. Describe the principle, construction and working and application of fluidized bed dryer.
9. Bernoulli's theorem and its applications

Answer briefly **(10 x 2 = 20)**

10. Mechanism of solid mixing
11. Bond's Theory
12. Raoult's law
13. Reynolds number
14. Factors influencing evaporation
15. Drying rate curve
16. Mechanism of filter aids
17. Kozeny carman equation
18. Azeotropic distillation
19. Principle involved in freeze drying

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QP CODE: **Reg. No:.....**

Fourth Semester B. Pharm Degree Examinations

PHARMACEUTICAL ORGANIC CHEMISTRY- III

(2017 Scheme)

(Model Question Paper)

Time: 3 Hrs **Total Marks: 75**

- Answer all the questions
- Write the reactions wherever necessary

ESSAYS **(2 x 10 = 20 Marks)**

1. Explain racemic modification and resolution of racemic mixture with suitable example. Write a note on elements of symmetry.
2. Discuss the reaction, mechanism and application of Schmidt reaction and Beckmann's rearrangement.

SHORT NOTES **(7 x 5 = 35 Marks)**

3. Explain Diastereomers and meso compounds with example.
4. Write in detail about stereo specific and stereo selective reaction.
5. Explain relative aromaticity of Pyrrole, Furan and Thiophene.
6. Give two methods for the synthesis of Pyridine and Quinoline and mention their medicinal uses.
7. Explain conformational isomerism in Cyclohexane.
8. Explain partial asymmetric synthesis.
9. Describe the electrophilic substitution reactions of Indole and Isoquinoline and their medicinal uses.

ANSWER BRIEFLY **(10 x 2 = 20 Marks)**

10. What is Optical isomerism?
11. Write the chemical structure and uses of Acridineand Thiophene
12. Briefly explain Metal hydride reduction.
13. What is Dakin reaction?
14. Write the synthetic importance of Oppenauer oxidation.
15. Why Pyrrole is more reactive in electrophilic substitution than benzene.
16. What is the difference between d, l and D, L notations?
17. What are condensed ring heterocycles give three examples.
18. Write the reaction for reduction of benzene and its derivatives to non - conjugated dienes.
19. Write any one method of synthesis of Indole.

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QP CODE: **Reg. No:.....**

Fourth Semester B. Pharm Degree Examinations
MEDICINAL CHEMISTRY- I
(2017 Scheme)

(Model Question Paper)

Time: 3 Hours **Max. Marks: 75**

- Answer all questions
- Draw diagrams wherever necessary

Essays **(2 x 10 = 20)**

1. Classify anticonvulsants with one structure from each class. Mention the synthesis of Chlorpromazine.
2. Explain Phase I and Phase II metabolism with examples.

Short notes **(7 x 5 = 35)**

3. Outline the synthesis of Phenylephrine and Ethosuximide.
4. Significance of partition coefficient of drugs in biological action.
5. Explain biosynthesis and catabolism of Acetylcholine.
6. Discuss the SAR of benzodiazepines.
7. Give structure and uses of Dicyclomine and Naproxen
8. Outline the synthesis and mechanism of action of Salbutamol.
9. Explain the SAR of cholinergic drugs.

Answer briefly **(10 x 2 = 20)**

10. Give mechanism of action and use of Pilocarpine.
11. Synthesis of Methohexital.
12. Give the structure and use of Triclofos Sodium.
13. Synthesis of Methadone.
14. Give structure and uses of any one synthetic cholinergic blocking agent.
15. Structure and use of Gabapentin
16. Chemistry and use of Haloperidol
17. Structure of Prochlorperazine.
18. Synthesis of Carbachol.
19. What are narcotic antagonists? Give name and use of anyone.

QP CODE: **Reg. No: .....**

Fourth Semester B. Pharm Degree Examinations

PHYSICAL PHARMACEUTICS - II

(2017 Scheme)

(Model Question Paper)

Time: 3 Hours **Max. Marks: 75**

- Answer all questions
- Draw labelled diagrams wherever necessary

Essays **(2 x 10 = 20)**

1. Classify colloids based on their characteristic features. Explain the different methods for purification of colloids.

2. Explain oxidative and hydrolytic decomposition in pharmaceutical products. Describe the different methods for protection against these decomposition reactions.

Short notes **(7 x 5 = 35)**

3. Write a note on non-Newtonian Liquid.

4. Derive an equation for spreading coefficient. What is its significance?

5. Classify surfactants based on their HLB value. Give two equations for calculation of HLB value.

6. Explain how flocculation can be induced in suspensions with the help of electrolytes.

7. Explain the stability problems in emulsions.

8. Give the construction and working of a falling sphere viscometer.

9. Explain the applications of thixotropy in pharmaceutical formulations.

Answer briefly **(10 x 2 = 20)**

10. Gold number

11. Stokes law

12. Zeta potential

13. Apparent zero order reactions

14. Plug flow

15. Yield value

16. Microemulsions

17. Factors to be considered in the preservation of emulsions.

18. Sedimentation volume.

19. Arrhenius equation.

QP CODE: **Reg. No: .....**

Fourth Semester B. Pharm Degree Examinations
PHARMACOLOGY-I
(2017 Scheme)
(Model Question Paper)

Time: 3 Hours **Max. Marks: 75**

- Answer all questions
- Draw labelled diagrams wherever necessary

Essays **(2 x 10 = 20)**

1. Discuss in detail the different processes involved in the development of a new drug till it is marketed.
2. Classify adrenergic drugs with examples. Discuss the pharmacological actions of adrenaline in detail. Mention its therapeutic uses.

Short notes **(7 x 5 = 35)**

3. **.** Outline the different types of drug antagonism.
4. Compare and contrast diazepam with Phenobarbitone.
5. Mechanism of action, uses, adverse effects and two examples of SSRIs.
6. Diagnosis and management of Myasthenia gravis.
7. Symptoms and management of methanol poisoning.
8. Pharmacological actions of Atropine.
9. Advantages and disadvantages of oral route of drug administration.

Answer briefly **(10 x 2 = 20)**

10. Name four non-renal routes for drug excretion.
11. Why levodopa is not effective in haloperidol induced Parkinsonism?
12. Give one example each for a microsomal inducer and inhibitor.
13. Define pre-anaesthetic medication.
14. Name any two major effector pathways involved in the functioning of G protein-coupled receptors.
15. Why Pralidoxime is not effective in Neostigmine poisoning?
16. What is meant by the statement “Pethidine is less potent but equally efficacious analgesic as Morphine”?
17. The rationale for giving Propranolol in acute situations of nervousness.
18. What is Pharmacovigilance?
19. Name two drugs effective in petitmal epilepsy

QP CODE: **Reg. No:**

Fourth Semester B. Pharm Degree Examinations
PHARMACOGNOSY AND PHYTOCHEMISTRY -I
(2017 Scheme)
(Model Question Paper)

Time: 3 Hours **Max. Marks: 75**

- Answer all questions
- Draw labelled diagrams wherever necessary

Essays **(2 x 10 = 20)**

1. Classify natural allergens with suitable examples? Add a note on the preparation and standardization of allergenic extracts.

2. Define plant tissue culture? Discuss in detail about the culture media used in plant tissue culture.

Short notes **(7 x 5 = 35)**

3. Write a note on different types of adulteration in crude drugs.

4. Describe the development and scope of Pharmacognosy.

5. Classify Tannins with suitable examples.

6. Write the biological sources, method of preparation and uses of Gelatin.

7. Write short note on Cotton.

8. What is polyploidy? Write the applications of polyploidy in medicinal plants.

9. With suitable examples write a note on the storage conditions for different crude drugs.

Answer briefly **(10 x 2 = 20)**

10. Name the general tests for identification of alkaloids.

11. Define Pharmacognosy.

12. What is Mutation?

13. Name different types of Artificial Drying methods for crude drugs.

14. What is an explant?

15. What is organized crude drugs?

16. Fiehe's test.

17. Biological sources of Agar.

18. Define stomatal number and stomatal index.

19. What are Tannins?

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QP Code: **Reg.No. ……**

Fifth Semester B.Pharm Degree Examinations

MEDICINAL CHEMISTRY II

(2017 scheme)

Model Question Paper

Time: 3 Hrs **Max. Marks: 75**

- **Answer all questions**
- **Draw chemical structures wherever necessary**

Essays **(2 X 10 = 20)**

1. What are antihistaminics? Classify them with examples and outline thesynthesis of diphenhydramine and promethazine.
2. Classify oral hypoglycemic agents with examples. Explain the structure, synthesis and mechanismof action of Tolbutamide.

Short Notes **(7 x 5 = 35)**

3. Explain the chemistry and uses of Thiazide diuretics.
4. Discuss the SAR of local anesthetics.
5. Discuss the inter-relationship between different oestrogens.
6. Structure, mechanism of action and uses of Lovastatin.
7. Outline the synthesis of Methotrexate.
8. Classify antihypertensive agents with specific examples.
9. Write a note on nitrates and give their uses.

Answer Briefly **(10 x 2 = 20)**

10. Give the structure and use of Warfarin.
11. Outline the synthesis of Furosemide.
12. Role of digoxin in CHF.
13. Give the structures of any two antithyroid drugs.
14. What are oral contraceptives?
15. Structure and uses of Nifedipine.
16. Mechanism of action of alkylating agents.
17. Give the structure and uses of any one carbonic anhydrase inhibitor.
18. Outline the synthesis of Benzocaine.
19. Mechanism of action and use of Captopril

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QP Code: **Reg.No. ……**

Fifth Semester B.Pharm Degree Examinations

FORMULATIVE PHARMACY

(2017 scheme)

Model Question Paper

Time: 3 Hrs **Max. Marks: 75**

- **Answer all questions**
- **Draw diagrams wherever necessary**

Essays **(2 X 10 = 20)**

1. Explain the rotary die process for the manufacturing of soft gelatin capsule and discuss the quality control tests for finished soft gelatin capsules.
2. Explain tablet manufacturing by wet granulation process and discuss various problems during tablet manufacturing.

Short Notes **(7 X 5 = 35)**

3. What are the chemical properties studied during preformulation?
4. Explain extrusion spheronization technique.
5. Discuss the various air handling systems in parenteral production facility.
6. Describe the formulation and stabilisation of eye drops.
7. Explain the quality control test for aerosols.
8. What are the factors influencing the choice of pharmaceutical containers?
9. Explain the formulation and manufacturing of vanishing cream.

Answer Briefly **(10 X 2 = 20)**

10. Define base adsorption value
11. What is milliards reaction and how it can be prevented?
12. List out the quality control tests for emulsion.
13. What are enteric film formers? Give two examples.
14. What is LAL test?
15. Give the composition of Rubber closures for pharmaceuticals.
16. Why Friability test is performed on tablets?
17. Classify propellants used in aerosols with examples
18. What is BCS classification of drugs?
19. Mention types of glass used in pharmaceuticals as per I.P.

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QP Code: **Reg.No. ……**

Fifth Semester B.Pharm Degree Examinations

PHARMACOLOGY -II

(2017 scheme)

Model Question Paper

Time: 3 Hrs **Max. Marks: 75**

- **Answer all questions**
- **Draw diagrams wherever necessary**

Essays **(2 X 10 = 20)**

1. Classify antihypertensive drugs. Describe the pharmacological actions, mechanism of action, uses and adverse effects of calcium channel blockers.
2. Classify NSAIDs. Write the mechanism of action, pharmacological actions, uses and adverse effects of aspirin.

Short Notes **(7 X 5 = 35)**

3. Define and classify antihistamines. Mention three uses of cetirizine.
4. What are prostaglandin analogues? Discuss with examples their clinical benefits.
5. Write the mechanism of action of a). Spirinolactone b). LMW Heparin
6. Classify antihyperlipidemic drugs. Write the mechanism of action and adverse effects of HMG CoA reductase inhibitors.
7. Define bioassay. Describe the principles and indications of bioassay.
8. Outline the mechanisms of action of different groups of drugs used in hyperthyroidism.
9. Classify oral hypoglycemic agents with examples. Discuss the mechanism of action of DPP 4 inhibitors.

Answer Briefly **(10 X 2 = 20)**

10. Name the benefits and drawbacks of HRT after menopause.
11. Why Allopurinol is given in chronic gout?
12. What is the mechanism of action of digoxin in CCF?
13. Outline the benefit produced by Streptokinase in acute myocardial infarction.
14. Name two drugs each from clinically used 5-HT receptor agonists and antagonists.
15. After continuous administration, the dose of steroids should be tapered before stopping. Why?
16. Why Stanozolol is sometimes abused by athletes?
17. Mention two specific uses of Vasopressin analogues.
18. Justify the use of Salbutamol in premature labour.
19. Pharmacological basis of nitroglycerine administration in angina pectoris.

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QP Code: **Reg.No. ……**

Fifth Semester B.Pharm Degree Examinations

PHARMACOGNOSY AND PHYTOCHEMISTRY-II

(2017 scheme)

Model Question Paper

Time: 3 Hrs **Max. Marks: 75**

- **Answer all questions**
- **Draw diagrams wherever necessary**

Essays **(2 X 10 = 20)**

1. Explain the production of aromatic amino acids by Shikimic acid pathway.
2. Give a detailed pharmacognostic study of Senna.

Short Notes **(7 X 5 = 35)**

3. Differentiate between black catechu and pale catechu.
4. Explain the microscopy of Fennel with a neat labelled diagram.
5. Write a brief note on Tracer techniques in the elucidation of biosynthetic pathway of plants.
6. Write a short note on gel electrophoresis.
7. Write a short note on industrial production and utilization of Artemisinin
8. General method of extraction of Alkaloids.
9. Write a short note on super critical fluid extraction.

Answer Briefly **(10 X 2 = 20)**

10. Name the types of spectroscopic methods used for the identification of compounds from crude drugs.
11. Thalleoquin test.
12. Chemical constituents of opium.
13. Biological source and use of Rauwolfia.
14. What is R_f value.
15. Biological source and use of a drug containing oleo gum resin.
16. Biological source and use of a drug containing cardiac glycoside.
17. Enfluerage method in isolation of volatile oil.
18. Write the major constituent present in cinnamon and its chemical structure.
19. Medicinal uses of Guggul.

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QP Code: **Reg.No. ……**

Fifth Semester B.Pharm Degree Examinations

PHARMACEUTICAL JURISPRUDENCE

(2017 scheme)

Model Question Paper

Time: 3 Hrs **Max. Marks: 75**

- **Answer all questions**

Essays **(2 X 10 = 20)**

1. What are the objectives of Pharmacy Act? Explain constitution and functions PCI.
2. Explain in detail about the manufacture of alcoholic preparations in bonded and non-bonded laboratories.

Short Notes **(7 x 5 = 35)**

3. Explain the constitution of DTAB.
4. What are the provisions under Medical Termination of Pregnancy Act?
5. What are the qualification and duties of drugs inspector?
6. Discuss Schedule M of Drug and Cosmetics Act & Rules.
7. Explain the objectives and schedules of Drug price control order.
8. Offences and penalties in Narcotic Drugs and Psychotropic Substances Act.
9. Explain on prohibited and exempted advertisements under Drugs and Magic Remedies Act.

Answer briefly **(10 x 2 = 20)**

10. Differentiate between Misbranded and Spurious drug.
11. Constitution ofInstitutional Animals Ethics Committee.
12. Define code of pharmaceutical ethics.
13. What are the minimum qualifications required for the registration of a pharmacist as per Educational Regulations of Pharmacy Act 1948?
14. Constitution and functions of Drugs Consultative Committee.
15. Define Loan Licence
16. Draw the specimen label for schedule X drug.
17. Define Drug as per Drug and Cosmetic Act.
18. What is schedule P and Schedule Y?
19. Define the term ‘opium derivatives’ as per Narcotic Drugs and Psychotropic Substances Act.

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QP CODE: **Reg. No: .....**

Sixth Semester B. Pharm Degree Examination
MEDICINAL CHEMISTRY- III
(2017 Scheme)
MODEL QUESTION PAPER

Time: 3 Hours **Max. Marks: 75**

- Answer all questions
- Draw diagrams wherever necessary

Essays **(2 x 10 = 20)**

1. Classify Sulfonamides and explain the SAR.
2. Explain the various physicochemical parameters commonly used in QSAR based drug design.

Short notes **(7 x 5 = 35)**

3. Outline the synthesis of Dapsone and Acyclovir.
4. Describe solid phase synthesis in combinatorial chemistry.
5. Explain the etiology of malaria.
6. Discuss the SAR of Quinolones.
7. Give structure and uses of Pyrazinamide and Chloramphenicol.
8. Outline the synthesis and mechanism of action of Trimethoprim.
9. Explain the concept of prodrug design.

Answer briefly **(10 x 2 = 20)**

10. Give mechanism of action and use of Sulfamethoxazole.
11. Synthesis of Metronidazole.
12. Give the structure and use of Amantidine hydrochloride.
13. Classify antimalarial drugs.
14. Give structure and uses of any one β-lactamase inhibitor.
15. Give the structure and uses of Miconazole.
16. Discuss the chemistry and uses of Monobactams.
17. Give the structure of Mefloquine and Proguanil.
18. Explain the synthesis of Isoniazid.
19. Briefly explain about macrolide antibiotics.

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QP CODE: **Reg. No: .....**

Sixth Semester B. Pharm Degree Examination
PHARMACOLOGY - III
(2017 Scheme)
MODEL QUESTION PAPER

Time: 3 Hours **Max. Marks: 75**

- Answer all questions
- Draw diagrams wherever necessary

Essays **(2 x 10 = 20)**

1. Classifying anticancer drugs with examples. Explain the pharmacology of alkylating agents.
2. Classify antimalarial drugs. Explain the pharmacology of drugs used for suppressive prophylaxis.

Short notes **(7 x 5 = 35)**

3. Applications of stem cell therapy.
4. Write short notes on urinary antiseptics.
5. MDT of leprosy.
6. Drugs used in the management of COPD
7. Therapeutic applications of co-trimoxazole.
8. RNTCP regimen for MDR-TB.
9. Write notes on Nucleoside reverse transcriptase inhibitors.

Answer briefly **(10 x 2 = 20)**

10. Adverse effects of Tetracycline
11. Therapeutic uses of chloramphenicol
12. Classify anti-ulcer drugs with examples.
13. Define biosimilars.
14. Applications of immunosuppressants.
15. Adverse effects of sulfonamides.
16. What are beta lactamase inhibitors. Give two examples.
17. Write the mechanism of action of ondansetron.
18. Give examples for first line antitubercular drugs.
19. Cinchonism.

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QP CODE: **Reg. No: .....**

Sixth Semester B. Pharm Degree Examination
HERBAL DRUG TECHNOLOGY
(2017 Scheme)
MODEL QUESTION PAPER

Time: 3 Hours **Max. Marks: 75**

- Answer all questions
- Draw diagrams wherever necessary

Essays **(2 x 10 = 20)**

1. Write in detail the preparation and standardization of Arishta.
2. Explain the preparation and evaluation of herbal tablet.

Short notes **(7 x 5 = 35)**

3. Write a short note on processing of herbal raw material.
4. Write a short note on natural pest control agents.
5. Write the basic principle involved in Homeopathy.
6. Write a short note on herb-drug interaction with reference to pepper.
7. Write a note on bleaching agents used in skin care products.
8. Write a note on natural sweeteners used as herbal excipients.
9. WHO guidelines for chemical evaluation of herbal drugs.

Answer briefly **(10 x 2 = 20)**

10. Write any two examples of nutraceuticals used in Irritable Bowel Syndrome.
11. Mention the health benefits of Fenugreek.
12. Mention the side effects and interactions of Ginseng.
13. Define IPR..
14. Schedule Z.
15. List any four institutions involved in research on medicinal and aromatic plants.
16. Mention the biological source of any two fixed oils used in cosmetics.
17. Define herbal medicine.
18. What are the components of schedule T?
19. What is biopiracy?

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QP CODE: **Reg. No: .....**

Sixth Semester B. Pharm Degree Examination
BIOPHARMACEUTICS AND PHARMACOKINETICS
(2017 Scheme)
MODEL QUESTION PAPER

Time: 3 Hours **Max. Marks: 75**

- Answer all questions
- Draw diagrams wherever necessary

Essays **(2 x 10 = 20)**

1. Describe the kinetics of one compartment open model i.v. bolus administration and explain how various kinetic parameters are determined.
2. Explain various physicochemical factors affecting drug absorption.

Short notes **(7 x 5 = 35)**

3. State Michaelis Menton equation and its significance.
4. Explain the influence of various physiological barriers in distribution of drugs.
5. Describe the significances of plasma protein binding.
6. Explain sigma minus method.
7. Discuss the concept of clearance.
8. What is entero-hepatic circulation of drugs? Mention its significances
9. Explain the determination of Absorption rate constant by method of residuals.

Answer briefly **(10 x 2 = 20)**

10. What are the significances of volume of distribution?
11. Explain any one method for determination of AUC.
12. Define bioavailability and bioequivalence.
13. What are the characteristic features of glucuronide conjugation?
14. Define the term Extraction ratio.
15. Give any two reasons for non-linearity with examples.
16. Differentiate passive and active transport mechanisms.
17. How are drugs a classified according to Biopharmaceutical Classification System?
18. What are the various levels of IVIVC?
19. Explain the design of any one official apparatus used for dissolution studies?

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QP CODE: **Reg. No: .....**

Sixth Semester B. Pharm Degree Examination
PHARMACEUTICAL BIOTECHNOLOGY
(2017 Scheme)
MODEL QUESTION PAPER

Time: 3 Hours **Max. Marks: 75**

- Answer all questions
- Draw diagrams wherever necessary

Essays **(2 x 10 = 20)**

1. Explain the various methods adopted for enzyme immobilization.
2. With the help of Fermentor design explain the production of Vitamin B12.

Short notes **(7 x 5 = 35)**

3. Discuss the production of penicillinase.
4. Explain microbial biotransformation and give its application.
5. With the help of a neat diagram explain the function of MHC.
6. Explain the relevance of biosensors in pharmaceutical Industry
7. What is Protein Engineering and give its application in health Care system?
8. Write in detail the application of rDNA Technology
9. Explain the method of preparation of toxoids.

Answer briefly **(10 x 2 = 20)**

10. Define immunity
11. Interferon
12. Mutation
13. Define PCR
14. Western Blotting
15. Antitoxins
16. What is Transformation?
17. Hybridoma Technology
18. Plasmids
19. Plasma Substitute

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QP CODE: **Reg. No: .....**

Sixth Semester B. Pharm Degree Examination
PHARMACEUTICAL QUALITY ASSURANCE
(2017 Scheme)
MODEL QUESTION PAPER

Time: 3 Hours **Max. Marks: 75**

- Answer all questions
- Draw diagrams wherever necessary

Essays **(2 x 10 = 20)**

1. Define quality assurance. Explain the elements and importance of total quality management in pharma industries.
2. Define validation, give its elements and also explain the validation of master formula.

Short notes **(7 x 5 = 35)**

3. Explain in detail the term stress testing.
4. Explain and give importance of risk assessment and control strategies in QbD.
5. Give the details of plant layout and its maintenance in the light of GMP.
6. Difference between QA and QC.
7. What are SOPs and give a specimen for manual tablet punching machine.
8. Define the term documentation; give importance and types of the same.
9. What are internal quality audits and what is their importance.

Answer briefly **(10 x 2 = 20)**

10. How many batches to be consider for a process validation
11. What is cGMP
12. Define warehousing and give the characteristics of good warehousing.
13. Explain the term Recall.
14. Give the advantages of QbD.
15. Difference between quality planning and quality improvement.
16. Give a flow chart of raw material quality assurance.
17. General conditions for stability studies.
18. Give a flow chart of quality audits life cycle.
19. Difference between validation and qualification.

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QP CODE: **Reg. No: .....**

Seventh Semester B. Pharm Degree Examination
INSTRUMENTAL METHODS OF ANALYSIS
(2017 Scheme)
MODEL QUESTION PAPER

Time: 3 Hours **Max. Marks: 75**

- Answer all questions
- Draw diagrams wherever necessary

Essays **(2 x 10 = 20)**

1. Define Beer-Lambert's law. Derive the equation and add a note on it's deviations.
2. Explain the principle and instrumentation of high performance liquid chromatography.

Short notes **(7 x 5 = 35)**

3. What is fluorescence and explain the factors affecting on it.
4. Explain the instrumentation and interferences of flame photometry.
5. Explain any two thermal detectors of IR spectroscopy.
6. Differentiate nephelometry and turbidimetry.
7. Explain principle, types and development techniques of paper chromatography.
8. Write a note on temperature programming and application of gas chromatography.
9. Explain the principle of gel filtration chromatography. Give its applications.

Answer briefly **(10 x 2 = 20)**

10. Define chromophore and auxochromes.
11. What are the different types of quenching?
12. Types of stretching vibrations of IR spectroscopy.
13. Mention the applications of Atomic absorption spectroscopy.
14. What is Rf value? Write any two significance.
15. What are the derivatization techniques of gas chromatography.
16. Applications of capillary electrophoresis.
17. Differentiate TLC and HPTLC.
18. Difference between adsorption and partition chromatography.
19. Write the radiation sources of IR spectroscopy.

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QP CODE: **Reg. No: .....**

Seventh Semester B. Pharm Degree Examination
INDUSTRIAL PHARMACY
(2017 Scheme)
MODEL QUESTION PAPER

Time: 3 Hours **Max. Marks: 75**

- Answer all questions
- Draw diagrams wherever necessary

Essays **(2 x 10 = 20)**

1. Explain the general considerations of pilot plant scale up techniques for the development of solid dosage forms with relevant documentation.
2. Describe the process of technology transfer from R & D to production.

Short notes **(7 x 5 = 35)**

3. Describe the various preventive and control measures for fire and explosion hazards.
4. Explain the NDA approval process
5. What are the organization structure and responsibilities of CDSCO?
6. Explain in detail about SUPAC guidelines.
7. What are the various TOT agencies in India?
8. Describe the factors influencing the location of the pharmaceutical industry.
9. Explain the steps involved in the drug approval process?

Answer briefly **(10 x 2 = 20)**

10. What are the steps involved in the scale up process?
11. List out the factors affecting technology transfer.
12. List out the responsibilities of State Licensing Authority.
13. What is the content of Investigator's Brochure?
14. Differentiate between Process Layout and Product Layout?
15. List out the major utility and service systems used in pharma industry?
16. What is COPP ?
17. Write the importance of risk management principles.
18. List out the five modules of Common Technical Document
19. What are the main contents of IND Application?

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QP CODE: **Reg. No: .....**

Seventh Semester B. Pharm Degree Examination
PHARMACY PRACTICE
(2017 Scheme)
MODEL QUESTION PAPER

Time: 3 Hours **Max. Marks: 75**

- Answer all questions
- Draw diagrams wherever necessary

Essays **(2 x 10 = 20)**

1. Describe in detail various drug dispensing methods to inpatients
2. Explain therapeutic drug monitoring. Mention its indications with examples.

Short notes **(7 x 5 = 35)**

3. Role of PTC in ensuring safe use of drugs in hospitals.
4. Rational use of injections.
5. Clinical management of bronchial asthma
6. Legal requirements for starting a community pharmacy.
7. Role of pharmacist in patient medication adherence.
8. Preparation and revision of hospital formulary.
9. Steps in patient counseling

Answer briefly **(10 x 2 = 20)**

10. Automatic stop order system.
11. Name any four biochemical parameters to assess liver function.
12. Define the term 'Reorder level'.
13. Give anti H.pylori regimen.
14. Write any two examples for Type A adverse drug reaction.
15. What is meant by tertiary hospital?
16. What is the role of Poison Information Centre in hospitals?
17. DOTS programme
18. Pharmacist intervention in patient medication history.
19. Primary Drug Information resources

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QP CODE: **Reg. No: .....**

Seventh Semester B. Pharm Degree Examination
NOVEL DRUG DELIVERY SYSTEMS
(2017 Scheme)
MODEL QUESTION PAPER

Time: 3 Hours **Max. Marks: 75**

- Answer all questions
- Draw diagrams wherever necessary

Essays **(2 x 10 = 20)**

1. Explain the various approaches to formulate gastro-retentive drug delivery systems?
2. Define Transdermal delivery of drugs. Explain the components and formulation approaches of transdermal delivery systems

Short notes **(7 x 5 = 35)**

3. Explain microencapsulation by Wurster process
4. What are implants? Describe the components and working of Alzet Osmotic Pump.
5. Write briefly on the design of ophthalmic inserts.
6. Explain the method of preparation and therapeutic applications of liposomes
7. Discuss the physicochemical characteristics of drug to be considered in the design of CDDS
8. Explain the principles mucoadhesion.
9. What are biodegradable polymers? Explain their applications in pharmaceutical formulations with examples.

Answer briefly **(10 x 2 = 20)**

10. What are the applications of pulmonary delivery of drugs?
11. What is Metered dose inhaler?
12. List out the different methods to enhance the drug permeation through transdermal route.
13. What are applications of microencapsulation of drugs?
14. Give four examples for mucoadessive polymers
15. Define diffusion controlled drug delivery systems?
16. List out the major components and applications of niosomes.
17. What are the applications of monoclonal antibodies in therapeutics?
18. List out the different approaches for targeted delivery of drugs.
19. Mention the merits and demerits of buccal drug delivery system.

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QP CODE: **Reg. No: .....**

Eighth Semester B. Pharm Degree Examination

BIOSTATISTICS AND RESEARCH METHODOLOGY

(2017 Scheme)

MODEL QUESTION PAPER

Time: 3 Hours **Max. Marks: 75**

- Answer all questions
- Draw diagrams wherever necessary

Essays **(2 x 10 = 20)**

1. With suitable examples discuss the different parametric and nonparametric tests used in the testing of hypothesis.
2. What is meant by sampling in epidemiology studies? Discuss its relevance and the different types of sampling techniques in detail.

Short notes **(7 x 5 = 35)**

3. Briefly discuss the different types of epidemiology studies.
4. Outline the format for a research protocol.
5. Discuss the different methods usually adopted for graphical representation of data.
6. Discuss the applications of some commonly used computer software in biostatistical analysis.
7. Write briefly on Publication ethics and Plagiarism.
8. Discuss the importance of research in pharmaceutical Sciences.
9. Write a short note on coding and tabulation of data.

Answer briefly **(10 x 2 = 20)**

10. Explain the meaning of "Research gap."
11. Differentiate between primary and secondary data.
12. What is meant by normal distribution of data?
13. With a suitable example describe the term "Confounding".
14. What is Type I error in hypothesis testing?
15. Mention the criteria of a good research.
16. What is meant by the term 'impact factor in research publication'?
17. What are drop outs in clinical research?
18. What is the difference between reference and bibliography?
19. Differentiate between methods and methodology in research.

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QP CODE: **Reg. No: .....**

Eighth Semester B. Pharm Degree Examination

SOCIAL AND PREVENTIVE PHARMACY

(2017 Scheme)

MODEL QUESTION PAPER

Time: 3 Hours **Max. Marks: 75**

- Answer all questions
- Draw diagrams wherever necessary

Essays **(2 x 10 = 20)**

1. Discuss Universal Immunization Programme.
2. Discuss in detail the various National Family Welfare Programmes.

Short notes **(7 x 5 = 35)**

3. Balanced diet
4. National Urban Health Mission
5. HIV and AIDS Control Programme
6. Nutritional deficiency disorders
7. Functions of PHC
8. Pulse Polio Programme
9. Prevention and control of malaria.

Answer briefly **(10 x 2 = 20)**

10. What are the deficiency disorders of Vitamin C and Vitamin D?
11. Define the term ‘Health’.
12. Define drug abuse.
13. Give measurers for effective control of dengue.
14. What is essential hypertension?
15. What is the impact of urbanisation on health?
16. What are the indicators of health?
17. Concept of prevention of disease.
18. National Leprosy Control Programme.
19. What is the general principle involved in the prevention of Lymphatic Filariasis?

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QP CODE: **Reg. No: .....**

Eighth Semester B. Pharm Degree Examination

PHARMACEUTICAL MARKETING

(2017 Scheme)

MODEL QUESTION PAPER

Time: 3 Hours **Max. Marks: 75**

- Answer all questions
- Draw diagrams wherever necessary

Essays **(2 x 10 = 20)**

1. Explain the various types of channels of distribution in Pharmaceutical marketing.
2. Explain the various concepts in marketing. Add a note on vertical and horizontal marketing.

Short notes **(7 x 5 = 35)**

3. Product folio analysis.
4. Explain quantitative and qualitative aspects of market research.
5. Sales promotion techniques.
6. Duties of professional sales representatives.
7. Product branding.
8. Global marketing of pharmaceuticals.
9. Role of product management team in pharmaceutical industry.

Answer briefly **(10 x 2 = 20)**

10. Define price. Name the pricing strategies employed for pharmaceutical marketing.
11. Online promotional techniques for OTC products.
12. Differentiate between marketing and selling.
13. Define product decision.
14. Mention the factors to be considered while selecting the channels.
15. Evaluation methods adopted for sales representative.
16. Define rural marketing.
17. Functions of NPPA.
18. Define promotional budget.
19. Methods of analysing consumer behaviour.

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QP CODE: **Reg. No: .....**

Eighth Semester B. Pharm Degree Examination
PHARMACEUTICAL REGULATORY SCIENCE
(2017 Scheme)
MODEL QUESTION PAPER

Time: 3 Hours **Max. Marks: 75**

- Answer all questions
- Draw diagrams wherever necessary

Essays **(2 x 10 = 20)**

1. Write in detail the developing of clinical trials protocols and other working procedures for conducting the clinical trials.
2. Explain in detail the Abbreviated New Drug Application (ANDA) regulatory approval process.

Short notes **(7 x 5 = 35)**

3. Write short note on Code of Federal Regulations.
4. Generic drug product development.
5. Stages of drug discovery.
6. Write short note on Drug Master File.
7. Describe briefly about regulatory authorities of Australia.
8. Discuss briefly about Informed consent process and procedures.
9. Describe the CTD and ETCD format and its usefulness in regulatory affairs.

Answer briefly **(10 x 2 = 20)**

10. Define Orange Book. Mention its significance.
11. Mention the functions of the Institutional Review Board.
12. Concept of generics
13. What are the preclinical studies involved in drug development?
14. Name the regulatory authorities of United States, Japan, Canada and European Union.
15. Define Pharmacovigilance
16. ASEAN Common Technical Document (ACTD)
17. What is the content of Purple Book?
18. Time lines involved in Investigational New Drug (IND)
19. Differentiate between Laws and Acts.

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QP CODE: **Reg. No: .....**

Eighth Semester B. Pharm Degree Examination

PHARMACOVIGILANCE

(2017 Scheme)

MODEL QUESTION PAPER

Time: 3 Hours **Max. Marks: 75**

- Answer all questions
- Draw diagrams wherever necessary

Essays **(2 x 10 = 20)**

1. Define and classify Adverse Drug Reactions. Explain the procedure involving In detection and reporting ADR.
2. Explain the genesis and development of Pharmacovigilance in India.

Short notes **(7 x 5 = 35)**

3. Explain the importance of drug safety monitoring.
4. Write briefly about WHO international drug monitoring programme.
5. Explain the different methods of causality assessment.
6. Discuss about the basic drug information resources.
7. Explain the functions of Contract Research Organisations (CROs) in pharmacovigilance.
8. Write the significance of .adverse events following immunization.
9. Explain the objectives of ICH and discuss in detail about its organization.

Answer briefly **(10 x 2 = 20)**

10. Mention the various drug information resources.
11. What is Preclinical phase in drug development?
12. How the safety of drugs can be evaluated in pediatrics?
13. What are the CIOMS requirements for ADR reporting?
14. Difference between Active and Passive surveillance
15. What is Cohort study?
16. Write the pharmacovigilance of vaccines.
17. Define Daily defined doses (DDD).
18. Write a note on CDSCO.
19. What is the role of communication in pharmacovigilance?

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QP CODE: **Reg. No: .....**

Eighth Semester B. Pharm Degree Examination

QUALITY CONTROL AND STANDARDIZATION OF HERBALS

(2017 Scheme)

MODEL QUESTION PAPER

Time: 3 Hours **Max. Marks: 75**

- Answer all questions
- Draw diagrams wherever necessary

Essays **(2 x 10 = 20)**

1. Discuss the WHO guidelines for quality control of herbal drugs.
2. Describe the regulatory requirements of herbal drugs.

Short notes **(7 x 5 = 35)**

3. What is meant by foreign organic matter? How will you determine foreign organic matter?
4. What are the applications of HPTLC in herbal drug standardization?
5. Describe the WHO guidelines on Good Agricultural Practices.
6. Describe briefly on physical evaluation of crude drugs.
7. Define extractive value. Give the procedure for determining alcohol soluble extractive value.
8. What documents are to be produced for new drug application and export registration?
9. Describe stability testing of herbal medicines.

Answer briefly **(10 x 2 = 20)**

10. What is the EU definition of herbal medicinal product?
11. What are the hazardous chemical contaminants present in herbal formulations?
12. What are the specific objectives of herbal drug regulation?
13. Define the term herbal drug standardization.
14. What is meant by cGMP?
15. Define biomarker giving example.
16. Why standardization is essential for a herbal formulation?
17. What is the objective of ICH guidelines?
18. Why safety evaluation is more complex in herbal medicines?
19. Describe any one basic test for detection of steroids in medicinal plant materials.

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QP CODE: **Reg. No: .....**

Eighth Semester B. Pharm Degree Examination

COMPUTER AIDED DRUG DESIGN

(2017 Scheme)

MODEL QUESTION PAPER

Time: 3 Hours **Max. Marks: 75**

- Answer all questions
- Draw diagrams wherever necessary

Essays **(2 x 10 = 20)**

1. Define QSAR. Explain multiparametric approaches to QSAR with special emphasis on Hansch Analysis and Free Wilson Analysis.
2. What is homology modeling? Explain the various steps involved in homology modeling to generate the 3Dstructure of a protein.

Short notes **(7 x 5 = 35)**

3. Explain the various stages of rational drug discovery process.
4. Define and classify bioisosterism with suitable examples.
5. Discuss the role of ADME database in drug discovery process.
6. Explain various energy minimization methods used in molecular modeling.
7. Describe the history of drug discovery and development.
8. Define molecular docking. Explain the different types of molecular docking.
9. Explain the applications of quantum mechanics in drug design.

Answer briefly **(10 x 2 = 20)**

10. What is meant by ‘structure based drug design’?
11. Give Hammet Equation. Mention its significance on substituent groups.
12. What is pharmacophore mapping?
13. Write various types of interactions which contribute to molecular mechanics force field?
14. Define 3D-QSAR.
15. What is the concept behind *de novo* drug design?
16. List out the bioinformatics tools used in drug design.
17. Define the term molecular modeling.
18. What is a molecular simulation study? Give its purposes and uses.
19. What is global minimum energy conformation?

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QP CODE: **Reg. No: .....**

Eighth Semester B. Pharm Degree Examination
CELL AND MOLECULAR BIOLOGY
(2017 Scheme)
MODEL QUESTION PAPER

Time: 3 Hours **Max. Marks: 75**

- Answer all questions
- Draw diagrams wherever necessary

Essays **(2 x 10 = 20)**

1. Enumerate the different receptors involved in cell signaling. Explain the signaling pathways.
2. Define and explain semiconservative DNA replication process.

Short notes **(7 x 5 = 35)**

3. Explain different types of RNA and their functions.
4. Describe transcription in prokaryotic cell.
5. Explain the different steps involved in eukaryotic cell replication.
6. Explain the different structures of protein.
7. Differentiate between mitosis and meiosis.
8. Compare and contrast DNA and RNA.
9. Explain genomic analysis.

Answer briefly **(10 x 2 = 20)**

10. Mention the significance of protein synthesis.
11. What are the functions of protein kinase?
12. What are essential aminoacids?
13. Define Translation.
14. What are the functions of DNA?
15. Define nucleosomes.
16. What are the properties of cell membrane?
17. Define transcription.
18. Define primosome.
19. Define chaperones.

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QP CODE: **Reg. No: .....**

Eighth Semester B. Pharm Degree Examination

COSMETIC SCIENCE

(2017 Scheme)

MODEL QUESTION PAPER

Time: 3 Hours **Max. Marks: 75**

- Answer all questions
- Draw diagrams wherever necessary

Essays **(2 x 10 = 20)**

1. Classify shampoo. Describe the ingredients used in the formulation of shampoo.
2. Explain the role of herbs in skin and oral care cosmetic products.

Short notes **(7 x 5 = 35)**

3. Describe the structure of hair and hair growth cycle.
4. Write a note on primary and secondary surfactants with examples.
5. What are the different methods for the analysis of shampoo?
6. Classify sunscreen preparations with examples.
7. Explain the principle involved in the measurement of tensile strength of hair and transepidermal water loss.
8. Explain the formulation and preparation of vanishing cream.
9. Describe the major cosmetic problems associated with skin.

Answer briefly **(10 x 2 = 20)**

10. Define and differentiate cosmetics and cosmeceuticals.
11. What is the mechanism of action of antiperspirants?
12. Define SPF Value.
13. Name two rheology modifiers.
14. What is the application of sebumeter?
15. Define and classify emollients.
16. What is the role of hair conditioners? Give examples.
17. List out the ingredients used in the formulation of dentifrices.
18. What are the common ingredients used in moisturizing cream?
19. What is the working principle of corneometer?

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QP CODE: **Reg. No: .....**

Eighth Semester B. Pharm Degree Examination
EXPERIMENTAL PHARMACOLOGY
(2017 Scheme)
MODEL QUESTION PAPER

Time: 3 Hours **Max. Marks: 75**

- Answer all questions
- Draw diagrams wherever necessary

Essays **(2 x 10 = 20)**

1. Explain the maintenance and breeding of experimental animals as per CPCSEA guidelines.
2. Explain the behavioral paradigms and experimental models (any two models) for screening of drugs affecting learning and memory (anti-Alzheimer activity).

Short notes **(7 x 5 = 35)**

3. Differentiate transgenic and mutant animals.
4. Interpretation of results using Student '*t*' test .
5. Explain MTT assay
6. Give any one experimental model for anti-epileptic agent screening.
7. Principle and procedure for *Tail suspension test* for antidepressant activity.
8. Explain pylorus ligation in rats as an animal model.
9. Chemically induced diabetes in animal model

Answer briefly **(10 x 2 = 20)**

10. Define euthanasia
11. What is Cross over design?
12. Define Null hypothesis
13. What are the uses of rabbit as an experimental animal?
14. Mention the uses of Eddy's hot plate.
15. What are Histograms?
16. When do you use one way ANOVA?
17. Give the uses of metabolic cages in screening of drugs
18. Give the procedure for retro orbital bleeding
19. What are the uses of isolated phrenic nerve diaphragm preparation in experimental pharmacology?

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QP CODE: **Reg. No: .....**

Eighth Semester B. Pharm Degree Examination
ADVANCED INSTRUMENTATION TECHNIQUES
(2017 Scheme)
MODEL QUESTION PAPER

Time: 3 Hours **Max. Marks: 75**

- Answer all questions
- Draw diagrams wherever necessary

Essays **(2 x 10 = 20)**

1. Define mass spectrometry. Explain any four ionization techniques.
2. What are thermal methods of analysis? Explain thermogravimetric analysis and differential scanning calorimetry.

Short notes **(7 x 5 = 35)**

3. Define chemical shift and explain the factors affecting it.
4. Explain various steps of radioimmuno assay.
5. Write a note on GC-MS/MS.
6. Explain the calibration of UV spectrophotometer.
7. Explain powder diffraction technique of X-ray spectroscopy.
8. Write a note on quadrupole mass analyzer.
9. Write briefly on applications of thermal methods of analysis.

Answer briefly **(10 x 2 = 20)**

10. Define calibration and validation.
11. Differentiate H-NMR and C-NMR.
12. Applications of radio immune assay.
13. Fragmentation pattern in mass spectrometry.
14. What is X-ray crystallography?
15. Write the principle of liquid-liquid extraction.
16. List out validation parameters as per ICH guidelines.
17. Write the importance of hyphenated techniques with examples.
18. Define coupling constant and spin-spin coupling.
19. Write the different peaks obtained in mass spectrum.

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