BHARATI VIDYAPEETH UNIVERSITY PUNE

INTRODUCTION

Bharati Vidyapeeth, the parent body of Bharati Vidyapeeth University was established on 10th May, 1964, by Dr. Patangrao Kadam with the objective of bringing above intellectual awakening and all sided development of the people of our country through dynamic education.

Bharati Vidyapeeth is now leading educational institution in the country, which has created a history by establishing with a short span of 46 years or so 171 educational institutions imparting education from the pre-primary stage to post-graduate stage. Our colleges and institutions of higher education impart education in different disciplines including Medicine, Ayurved, Dentistry, Homeopathy, Nursing, Arts, Science, Commerce, Engineering, Pharmacy, Management, Social Sciences, Law, Environmental Science, Architecture, Hotel Management and Catering Technology, Physical Education, Computer Science, Library Science, Information Technology, Biotechnology and Agriculture.

The Department of Human Resource Development, Government of India on the recommendation of University Grants Commission accorded the status of University initially to twelve of the University Grants Commission Act of 1956.

Subsequently, the Govt. of India on the recommendations of the UGC and AICTE brought three more institutions of Bharati Vidyapeeth within the ambit of Bharati Vidyapeeth University vide their letter No. F9-15/95-U3 dated 28th July, 2000. The University Grants Commission vide their letter No. F.No.3-2/90 CPP -1 dated 17th August 2002, have agreed to bring two more research institutions within the ambit of Bharati Vidyapeeth University. During the current year, a Medical College of Sangli and a Dental College at Navi Mumbai has also been brought within the ambit of this University by Ministry of Human Resource Development, Govt. of India vide its notification dated 19th August, 2004. In Feb. 2005 once again Govt. of India vide notification No.F9/2004U3 dated 25th Feb. 2005 brought seven institutes under the ambit of Bharati Vidyapeeth University. Now there are in all 32 institutions as constituents of this University.

1. Bharati Vidyapeeth Medical College, Pune.
2. Bharati Vidyapeeth Dental College & Hospital, Pune.
3. Bharati Vidyapeeth College of Ayurved, Pune.
4. Bharati Vidyapeeth Homeopathic Medical College, Pune.
5. Bharati Vidyapeeth College of Nursing, Pune.
6. Bharati Vidyapeeth Yashwantrao Mohite College Of Arts, Science and Commerce, Pune.

7. New Law College, Pune.
8. Social Sciences Centre (M.S.W), Pune.
9. Poona College of Pharmacy, Pune.
10. College of Engineering, Pune.
11. Institute of Management Entrepreneurship Development, Pune.
12. Yashwantrao Chavan Institute of Social Science Studies & Research, Pune.
13. Research and Development Centre in Pharmaceutical Science & Applied Chemistry, Pune
14. College of Physical Education, Pune
15. Bharati Vidyapeeth's Institute of Environment Education & Research, Pune
16. Rajiv Gandhi, Institute of Information Technology and Biotechnology
17. Interactive Research School in Health Affairs (IRSHA)
18. R& D Center in Pharm. Sciences & Applied Chemistry, Pune
19. Bharati Vidyapeeth's Institute of Management and Research, New Delhi
20. Bharati Vidyapeeth's College of Architecture, Pune
21. Bharati Vidyapeeth's Institute of Hotel Management and Catering Technology, Pune
22. Bharati Vidyapeeth's Yashwantrao Mohite Institute of Management, Kolhapur
23. Bharati Vidyapeeth's Institute of Management & Rural Development Administration, Sangli
24. Bharati Vidyapeeth's Abhijit Kadam Institute of Management and Social Sciences, Solapur
25. Bharati Vidyapeeth's Medical College and Hospital, Sangli
26. Bharati Vidyapeeth's Dental College & Hospital, Mumbai
27. Bharati Vidyapeeth's College of Engineering, New Delhi
28. Bharati Vidyapeeth's Institute of Computer Applications & Management, New Delhi
29. Bharati Vidyapeeth's Dental College and Hospital, Sangli
30. Bharati Vidyapeeth's College of Nursing, Sangli
31. Bharati Vidyapeeth's College of Nursing, Navi Mumbai
32. Bharati Vidyapeeth's Medical College and Hospital, Navi Mumbai

BHARATI VIDYAPEETH UNIVERSITY
POONA COLLGE OF PHARMACY, PUNE

Bharati Vidyapeeth's Poona College of Pharmacy was established in 1981. This college has got approval and recognition of All India Council of Technical Education, New Delhi, Pharmacy Council of India, New Delhi and Board of Technical Exam Govt. of Maharashtra. Earlier the college was affiliated to University of Poona and Maharashtra University of Health Sciences. Now it is a constituent unit of Bharati Vidyapeeth Deemed University. The College conducts B.Pharm, M.Pharm (in Pharmaceutics, Pharm. Chemistry, Pharmacology, Pharmacognosy and Quality Assurance Techniques). The college is housed in beautiful building and located in our bewitching teaching complex at Erandwane, Paud Road, Pune. The excellence which this college has achieved during these years in Pharmacy education is mainly due to its experienced and qualified teaching faculty and the infrastructural facilities of high quality provided in the college. The college has excellent library with modern books on pharmacy. The college also provides hostel facilities on a limited scale to our students both boys and girls.

As soon as the college came under the ambit of Bharati Vidyapeeth Deemed University, the syllabus of B.Pharm and M.Pharm Course was revised and upgraded with the help of eminent experts in the pharmacy and the same was approved by University Authorities. While doing so the guidelines given by UGC, AICTE, Pharmacy Council of India, and the societal needs have been taken into consideration.

VISION:

To be recognized as a premier pharmacy institution of academic excellence.

MISSION STATEMENT:

1) To produce competent pharmacists catering to the needs of Industry, Academia, Research and Society.

2) To create a centre of excellence for education and research in the field of pharmaceutical sciences.

3) To contribute our humble share to ensure the well being and to reduce the suffering of mankind.

Programme Educational Objectives (PEO)

1) To provide a comprehensive pharmaceutical education leading to B. Pharm. Degree.

2) To integrate pharmacy knowledge and skills with pharmaceutical research so as to increase inclination for higher studies and research.

3) To develop pharmacists to contribute effectively in the social health care system.

4) To provide hands on training through state of art infrastructure to meet challenges of pharmacy profession.

5) To inculcate leadership and entrepreneurship capabilities in future pharmacists.

Program Outcomes (POs)

On completion of the B. Pharm. program, a student will be able to:

1. Demonstrate knowledge of the basic pharmaceutical sciences and the ability to acquire, manage and use current information for problem solving.
2. Describe the synthesis, formulation, analysis and pharmacological aspects of drugs and pharmaceuticals.
3. Identify the rules and regulations involved in the drug discovery and development, manufacture, distribution and sale of medicines.
4. Observe record, analyze, criticize, organize, improvise and manage documents, data and information related to pharmaceutical products and practices.
5. Develop problem-based learning approach and analytical thinking in his/her academic and professional life.
6. Demonstrate the ability to plan and implement professional activities.
7. Act efficiently as a leader in the diverse areas of the profession.
8. Write, interpret and communicate effectively and scientifically.
9. Apply the knowledge and skills gained through education to gain recognition in professional circle and society.
10. Partnering with other health care communities to provide innovative solutions.
11. Create awareness in society about the effective and safe use of medicines.
12. Demonstrate eco-friendly products and processes to maintain public health.
13. Imbibe ethical practices and moral values in personal and professional endeavors.
14. Tackle future challenges through lifelong learning.

STRUCTURE AND SYLLABUS

Ordinances Including Scheme and Syllabi regulating the Bachelor of Pharmacy (B. Pharm) Degree Course (Semester Pattern) effective from Academic Year (2011-2012).

The following criteria are applicable to all the candidates for continuation in the course

A candidate to be eligible for the degree will be required to pass examination as under:

	First year B. Pharm.	Semester-I & Semester-II
	Second year B. Pharm.	Semester-III & Semester-IV
	Third year B. Pharm.	Semester-V & Semester-VI
	Fourth year B. Pharm.	Semester-VII & Semester-VIII
1.	Course Title	: Bachelor of Pharmacy
2.	Abbreviation	: B. Pharm.
3.	Type of Course	: A four year degree course Consisting of eight Semesters.
4.	Pattern	: Semester.
5.	Number of Years & Semester	: Four Years of eight semesters duration with two semesters per year.
6.	Nomenclature of Semesters	:

- Semester-I & Semester-II First year B. Pharm.
- Semester-III & Semester-IV Second year B. Pharm.
- Semester-V & Semester-VI Third year B. Pharm.
- Semester-VII & Semester-VIII Final year B. Pharm.

7. Award of the Degree:Degree will be awarded for those passing in all the eight semesters as per the rules and regulations given subsequently.

8. Duration of Semester:Each Semester will be of 15 weeks duration for class room

teaching/ lecture and examination for that semester will be held during or after the 16th week from the commencement of the semester.

9. Entry levels into the course, eligibility criteria, admission authority and procedures.

Entry levels into the course will be at the beginning of the Semester- I or at the beginning of the Semester –III (for students who have passed Diploma in Pharmacy Examination).

9.1 Eligibility Criteria for Admission at the entry level at Semester – I into the Course.

In order to secure admission to Semester – I of the Four year Degree Course in Pharmacy, the candidate should fulfill the following eligibility criteria;

Passed 10+2 with English, Physics, Chemistry and either Mathematics/ Biology/Biotechnology/other vocational courses

OR

Must have passed Diploma in Pharmacy or its equivalent examination by Board of Technical Education or equivalent examination with not less than 50% of marks in the aggregate of all subjects taken together at the Final Year Examination.

9.2 **Eligibility Criteria for Direct Admission at the entry level of Semester-III (i.e. the first semester of Second Year B. Pharm.) into the Course.**

The candidate who has passed the final examination leading to the Diploma in Pharmacy conducted by the Board of Technical Education, Maharashtra State or equivalent examination from the institute approved by the Pharmacy Council of India And with a minimum First Class (60% i.e.600 out of 1000 at part-II examination for the Diploma in Pharmacy Course) as per ER-91 (i.e. Post H.S.C. two year Diploma Course) be held eligible for admission to Semester-III.

9.3 **Reservation**: Seats are reserved for backward class and N.R.I. candidates as per the guidelines of Government of Maharashtra.

9.4 Admission authority and procedure at the entry levels into the course.

As per the directives of Government of Maharashtra / Director of Technical Education prevailing at the time of admissions. The following criteria are applicable to all

the candidates for continuation in the course. A candidate, to be eligible for the Degree will be required to pass examinations, as under:-

First year B. Pharm.	Semester-I & Semester-II
Second year B. Pharm.	Semester-III & Semester-IV
Third year B. Pharm.	Semester-V & Semester-VI
Fourth year B. Pharm.	Semester-VII & Semester-VIII

10. Grant of Terms :

No candidate will be admitted to any examination unless he/she keeps term at a College affiliated to the University, and produces testimonials of the same from the Principal of the College.

Satisfactory attendance at the Theory and Practical classes as prescribed i.e. 75 % of the theory as well as practicals for each subject separately and should have successfully appeared for the sessional examination held for each of the subject separately for theory and practicals.

11. Scheme of Examination :

11.1 There will be a Semester examination of the University at the end of each Semester in the academic year.

11.2 80 % of the total mark of each Theory paper and Practical are allotted to them at the Semester Examination. The remaining 20 % of the marks are allotted to each theory paper and practical at the sessional examinations.

11.3 The allotment of marks and duration for each theory and practical examination will be as mentioned in the Tables V to XII.

11.4 There will be One sessional examination during each semester. The marks obtained by the student in each theory paper and practical at the sessional examination will be communicated to the University for inclusion in his final result of the examination.

11.5 The sessional examination marks in the practicals shall be allotted on the following bases.

i) Actual performance in the sessional examination - 10 Marks

ii) Day to day assessment in the practical class work - 10 Marks

12. A.T.K.T rules:

a) A candidate failing in Semester – I, III, V & VII shall be promoted to next

higher semester i.e. II, IV, VI and VIII irrespective of the no. of subject heads in which he/she is failing.

b) A candidate failing in not more than three theory and two practical heads of semester I & II together shall be promoted to semester- III however if he fails in more than three theory and two practical heads of semester – I & II taken together he will not be promoted to semester-III

c) A candidate failing in not more than three theory and two practical heads of semester III & IV together shall be promoted to semester- V provided he has cleared all the subjects of semester-I & II. However if he fails in more than three theory and two practical heads of semester – III & IV taken together he will not be promoted to semester-V until the no. of failure subject heads is three theory and two practical heads of semester- III & IV taken together he will not be promoted to semester –V.

d) A candidate failing in not more than three theory and two practical heads of semester V & VI together shall be promoted to semester- VII provided he has cleared all the subjects of semester-I to IV. However, if he fails in more than three theory and two practical heads of semester – V & VI taken together he will not be promoted to semester-VII.

13. Examinations:

Examination conducting authority: Bharati Vidyapeeth Deemed University, Pune

Main and second examinations and time:

Semester	Semester Examination	Semester Examination
I, III, V & VII	November / December	April / May
II, IV, VI & VIII	April / May	November / December

Structure and scheme of examination, marks etc.

First Year B. Pharm. (Semester I)

Sr. No.	Theory Papers	HR / WK Teaching load	Duration of Examination	Paper	Sessional	Total	Minimum Passing
1.	Pharmaceutical Chemistry –I (Inorganic)	3	3	80	20	100	45
2.	Pharmaceutical Chemistry - II (Organic)	3	3	80	20	100	45
3.	Modern Dispensing Pharmacy	3	3	80	20	100	45
4.	Pharmaceutical Engineering – I	3	3	80	20	100	45
5.	Human Anatomy and Physiology-I	3	3	80	20	100	45
6.	Pharmaceutical Statistics	3	3	80	20	100	45
Total (A)		**18**		**480**	**120**	**600**	**--**
Practical							
1.	Pharmaceutical Chemistry -I (Inorganic)	3	4	80	20	100	45
2.	Pharmaceutical Chemistry -II (Organic)	3	4	80	20	100	45
3.	Modern Dispensing Pharmacy	3	4	80	20	100	45
4.	Human Anatomy & Physiology-I	3	4	80	20	100	45
5.	Communication Skill	3	4	80	20	100	45
Total (B)		**15**		**400**	**100**	**500**	**--**
Total (A+B)		**33**		**880**	**220**	**1100**	**--**

First Year B. Pharm. (Semester II)

Sr. No.	Theory Papers	HR / WK Teaching load	Duration of Examination	Paper	Sessional	Total	Minimum Passing
1.	Pharmaceutical Chemistry –III (Inorganic)	3	3	80	20	100	45
2.	Pharmaceutical Chemistry -IV (Organic)	3	3	80	20	100	45
3.	Pharmaceutical Biochemistry - I	3	3	80	20	100	45
4.	Pharmaceutical Engineering -II	3	3	80	20	100	45
5.	Community Pharmacy & Hospital Pharmacy	3	3	80	20	100	45
6.	Human Anatomy & Physiology - II	3	3	80	20	100	45
Total (A)		**18**		**480**	**120**	**600**	--
Practical							
1.	Pharmaceutical Chemistry -III (Inorganic)	3	4	80	20	100	45
2.	Pharmaceutical Chemistry -IV (Organic)	3	4	80	20	100	45
3.	Pharmaceutical Biochemistry - I	3	4	80	20	100	45
4.	Human Anatomy & Physiology - II	3	4	80	20	100	45
5.	Computer Applications	3	4	80	20	100	45
Total (B)		**15**		**400**	**100**	**500**	--
Total (A+B)		**33**		**880**	**220**	**1100**	

Second Year B. Pharm. (Semester III)

Sr. No.	Theory Papers	HR / WK Teaching load	Duration of Examination	Paper	Sessional	Total	Minimum Passing
1.	Pharmaceutical Chemistry-V (Organic)	3	3	80	20	100	45
2.	Pharmaceutical Biochemistry – II	3	3	80	20	100	45
3.	Pharmaceutical Analysis - I	3	3	80	20	100	45
4.	Physical Pharmacy - I	3	3	80	20	100	45
5.	Pharmaceutical Microbiology - I	3	3	80	20	100	45
6.	Pathophysiology	3	3	80	20	100	45
Total (A)		**18**		**480**	**120**	**600**	
Practical							
1.	Pharmaceutical Chemistry - V(Organic)	3	4	80	20	100	45
2.	Pharmaceutical Biochemistry-II	3	4	80	20	100	45
3.	Pharmaceutical Analysis - I	3	4	80	20	100	45
4.	Physical Pharmacy – I	3	4	80	20	100	45
5.	Pharmaceutical Microbiology - I	3	4	80	20	100	45
Total (B)		**15**		**400**	**100**	**500**	
Total (A+B)		**33**		**880**	**220**	**1100**	

Second Year B. Pharm. (Semester IV)

Sr. No.	Theory Papers	HR / WK Teaching load	Duration of Examination	Paper	Sessional	Total	Minimum Passing
1.	Pharmaceutical Chemistry - VI (Organic)	3	3	80	20	100	45
2.	Pharmaceutical Analysis - II	3	3	80	20	100	45
3.	Physical Pharmacy - II	3	3	80	20	100	45
4.	Dosage Form Design –I	3	3	80	20	100	45
5.	Pharmaceutical Microbiology - II (Including Immunology)	3	3	80	20	100	45
6.	Pharmacology – I	3	3	80	20	100	45
Total (A)		**18**		**480**	**120**	**600**	
Practical							
1.	Pharmaceutical Chemistry -V (Organic)	3	4	80	20	100	45
2.	Pharmaceutical Analysis - II	3	4	80	20	100	45
3.	Physical Pharmacy - II	3	4	80	20	100	45
4.	Dosage Form Design –I	3	4	80	20	100	45
5.	Pharmaceutical Microbiology - II (including Immunology)	3	4	80	20	100	45
6.	Pharmacology – I	3	4	80	20	100	45
Total (B)		**18**		**480**	**120**	**600**	
Total (A+B)		**36**		**960**	**240**	**1200**	

Third Year B. Pharm. (Semester V)

Sr. No.	Theory Papers	HR / WK Teaching load	Duration of Examination	Paper	Sessional	Total	Minimum Passing
1.	Medicinal Chemistry – I	3	3	80	20	100	45
2.	Pharmaceutical Analysis – III	3	3	80	20	100	45
3.	Dosage Form Design – II	3	3	80	20	100	45
4.	Cosmeticology	3	3	80	20	100	45
5.	Pharmacology – II	3	3	80	20	100	45
6.	Pharmacognosy – I	3	3	80	20	100	45
Total (A)		**18**		**480**	**120**	**600**	
Practical							
1.	Medicinal Chemistry – I	3	4	80	20	100	45
2.	Pharmaceutical Analysis. – III	3	4	80	20	100	45
3.	Dosage Form Design – II	3	4	80	20	100	45
4.	Cosmeticology	3	4	80	20	100	45
5.	Pharmacology – II	3	4	80	20	100	45
6.	Pharmagonosy – I	3	4	80	20	100	45
Total (B)		**18**		**480**	**120**	**600**	
Total (A+B)		**36**		**960**	**240**	**1200**	

Third Year B. Pharm. (Semester VI)

Sr. No.	Theory Papers	HR / WK Teaching load	Duration of Examination	Paper	Sessional	Total	Minimum Passing
1.	Medicinal Chemistry – II	3	3	80	20	100	45
2.	Pharmaceutical Analysis – IV	3	3	80	20	100	45
3.	Dosage Form Design – III	3	3	80	20	100	45
4.	Pharmacology – III	3	3	80	20	100	45
5.	Pharmaceutical Biotechnology (including Molecular Biology)	3	3	80	20	100	45
6.	Pharmacognosy – II	3	3	80	20	100	45
Total (A)		**18**		**480**	**120**	**600**	
Practical							
1.	Medicinal Chemistry – II	3	4	80	20	100	45
2.	Pharmaceutical Analysis – IV	3	4	80	20	100	45
3.	Dosage Form Design – III	3	4	80	20	100	45
4.	Pharmaceutical Biotechnology	3	4	80	20	100	45
5.	Pharmacognosy – II	3	4	80	20	100	45
Total (B)		**15**		**400**	**100**	**500**	
Total (A+B)		**33**		**880**	**220**	**1100**	

Final Year B. Pharm. (Semester VII)

Sr. No.	Theory Papers	HR / WK Teaching load	Duration of Examination	Paper	Sessional	Total	Minimum Passing
1.	Medicinal Chemistry –III	3	3	80	20	100	45
2.	Pharmaceutical Analysis – V	3	3	80	20	100	45
3.	Dosage Form Design – IV	3	3	80	20	100	45
4.	Biopharmaceutics and Pharmacokinetics	3	3	80	20	100	45
5.	Clinical Pharmacy	3	3	80	20	100	45
6.	Pharmacognosy – III	3	3	80	20	100	45
Total (A)		**18**		**480**	**120**	**600**	
Practical							
1.	Medicinal Chemistry – III	3	4	80	20	100	45
2.	Pharmaceutical Analysis – V	3	4	80	20	100	45
3.	Dosage Form Design – IV	3	4	80	20	100	45
4.	Pharmacognosy – III	3	4	80	20	100	45
Total (B)		**12**		**320**	**80**	**400**	
Total (A+B)		**30**		**800**	**200**	**1000**	

Final Year B. Pharm. (Semester VIII)

Sr. No.	Theory Papers	HR / WK Teaching load	Duration of Examination	Paper	Sessional	Total	Minimum Passing
1.	Medicinal Chemistry – IV	3	3	80	20	100	45
2.	Pharmaceutical Analysis – VI	3	3	80	20	100	45
3.	Pharmacology - IV	3	3	80	20	100	45
4.	Pharmacognosy - IV	3	3	80	20	100	45
5.	Drug Regulatory Affairs	3	3	80	20	100	45
6.	Pharmaceutical Management	3	3	80	20	100	45
Total (A)		**18**		**480**	**120**	**600**	
Practical							
1.	Medicinal Chemistry – IV	3	4	80	20	100	45
2.	Pharmaceutical Analysis – VI	3	4	80	20	100	45
3.	Pharmacology - IV	3	4	80	20	100	45
4.	Pharmacognosy - IV	3	4	80	20	100	45
5.	Project (Non-Experimental)	3	4	80	20	100	45
Total (B)		**15**		**400**	**100**	**500**	
Total (A+B)		**33**		**880**	**220**	**1100**	

13.1 Criteria for admitting the candidate for examinations irrespective of regular or suplementary examinations:

Candidate must have been admitted to the respective Semester as per the criteria for continuation into the respective semesters given in B.Pharm. and has kept the term for the Semester for which he is examined. The candidate must submit prescribed application form along with fees. Candidates must appear for the examination in the place and time as decided by the admitting Institute /the University as the case may be. Candidate who has failed in a particular Semester or has ATKT will be allowed to appear for the same examination on a new application being forwarded and a fresh fee paid.

13.2 Clarifications:

Candidate who has ATKT will appear for examinations in only those subject heads in which the candidate has failed.

The candidate who has passed in all the subjects but failed due to not getting overall 50% marks will be allowed to appear in any number of subject heads (Theory and Practical both for that subject head) the candidate desires except the subject head of Project report.

For all the remaining cases, the candidate has to appear for examination in all those subject heads in which the candidate has failed.

13.3 Time Schedule:

The sessional examination shall be normally conducted after completion of at least two thirds of the Semester instruction weeks.

Any candidates remaining absent for the sessional examination for any reason what so ever will be treated as not appeared for the sessional examination. However a Committee constituted by the Principal may allow the candidate for appearing in the re-sessional subject to the conditions as specified by the committee, otherwise no separate examination will be conducted.

The institute conducting the course must submit the Sessional examination marks of the respective Semester to the Controller of Examination before the commencement of theory or practical examination whichever is later.

14. Marks, Criteria for passing and other conditions.

14.1. Passing criteria for each subject head:

Maximum marks for each subject head (theory and practicals separately) and the minimum marks for passing in each of the subject head (theory and practicals separately) has been given in the Examination scheme.

Candidate will be considered as passed in the subject heads when the candidate fulfils the following two criteria considered together.

1. Has got minimum 45% marks prescribed for the Semester examinations of each subject head (theory and practical's separately) and
2. Has got minimum 50% marks in aggregate out of the total marks prescribed for that semester.
3. Candidate will be considered as failed in the subject head (theory and practical separately) if the candidate does not fulfill criteria 1 or 2 or both given above.

No separate passing is required for Sessional examination and if the candidate remains absent for the test the candidate will be treated as not appeared for the test and treated at par with other candidates who have appeared for all the tests.

If a candidate's application form for reappearing in the examination in a subject head is accepted and the candidate appears in the examination (Sessional examination and Semester examination) fresh marks will be considered and the candidate forfeits the marks obtained in the previous examination in that subject head and those marks will not be reconsidered for any purpose again under any circumstances what-soever. If a student fails in any head of passing (theory and practicals separately), he will have to appear only in that head of subjects in which he has failed (theory and practicals separately).

14.2. Passing of the Semester:

Candidate will be considered as passed the semester only when the candidate passes in all the subject heads and obtains overall a minimum of 50% of the aggregate marks prescribed for the semester.

15. Award of degree and Class:

Degree will be awarded to the candidates who have passed all the eight Semesters. Class will be awarded to those candidates who have passed the Semester-VII and VIII in one and the same sitting.

1.	Those obtaining 50% and above but below 55 % of the total marks	Second class
2.	Those obtaining 55% and above but less than 60% of the total marks in higher Second class.	Higher second class
3.	Those obtaining 60% and above but below 70% of the total marks.	First class
4.	Those obtaining 70% of the total marks and above	First class with distinction

16. Withholding of results:

A candidate's result will be withheld under the following situations and of the respective Semester. Result of Semester-IV will be held if the candidate has not passed Semester – I and Semester-II.

Result of semester VI will be withheld if the candidate has not passed semester-III and semester –IV. Result of semester VIII will be withheld if the candidate has not passed semester-V and semester –VI.

17. Practical Training:

Every candidate shall be required to work for at least four weeks in a Pharmaceutical Industry or Govt. Hospital or research and development organization or public testing laboratory after the Semester –V of the course study, and shall submit satisfactory report of such work to the head of the institute.

18. Improvement of Class:

A student will be allowed to improve his/her class at B.Pharm degree by appearing for any subject (both theory and practicals for that subject) of his/her choice at VII and VIII Semester of B.Pharm.

19. Validity of Term:

A term once granted shall be valid for four attempts.

20. Environmental Sciences:

As per the decision of the Supreme Court and directives of the U.G.C., every student has to pass in the subject of Environmental Sciences during the course of the study of B.Pharm.

Course Objectives and Course Outcomes

Course	Subject	Course Objectives	Course Outcomes
First Year B. Pharm. (Sem I)	1. Pharmaceutical Chemistry –I (Inorganic) **Theory**	1. To study the principles of inorganic chemistry with reference to inorganic pharmaceuticals. 2. To elucidate importance of impurities in pharmaceuticals and acquire skills to detect and control them by official standards. 3. To demonstrate significance of contents of monographs of important inorganic pharmaceuticals with reference to treatment of diseases.	1. Understand the relevance and significance of inorganic chemistry with reference to pharmaceutical sciences. 2. Develop competency for official standard methods to detect and control impurities. 3. Acquire knowledge of complete profiles of important inorganic pharmaceuticals.
	1. Pharmace-utical Chemistry –I (Inorganic) **Practical**	1. To study monographs of important inorganic substances. 2. To develop skills for performing official tests for purity and assays. 3. To demonstrate principles of qualitative analysis of inorganic binary mixtures.	1. Conceptualize significance of official standards for drug substances and pharmaceutical aids. 2. Apply the skills of qualitative analysis to unknown samples. 3. Develop mathematical approach to calculate quantitative parameters for synthesized compounds. 4. Identify impurities from pharmaceutical substances. 5. Compute, quantitate and record purity of inorganic pharmaceuticals.

Course	Subject	Course Objectives	Course Outcomes
First Year B. Pharm. (Sem I)	2. Pharmaceutical Chemistry – II (Organic) **Theory**	1. To imbibe the foundation of organic chemistry. 2. To demonstrate logical approach to reaction mechanisms. 3. To ascertain knowledge of official nomenclature, properties, methods of preparation, reactions of various functional groups and their applications. 4. To inculcate basic concepts of stereochemistry.	1. Understand concepts of fundamentals of organic reactions and IUPAC nomenclature. 2. Elucidate reaction mechanisms through problem based approach. 3. Conceptualize the basic concepts of stereochemistry.
	2. Pharmace-utical Chemistry – II (Organic) **Practical**	1. To create awareness about safety measures and Good Laboratory Practices. 2. To develop skills for identification of unknown organic compounds and its application in synthetic chemistry. 3. To train for basic laboratory techniques.	1. Imbibe the safety measures and inculcate Good Laboratory Practices. 2. Apply analytical tools for identification of organic compounds. 3. Master important laboratory techniques and documentation of results.

Course	Subject	Course Objectives	Course Outcomes
First Year B. Pharm. (Sem I)	3. Modern Dispensing Pharmacy **Theory**	1. Knowledge and skill of prescription handling. 2. Compounding and dispensing aspects, patient counseling 3. Maintenance of the various records (CDR, PMR) regarding the patients and prescriptions.	1. Analyze prescription critically in view of rationale drug therapy. 2. Understand compounding and dispensing aspects of various dosage forms including storage conditions, labeling directions, etc. 3. Practice patient counseling. 4. Prepare and maintain records related to patient care and inventory. 5. Apply pharmaceutical calculations for dosage forms and posology.
	3. Modern Dispensing Pharmacy **Practical**	1. Knowledge and skill of the handling of the prescription. 2. Importance of patient counseling with the help of pictograms, patient information leaflets. 3. Learning of maintenance of patient medication records.	1. Read and analyze prescriptions. 2. Understand compounding methods of different dosage forms and ideal dispensing procedure. 3. Practice patient counseling regarding the route of administration, side effects and storage of the dosage forms. pounds. 4. Understand the importance of record keeping, patient counseling while dispensing the medications.

Course	Subject	Course Objectives	Course Outcomes
First Year B. Pharm. (Sem I)	4. Pharmaceutical Engineering – I **Theory**	1. To provide general understanding of pharmaceutical unit operations 2. To provide knowledge of different pharmaceutical processes such as mixing, size reduction, granulation, extraction, filtration, etc. 3. To provide information on selection and functioning of different equipments used in pharmaceutical products preparation	1. The student will be able to understand steps involved in manufacturing of solid, liquid drug delivery systems 2. The students will be able to select appropriate equipments for manufacturing of pharmaceutical products 3. The student will learn the process engineering technologies involved in pharmaceutical products

Course	Subject	Course Objectives	Course Outcomes
	5. Human Anatomy and Physiology-I **Theory**	1. To introduce scientific terminologies with respect to human body. 2. To convey structural organization (anatomy) and functions (physiology) of human body. 3. To exemplify the mechanisms of synchronous working of organs. 4. To impart knowledge of the physiological basis of disorders in human body.	1. Understand the terminologies related to human anatomy and physiology. 2. Identify and describe the structure and functions of various systems of the human body. 3. Realize synchronous working of various organs. 4. Appreciate the concept of imbalance of homeostasis with respect to diseases
	5. Human Anatomy and Physiology-I **Practical**	1. To develop skills for determining hematological parameters. 2. To understand the structure and identification of human skeletal system. 3. To acquaint with the internal structure of various organs. 4. To learn common techniques of assessing cardiovascular functions.	1. Examine blood samples for hematological parameters and correlate with clinical conditions. 2. Identify bones and their structure. 3. Acquaint with the histology of various tissue sections. 4. Gain expertise in measurement of blood pressure.

Course	Subject	Course Objectives	Course Outcomes
First Year B. Pharm. (Sem I)	6. Pharmaceutical Statistics **Theory**	1. To analyze data statistically using various experimental design 2. To present and interpret the results graphically 3. To learn and apply statistical softwares	1. Analyze statistically the data obtained from a given experimental design. 2. Present graphically and interpret the results obtained. 3. Use modern statistical computer softwares
	7. Communication Skill **Practical**	1. To be able to write and communicate effectively 2. To be able to document data and information 3. To learn oral communication skills	1. Write, interpret and communicate effectively and scientifically. 2. Manage documents, data and information. 3. Face interview, speak in public settings and act efficiently as a leader.

Course	Subject	Course Objectives	Course Outcomes
First Year B. Pharm. (Sem II)	1. Pharmaceutical Chemistry –III (Inorganic) **Theory**	1. To study the principles of inorganic chemistry with reference to inorganic pharmaceuticals. 2. To elucidate importance of impurities in pharmaceuticals and acquire skills to detect and control them by official standards. 3. To demonstrate significance of contents of monographs of important inorganic pharmaceuticals with reference to treatment of diseases.	1. Understand the relevance and significance of inorganic chemistry with reference to pharmaceutical sciences. 2. Develop competency for official standard methods to detect and control impurities. 3. Acquire knowledge of complete profiles of important inorganic pharmaceuticals.
	1. Pharmaceutical Chemistry – III (Inorganic) **Practical**	1. To study monographs of important inorganic substances. 2. To develop skills for performing official tests for purity and assays. 3. To demonstrate principles of qualitative analysis of inorganic binary mixtures.	1. Conceptualize significance of official standards for drug substances and pharmaceutical aids. 2. Apply the skills of qualitative analysis to unknown samples. 3. Develop mathematical approach to calculate quantitative parameters for synthesized compounds. 4. Identify impurities from pharmaceutical substances. 5. Compute, quantitate and record purity of inorganic pharmaceuticals.

Course	Subject	Course Objectives	Course Outcomes
First Year B. Pharm. (Sem II)	2. Pharmaceutical Chemistry -IV (Organic) **Theory**	1. To imbibe the foundation of organic chemistry. 2. To demonstrate logical approach to reaction mechanisms. 3. To ascertain knowledge of official nomenclature, properties, methods of preparation, reactions of various functional groups and their applications. 4. To inculcate basic concepts of stereochemistry.	1. Understand concepts of fundamentals of organic reactions and IUPAC nomenclature. 2. Elucidate reaction mechanisms through problem based approach. 3. Conceptualize the basic concepts of stereochemistry.
	2. Pharmaceutical Chemistry -IV (Organic) **Practical**	1. To create awareness about safety measures and Good Laboratory Practices. 2. To develop skills for identification of unknown organic compounds and its application in synthetic chemistry. 3. To train for basic laboratory techniques.	1. Imbibe the safety measures and inculcate Good Laboratory Practices. 2. Apply analytical tools for identification of organic compounds. 3. Master important laboratory techniques and document the results..

Course	Subject	Course Objectives	Course Outcomes
First Year B. Pharm. (Sem II)	3. Pharmaceutical Biochemistry – I **Theory**	1. To highlight and correlate chemistry of life process with different biomolecules and their simplicity to perform complex functions of living systems. 2. To demonstrate biochemical basis of interaction of drugs with biocatalysts & receptors. 3. To create knowledge base for molecular genetics, nutrition & role of diet in treatment of diseases. 4. To study principles of bioassays for application to toxicity studies & diagnosis of genetic disorders. 5 To reinforce the topics in anatomy and physiology in understanding the subject.	1. Exemplify structure- function relationship of biomolecules from living system. 2. Conceptualize importance of metabolism and regulation of pathways with reference to homeostasis of key metabolites. 3. Understand flow of genetic information, manipulation of gene to treat diseases
	3. Pharmaceutical Biochemistry – I **Practical**	1. To study of properties of important biomolecules such as proteins, amino acids, vitamins. 2. To study various biochemical techniques such as precipitation, centrifugation, incubation, enzyme & colorimetric assays. 3. Estimations of marker or indicator metabolites form blood, urine to diagnose diseases. 4. To study methods of separations of biomolecules like electrophoresis & chromatography.	1. Develop skill for handling of laboratory instruments and biological samples. 2. Estimate biomolecules for diagnosis of diseases. 3. Inculcate the separation technique for biomolecules and their characterization. 4. Compute the data and record the observations.

Course	Subject	Course Objectives	Course Outcomes
First Year B. Pharm. (Sem II)	4. Pharmaceutical Engineering –II **Theory**	1. To provide general understanding of pharmaceutical unit operations 2. To provide knowledge of different pharmaceutical processes such as drying, distillation, evaporation, crystallization, etc. 3. To provide information on selection and functioning of different equipments used in pharmaceutical products preparation	1. The student will be able to understand steps involved in manufacturing of solid, liquid drug delivery systems 2. The students will be able to select appropriate equipments for manufacturing of pharmaceutical products 3. The student will learn the process engineering technologies involved in pharmaceutical products.

Course	Subject	Course Objectives	Course Outcomes
First Year B. Pharm. (Sem II)	5. Community Pharmacy & Hospital Pharmacy **Theory**	1. The knowledge and skill regarding the responsibilities of hospital pharmacist. 2. Responding to minor ailments by understanding the symptoms. 3. Patient counseling for the safe use of medicines and health screening services	1. Understand social and professional responsibility in the hospital and community pharmacy. 2. Integrate the concepts of dispensing pharmacy for the patient counseling and rational drug use. 3. Apply techniques related to health screening services. 4. Understand concepts of special services related to chemotherapy, intravenous admixtures and radiopharmaceuticals.
	5. Computer Applications **Practical**	1. To make student well verse with the basic components of computer. 2. To perform fundamental operating system functions 3. To use the computer as a business and personal tool through the use of applications software 4. To make students learn how to use the Internet and electronic communication system for obtaining the required data. 5. To help student understand application of computer in data manipulation, presentation, analysis and retrieval.	1. Gain expertise in use of computer as a business and personal tool through the use of applications software. 2. Gain expertise in collection and manipulation of required data through use of internet and electronic communication system. 3. Present the available data in graphical or pictorial manner. 4. Analyze the data by use of software.

Course	Subject	Course Objectives	Course Outcomes
First Year B. Pharm. (Sem II)	6. Human Anatomy & Physiology – II **Theory**	1. To introduce scientific terminologies with respect to human body. 2. To convey structural organization (anatomy) and functions (physiology) of human body. 3. To exemplify the mechanisms of synchronous working of organs. 4. To impart knowledge of the physiological basis of disorders in human body.	1. Understand the terminologies related to human anatomy and physiology. 2. Identify and describe the structure and functions of various systems of the human body. 3. Realize synchronous working of various organs. 4. Appreciate the concept of imbalance of homeostasis with respect to diseases.
	6. Human Anatomy & Physiology – II **Practical**	1. To develop skills for determining hematological parameters. 2. To acquaint with the internal structure of various organs. 3. To learn common techniques of assessing respiratory functions.	1. Examine blood samples for hematological parameters and correlate with clinical conditions. 2. Acquaint with the histology of various tissue sections. 3. Gain expertise in measurement of respiratory functions.

Course	Subject	Course Objectives	Course Outcomes
Second Year B. Pharm. (Semester III)	1. Pharmace-utical Chemistry-V (Organic) **Theory**	1. To imbibe the foundation of organic chemistry. 2. To demonstrate logical approach to reaction mechanisms. 3. To ascertain basic understanding of heterocyclic compounds and biomolecules. 4. To integrate principles of stereochemistry with chiral drugs to create awareness of stereochemical purity.	1. Understand the fundamentals of various organic reactions. 2. Understand the mechanism of different types of reactions. 3. Understand IUPAC nomenclature, physicochemical properties, methods of preparation, reactions of heterocyclic compounds, and biomolecules such as carbohydrates and proteins. 4. Understand the significance of stereochemistry in biological action of drugs and knowledge of chiral drugs.
	1. Pharmaceutical Chemistry-V (Organic) **Practical**	1. To train for basic synthetic techniques. 2. To develop analytical tools for fats, oils and functional groups.	1. Correlate characteristic properties of organic compounds with synthetic tools to synthesize organic compounds. 2. Master important synthetic techniques and safety measures in handling of chemicals. 3. Apply analytical tools to check purity of organic compounds and record the same.

Course	Subject	Course Objectives	Course Outcomes
Second Year B. Pharm. (Semester III)	2. Pharmaceutical Biochemistry – II **Theory**	1. To highlight and correlate chemistry of life process with different biomolecules and their simplicity to perform complex functions of living systems. 2. To demonstrate biochemical basis of interaction of drugs with biocatalysts & receptors. 3. To create knowledge base for molecular genetics, nutrition & role of diet in treatment of diseases. 4. To study principles of bioassays for application to toxicity studies & diagnosis of genetic disorders. 5 To reinforce the topics in anatomy and physiology in understanding the subject.	1. Exemplify structure- function relationship of biomolecules from living system. 2. Conceptualize importance of metabolism and regulation of pathways with reference to homeostasis of key metabolites. 3. Understand flow of genetic information, manipulation of gene to treat diseases
	2. Pharmaceutical Biochemistry – II **Practical**	1. To study of properties of important biomolecules such as proteins, aminoacids, vitamins. 2. To study various biochemical techniques such as precipitation, centrifugation, incubation, enzyme & colorimetric assays. 3. Estimations of marker or indicator metabolites form blood, urine to diagnose diseases. 4. To study methods of separations of biomolecules like electrophoresis & chromatography.	1. Develop skill for handling of laboratory instruments and biological samples. 2. Estimate biomolecules for diagnosis of diseases. 3. Inculcate the separation technique for biomolecules and their characterization. 4. Compute the data and record the observations.

Course	Subject	Course Objectives	Course Outcomes
Second Year B. Pharm. (Semester III)	3. Pharmace-utical Analysis - I **Theory**	1. To provide the foundation in analysis of a drug and to train graduates in the basic analytical techniques. 2. To elucidate importance of titrimetric methods for application in drug analysis. 3. To integrate physicochemical & electrochemical properties with analytical methods for drugs. 4. To reinforce the topics studied in inorganic & organic chemistry	1. Apply mathematical tools for data treatment and data handling. 2. Correlate principles of titrimetric and electro-analytical techniques to quantitative and qualitative determination of pure drug and drug content in dosage forms.
	3. Pharmaceutical Analysis - I **Practical**	1. To create awareness and significance of calibration in Analytical Chemistry & safety measures. 2. To develop practical hand in titrimetric analysis. 3. To nurture fundamental understanding of analytical instruments and train for their handling with problem solving approach. 4. To understand the importance of terms SOP/ Procedure and Protocol.	1. Correlate physicochemical and electrochemical properties with analytical methods for drugs. 2. Master important analytical techniques and inculcate precautionary measures in handling of chemicals and instruments. 3. Compute, analyze and record the purity of drug substances.

Course	Subject	Course Objectives	Course Outcomes
Second Year B. Pharm. (Semester III)	4. Physical Pharmacy – I **Theory**	1. To brush-up students with the fundamental aspects of physics and chemistry. 2. To help students to understand application of these fundamental aspects in pharmaceutical field. 3. To make students well verse with the fundamental processes such as solubilization, chemical stabilization and interactions etc. which play a key role in formulation of finished product. 4. To develop independent thinking ability in students through problem solving approach.	1. Correlate utility of physicochemical properties in design of pharmaceutical product. 2. Gain insight of techniques for determination of physicochemical properties. 3. Understand factors governing stability of finished pharmaceutical product. 4. Analyze and tackle problems encountered in formulation development.
	4. Physical Pharmacy – I **Practical**	1. To help students understand the fundamental concepts of physical pharmacy and their implications towards design of pharmaceutical formulations. 2. To give students hands on experience on determination of various physical properties 3. To develop independent thinking ability of students through problem solving approach.	1. Understand utility of physicochemical properties in design of stable pharmaceutical formulation. 2. Gain expertise in determination of physicochemical properties as part of preformulation

Course	Subject	Course Objectives	Course Outcomes
Second Year B. Pharm. (Semester III)	5. Pharmace-utical Microbiology – I **Theory**	1. To make students know about scope and applications of pharmaceutical microbiology 2. To introduce them to various types of micro-organisms, their isolation, characteristics and identification. 3. To make them familiarize with microscopy, sterilization, disinfection and such other processes along with practical training. 4. To enhance their knowledge about biological hazards, waste treatment and preventive measures.	1. Integrate basic knowledge of microbiology with pharmaceutical sciences. 2. Understand microbiological techniques. 3. Understand aspects of immunology and immunological products.
	5. Pharmaceutical Microbiology – I **Practical**	1. To make students know about good laboratory practices in pharmaceutical microbiology 2. To enhance practical skills of students for isolation and characterization of various micro-organisms 3. To learn use of microscope, hot air oven and autoclave	1. Apply the techniques in identification, isolation, and cultivation of microorganisms. 2. Perform microbiological assessment of antimicrobials, disinfectants and preservatives and sterility testing of pharmaceuticals. 3. Develop practical skills in industrial microbiology

Course	Subject	Course Objectives	Course Outcomes
Second Year B. Pharm. (Semester III)	6. Pathophysiology **Theory**	1. To study etiopathogenesis of diseases of the vital systems. 2. To impart knowledge of the specific pathological conditions associated with disorders and correlate pathophysiology with clinical manifestations. 3. To understand the convergence of pathology with physiology.	1. Explain functional changes associated with disease or injury. 2. Explain the physiological processes, mechanisms of disease and correlate with their clinical course. 3. Identify the targets for the treatment of disease.

Course	Subject	Course Objectives	Course Outcomes
Second Year B. Pharm. (Semester IV)	1. Pharmace-utical Chemistry - VI (Organic) **Theory**	1. To imbibe the foundation of organic chemistry. 2. To demonstrate logical approach to reaction mechanisms. 3. To ascertain basic understanding of heterocyclic compounds and biomolecules. 4. To integrate principles of stereochemistry with chiral drugs to create awareness of stereochemical purity.	1. Understand the fundamentals of various organic reactions. 2. Understand the mechanism of different types of reactions. 3. Understand IUPAC nomenclature, physicochemical properties, methods of preparation, reactions of heterocyclic compounds, and biomolecules such as carbohydrates and proteins. 4. Understand the significance of stereochemistry in biological action of drugs and knowledge of chiral drugs.
	1. Pharmaceutical Chemistry - VI (Organic) **Practical**	1. To train for basic synthetic techniques. 2. To develop analytical tools for fats, oils and functional groups.	1. Correlate characteristic properties of organic compounds with synthetic tools to synthesize organic compounds. 2. Master important synthetic techniques and safety measures in handling of chemicals. 3. Apply analytical tools to check purity of organic compounds and record the same.

Course	Subject	Course Objectives	Course Outcomes
Second Year B. Pharm. (Semester IV)	2. Pharmace-uti-cal Analysis – II **Theory**	1. To provide the foundation in analysis of a drug and to train graduates in the basic analytical techniques. 2. To elucidate importance of titrimetric methods for application in drug analysis. 3. To integrate physicochemical & electrochemical properties with analytical methods for drugs. 4. To reinforce the topics studied in inorganic & organic chemistry	1. Apply mathematical tools for data treatment and data handling. 2. Correlate principles of titrimetric and electro-analytical techniques to quantitative and qualitative determination of pure drug and drug content in dosage forms.
	2. Pharmace-uti-cal Analysis – II **Practical**	1. To create awareness and significance of calibration in Analytical Chemistry & safety measures. 2. To develop practical hand in titrimetric analysis. 3. To nurture fundamental understanding of analytical instruments and train for their handling with problem solving approach. 4. To understand the importance of terms SOP/ Procedure and Protocol.	1. Correlate physicochemical and electrochemical properties with analytical methods for drugs. 2. Master important analytical techniques and inculcate precautionary measures in handling of chemicals and instruments. 3. Compute and analyze the purity of drug substances.

Course	Subject	Course Objectives	Course Outcomes
Second Year B. Pharm. (Semester IV)	3. Physical Pharmacy – II **Theory**	1. To update students with recent developments in pharmaceutical formulations. 2. To give an insight to students about latest tools used for determination of physicochemical properties. 3. To make students well verse with the fundamental processes and its correlation with the formulation of stable finished product. 4. To develop independent thinking ability in students through problem solving approach.	1. Correlate utility of physicochemical properties in design of pharmaceutical product. 2. Gain insight of techniques for determination of physicochemical properties. 3. Understand factors governing stability of finished pharmaceutical product. 4. Analyze and tackle problems encountered in formulation development.
	3. Physical Pharmacy – II **Practical**	1. To help students understand the latest concepts of physical pharmacy and their implications towards design of pharmaceutical formulations. 2. To give students hands on experience on determination of various physicochemical properties 3. To develop independent thinking ability of students through problem solving approach.	1. Understand utility of physicochemical properties in design of stable pharmaceutical formulation. 2. Gain expertise in determination of physicochemical properties as part of preformulation.

Course	Subject	Course Objectives	Course Outcomes
Second Year B. Pharm. (Semester IV)	4. Dosage Form Design –I **Theory**	1. To provide knowledge of different oral liquid dosage forms 2. To provide information of preformulation parameters of oral dosage forms 3. To provide information about large scale manufacturing and QC of liquid oral products 4. To reinforce the topics studied in inorganic & organic chemistry	1. Apply the concept of physicochemical, biopharmaceutical and therapeutic aspects in formulation design. 2. Design formulation, select appropriate processes and equipments for manufacturing of liquid orals
	4. Dosage Form Design –I **Practical**	1. To provide information of marketed products and conduct market survey 2. To provide hands on experience of preparation and evaluation of liquid oral products 3. To provide information about packaging and labeling of liquid oral products	1. Record and analyze market survey of Pharmaceutical products. 2. Design, develop and evaluate formulations as per official standards 3. Select appropriate processes, equipments and packaging of liquid orals.

Course	Subject	Course Objectives	Course Outcomes
Second Year B. Pharm. (Semester IV)	5. Pharmaceutical Microbiology - II (Including Immunology) **Theory**	1. To introduce students to various sterility tests and microbial assays. 2. To enhance the technical know-how about industrial microbiology, fermentation of biological products, manufacturing of vaccine and sera. 3. To elucidate about various concepts and applications of immunology. 4. To familiarize with probiotics.	1. Integrate basic knowledge of microbiology with pharmaceutical sciences. 2. Understand microbiological techniques. 3. Understand aspects of immunology and immunological products
	5. Pharmaceutical Microbiology - II (Including Immunology) **Practical**	1. To make students learn various official sterility tests and microbial assays as per I.P. 2. To develop practical skills in isolation and inoculum development of commercially important microbial species	1. Apply the techniques in identification, isolation, and cultivation of microorganisms. 2. Perform microbiological assessment of antimicrobials, disinfectants and preservatives and sterility testing of pharmaceuticals 3. Develop practical skills in industrial microbiology

Course	Subject	Course Objectives	Course Outcomes
Second Year B. Pharm. (Semester IV)	6. Pharmacology – I **Theory**	1. To introduce knowledge on basic aspects and significance of pharmacology. 2. To identify therapeutic targets for drug therapy. 3. To reinforce the physiological and pathophysiological aspects of human body. 4. To develop competence on evaluating the efficacy, safety and risk profile of drugs.	1. Acquaint with the basic concepts of pharmacology. 2. Understand the pharmacological basis of therapeutics. 3. Conceptualize the mode and mechanisms of action of drug in diseases. 4. Understand the uses, adverse effects and drug interactions
	6. Pharmacology – I **Practical**	1. To imbibe ethics of animal experimentation. 2. To acquaint with skills of animal handling. 3.To acquire expertise in in vitro experimental pharmacology.	1. Perform animal experiments ethically. 2. Administer drugs through various routes to the experimental animals. 3. Carryout bioassays for various drugs.

Course	Subject	Course Objectives	Course Outcomes
Third Year B. Pharm. (Semester V)	1. Medicinal Chemistry – I **Theory**	1. To integrate structural requirements of drugs to exhibit the biological activity. 2. To demonstrate the mechanism of action on a molecular basis. 3. To highlight significance of drug metabolism in drug discovery and toxicity. 4. To provide knowledge of therapeutic uses and adverse reactions of various drugs. 5. To apply principles of organic chemistry for synthesizing various clinically significant drugs. 6. To reinforce the topics studied in anatomy and physiology, biochemistry, organic chemistry and pharmacology.	1. Exemplify the relationship between physicochemical properties and drug action. 2. Describe the different routes of drug metabolism & understand routes of synthesis of important drugs. 3. Conceptualize influence of substituents on the physicochemical properties and biological activity of drugs. 4. Explain the uses and adverse reactions of drugs belonging to different classes.
	1. Medicinal Chemistry – I **Practical**	1. To integrate knowledge of organic chemistry for synthesis of medicinal compounds. 2. To analyze the purity of the drug substances by TLC & qualitative tests. 3. To acquire expertise in in vitro experimental pharmacology.	1. Apply principles of organic chemistry for synthesis of intermediates & drugs. 2. Apply TLC technique for monitoring reactions and checking purity of synthesized compounds. 3. Apply principles of qualitative analysis for identification and structural confirmation of synthesized compounds 4. Compute, analyze and record the observations.

Course	Subject	Course Objectives	Course Outcomes
Third Year B. Pharm. (Semester V)	2. Pharmaceutical Analysis – III **Theory**	1. To impart knowledge about modern instruments in chromatographic analysis with special reference to quality control and quality assurance. 2. To apply the principles of inorganic & organic chemistry for food analysis. 3. To impart quality consciousness among the students to produce quality pharmaceuticals by applying principles of quality assurance.	1. Understand and apply principles of chromatographic techniques for quantitative and qualitative determination of pure drug and drug content in dosage forms. 2. Employ the principles of inorganic and organic chemistry for food analysis. 3. Apply the basics of analysis in the area of pharmaceutical analysis and quality assurance. 4. Develop problem solving and mathematical approach.
	2. Pharmaceutical Analysis – III **Practical**	1. To explain the working principles of analytical instruments for chromatography. 2. Describe the need and perform techniques for separation of a drug from the experimental matrix. 3. Understand the Advantages and Disadvantages of some these methods 4. Employ technical & mathematical skills to generate a comprehensive lab report on the findings. 5. Define quality control criterion for food substances.	1. Define quality control criterion for food substances. 2. Correlate principles of separation with chromatographic techniques for qualitative determination of pure drug. 3. Master important chromatographic techniques 4. Compute and analyze the purity of drug substances.

Course	Subject	Course Objectives	Course Outcomes
Third Year B. Pharm. (Semester V)	3. Dosage Form Design – II **Theory**	1. Understand the principle involved in preformulation of solid and semisolids dosage forms 2. To impart knowledge on the formulation design, manufacturing and evaluation of solid and semisolids dosage forms	1. Apply the concepts of physicochemical, biopharmaceutical and therapeutic aspects in formulation design. 2. Design formulation, select appropriate processes and equipments for manufacturing of semisolids, solid orals and sterile dosage forms
	3. Dosage Form Design – II **Practical**	1. To conduct market survey 2. To prepare and evaluate solid and semisolids dosage forms	1. Design, develop and evaluate non sterile formulations as per official standards. 2. Select appropriate processes, equipments and packaging of pharmaceuticals during the manufacturing of sterile preparations and auditing the pharmaceutical units as well

Course	Subject	Course Objectives	Course Outcomes
Third Year B.Pharm. (Semester V)	4. Cosmeticology **Theory**	1. To provide general understanding of cosmetics 2. To provide knowledge of different cosmetics products 3. To provide information about safety testing and regulatory aspects of different cosmetics	1. Understand the principles involved in formulation of cosmetic products. 2. Learn, select and apply appropriate process and equipment in manufacturing cosmetic products. 3. Acquaint regulatory aspects in manufacturing and evaluation of cosmetic products.
	4. Cosmeticology **Practical**	1. To provide information of marketed cosmetic products 2. To provide knowledge about role of ingredients for cosmetic products 3. To provide hands on experience of preparation and evaluation of cosmetic products 4. To provide information about packaging and labeling of cosmetic products	1. Record and analyze market survey of cosmeceuticals. 2. Design, develop and evaluate cosmetic products 3. Select process, equipment and packaging of cosmetic products.

Course	Subject	Course Objectives	Course Outcomes
Third Year B.Pharm. (Semester V)	5. Pharmacology – II **Theory**	1. To identify molecular targets for a drug action. 2. To develop competence on evaluating the efficacy, safety and risk profile of drugs. 3. To impart knowledge of pharmacotherapy in correlation with physiology and pathophysiology.	1. Understand the molecular basis of drug action. 2. Understand the uses of drugs in various diseases, their adverse effects and drug interactions. 3. Correlate pathophysiology with treatment approaches.
	5. Pharmacology – II **Practical**	1. To demonstrate the 3R principles (Reduce, Replace and Refine) in animal experimentation using computer simulation. 2. To illustrate treatment profiles for diseases. 3. To exemplify the clinical aspect of pharmacology with prescription auditing. 4. To acquire expertise in in vitro experimental pharmacology. 5. To evaluate the efficacy, safety and risk profile of drugs. 6. To analyze the drug promotional Literatures.	1. Comprehend the need of alternatives to animal experimentation. 2. Elucidate treatment profiles for various diseases. 3. Criticize, audit and rewrite prescription with respect to their safety and efficacy profiles. 4. Carryout bioassays for drugs. 5. Assess risk benefit ratio in clinical pharmacology. 6. Validate the drug promotional literatures.

Course	Subject	Course Objectives	Course Outcomes
Third Year B.Pharm. (Semester V)	6. Pharmacognosy – I **Theory**	1. To introduce the concept and scope of Pharmacognosy and traditional medicines. 2. To understand the basic principles of cultivation, collection and storage of crude drugs. 3. To impart the knowledge of primary and secondary metabolites of the plant. 4. To acquaint with the techniques and methods for herbal drug standardization as per WHO guidelines. 5. To understand the biotechnological techniques for obtaining and improving the quality of phytoconstituents. 6. To understand industrial requirements for quality control and quality assurance of herbal drugs. 7. To introduce about herbal cosmetics and their formulations.	1. Understand the basic principles of cultivation, collection and storage of crude drugs. 2. Describe the pharmacognostic profile of crude drugs. 3. Understand the applications of primary and secondary metabolites of the plant.
	6. Pharmacognosy – I **Practical**	1. To understand the concept and application of microscope. 2. To familiarize the morphological parameters and powder characteristics crude drugs. 3. To perform different phytochemical test to identify the phyto-constituent. 4. To understand the adulteration of crude drugs and methods analysis. 5. To impart the basic knowledge of chromatography	1. Understand the application of microscopy. 2. Prepare microscopical slides to examine the plant cell and their contents. 3. Describe morphology and powder characteristics of crude drugs. 4. Identify chemical constituents through chemical tests. 5. Standardize natural products as per WHO guidelines. 6. Find the adulteration in crude drugs. 7. Utilize the concepts of chromatography

Course	Subject	Course Objectives	Course Outcomes
Third Year B. Pharm. (Semester VI)	1. Medicinal Chemistry – II **Theory**	1. To integrate structural requirements of drugs to exhibit the biological activity. 2. To demonstrate the mechanism of action on a molecular basis. 3. To highlight significance of drug metabolism in drug discovery and toxicity. 4. To provide knowledge of therapeutic uses and adverse reactions of various drugs. 5. To apply principles of organic chemistry for synthesizing various clinically significant drugs. 6. To reinforce the topics studied in anatomy and physiology, biochemistry, organic chemistry and pharmacology	1. Exemplify the relationship between physicochemical properties and drug action. 2. Describe the different routes of drug metabolism & understand routes of synthesis of important drugs. 3. Conceptualize influence of substituents on the physicochemical properties and biological activity of drugs. 4. Explain the uses and adverse reactions of drugs belonging to different classes.
	1. Medicinal Chemistry – II **Practical**	1. To integrate knowledge of organic chemistry for synthesis of medicinal compounds. 2. To analyze the purity of the drug substances by TLC & qualitative tests.	1. Apply principles of organic chemistry for synthesis of intermediates & drugs. 2. Apply TLC technique for monitoring reactions and checking purity of synthesized compounds. 3. Apply principles of qualitative analysis for identification and structural confirmation of synthesized compounds. 4. Compute, analyze and record the observations.

Course	Subject	Course Objectives	Course Outcomes
Third Year B. Pharm. (Semester VI)	2. Pharmaceutical Analysis – IV **Theory**	1. To impart knowledge about modern instruments in chromatographic analysis with special reference to quality control and quality assurance. 2. To apply the principles of inorganic & organic chemistry for food analysis. 3. To impart quality consciousness among the students to produce quality pharmaceuticals by applying principles of quality assurance.	1. Understand and apply principles of chromatographic techniques for quantitative and qualitative determination of pure drug and drug content in dosage forms. 2. Employ the principles of inorganic and organic chemistry for food analysis. 3. Apply the basics of analysis in the area of pharmaceutical analysis and quality assurance. 4. Develop problem solving and mathematical approach.
	2. Pharmaceutical Analysis – IV **Practical**	1. To explain the working principles of analytical instruments for chromatography. 2. Describe the need and perform techniques for separation of a drug from the experimental matrix. 3. Understand the Advantages and Disadvantages of some these methods 4. Employ technical & mathematical skills to generate a comprehensive lab report on the findings. 5. Define quality control criterion for food substances.	1. Define quality control criterion for food substances. 2. Correlate principles of separation with chromatographic techniques for qualitative determination of pure drug. 3. Master important chromatographic techniques 4. Compute and analyze the purity of drug substances.

Course	Subject	Course Objectives	Course Outcomes
Third Year B. Pharm. (Semester VI)	3. Dosage Form Design – III **Theory**	1. To make the students understand the significance aseptic techniques used in the development of sterile formulations. 2. To provide knowledge on selection of additives in sterile formulation development 3. To stress upon the importance of GMP in the manufacturing of sterile preparations.	1. Apply the concepts of physicochemical, biopharmaceutical and therapeutic aspects in formulation design. 2. Design formulation, select appropriate processes and equipments for manufacturing of sterile dosage forms.
	3. Dosage Form Design – III **Practical**	1. To make the students understand sterile procedures and aseptic techniques used in the development of sterile formulations. 2. To impart the training to the students on developing safe and tolerable sterile formulations	1. Design, develop and evaluate sterile formulations as per official standards. 2. Select appropriate processes, equipments and packaging of sterile pharmaceuticals.

Course	Subject	Course Objectives	Course Outcomes
Third Year B. Pharm. (Semester VI)	4. Pharmacology – III **Theory**	1. To impart knowledge of molecular targets of drug action. 2. To develop competence on evaluating the efficacy, safety and risk profile of drugs. 3. To comprehend the concepts of toxicology.	1. Understand the molecular basis of drug action. 2. Understand the uses of drugs in various diseases, their adverse effects and drug interactions. 3. Understand the general management of poisoning and drug toxicity.

Course	Subject	Course Objectives	Course Outcomes
Third Year B. Pharm. (Semester VI)	5. Pharmaceutical Biotechnology (including Molecular Biology) **Theory**	1. To impart knowledge of molecular biology. 2. To comprehend the concepts and applications of recombinant technology. 3. To impart quality consciousness among the students to produce quality pharmaceuticals by applying principles of quality assurance.	1. Understand the principle and technique involved in basics of molecular biology. 2. Learn the concepts of basic and advance techniques of DNA manipulation. 3. Understand the recombinant DNA technology and its pharmaceutical applications
	5. Pharmace-utical Bio-technology (including Molecular Biology) **Practical**	1. To make the students understand techniques of molecular biology. 2. To impart the training to the students on isolation and evaluation techniques in biotechnology.	1. Evaluate enzyme reaction in free and immobilized form 2. Learn about techniques of DNA and plasmid isolation. 3. Learn how to run a horizontal agarose gel electrophoresis to analyze and visualize DNA and RNA 4. Understand role restriction endonucleases and ligation. 5. Carry out DNA amplification through PCR using specific and random primers

Course	Subject	Course Objectives	Course Outcomes
Third Year B. Pharm. (Semester VI)	6. Pharmacognosy – II **Theory**	1. To introduce the concept and scope of Pharmacognosy and traditional medicines. 2. To understand the basic principles of cultivation, collection and storage of crude drugs. 3. To impart the knowledge of primary and secondary metabolites of the plant. 4. To acquaint with the techniques and methods for herbal drug standardization as per WHO guidelines. 5. To understand the biotechnological techniques for obtaining and improving the quality of phytoconstituents. 6. To understand industrial requirements for quality control and quality assurance of herbal drugs. 7. To introduce about herbal cosmetics and their formulations	1. Apply the principles of chromatography for the detection of phyto-constituents.molecular biology. 2. Familiarize with the concepts and applications of plant biotechnology for the production of phytoconstituents. 3. Comprehend the significance of WHO guidelines for standardization of medicinal plants.
	6. Pharmacognosy – II **Practical**	1. To understand the concept and application of microscope. 2. To familiarize the morphology and powder characteristics crude drugs. 3. To understand different phytochemical test to identify the phyto-constituent. 4. To understand the importance of ash value, extractive value and other parameters in standardization of herbal drugs. 5. To impart the knowledge of chromatographic techniques in herbal sample analysis.	1. Understand the application of microscopy. 2. Prepare microscopical slides to examine the plant cell and their contents. 3. Describe morphology and powder characteristics of crude drugs. 4. Identify chemical constituents through chemical tests. 5. Standardize natural products as per WHO guidelines. 6. Find the adulteration in crude drugs. 7. Utilize the concepts of chromatography

Course	Subject	Course Objectives	Course Outcomes
Final Year B. Pharm. (Semester VII)	1. Medicinal Chemistry –III **Theory**	1. To impart knowledge of structural requirements of drugs to exhibit the biological activity in order to explain the mechanism of action on a molecular basis. 2. To provide knowledge of drug metabolism, physicochemical properties and their relationship with the drug action, structure activity relationships. 3. To provide knowledge of therapeutic uses and adverse reactions of various drugs. 4. To apply principles of organic chemistry for synthesizing various clinically significant drugs. 5. To reinforce the topics studied in anatomy and physiology, biochemistry, organic chemistry and pharmacology.	1. Understand the principles of drug design and QSAR. 2. Describe the different routes of biotransformation and synthesis of important drugs. 3. Demonstrate influence of structural modification on the physicochemical properties and biological activity. 4. Demonstrate the uses and adverse reactions of drugs belonging to different classes.
	1. Medicinal Chemistry –III **Practical**	1. To prepare medicinal compounds by simple chemical reactions. 2. Structural confirmation of synthesized compounds by spectral analysis. 3. To carry out the monograph analysis of the medicinal compounds and assess the quality of the product. 4. To determine important physico-chemical parameters for QSAR analysis.	1. Apply principles of organic chemistry for synthesis of intermediates and drugs. 2. Apply TLC technique for monitoring reactions and checking purity of synthesized compounds. 3. Apply principles of qualitative and spectral analysis for identification and structural confirmation of synthesized compounds. 4. Compute, analyze and record the observations.

Course	Subject	Course Objectives	Course Outcomes
Third Year B. Pharm. (Semester VII)	2. Pharmaceutical Analysis – V **Theory**	1. To impart knowledge about basic concepts of various modern instruments involved in spectroscopic techniques, instrumentation and their applications. 2. To make students aware about the basic principles of immunoassays and their importance	1. Understand the principles, working and applications of spectroscopic techniques and other modern instruments for analysis of drug/pharmaceutical products. 2. Develop skills for selection of techniques, method development and validation for analysis of drugs/pharmaceutical products
	2. Pharmaceutical Analysis – V **Practical**	1. To develop expertise in the analysis, method development & validation of drugs using sophisticated instruments and advanced techniques. 2. To provide hands on experience for handling of analytical instruments.	1. Enrich knowledge base about working principle, instrumentation and industrial applications of various analytical techniques. 2. Harness technical skills to handle sophisticated instruments for quantitative analysis of bulk drugs and formulations 3. Compute and analyze the purity of drug substances.

Course	Subject	Course Objectives	Course Outcomes
Third Year B. Pharm. (Semester VII)	3. Dosage Form Design – IV **Theory**	1. To impart knowledge about principles and design of novel drug delivery system 2. To learn the regulatory aspects related to manufacturing of controlled drug delivery systems	1. Apply principles of controlled drug delivery systems in formulation design. 2. Understand the concept of management and regulatory guidelines in pharmaceutical industry.
	3. Dosage Form Design – IV **Practical**	1. To learn techniques in preparation and evaluation of controlled release formulations. 2. To learn calculation of shelf life of developed formulation	1. Develop and evaluate controlled release formulations. 2. Understand and apply the quality assurance techniques in manufacturing facility. 3. Compute and calculate life period of dosage forms.

Course	Subject	Course Objectives	Course Outcomes
Third Year B. Pharm. (Semester VII)	4. Biopharmaceutics and Pharmacokinetics **Theory**	1. To impart knowledge about ADME process 2. To understand physicochemical, pharmaceutical and biological factors affecting ADME 3. To provide concept of different pharmacokinetic compartment models 4. To understand computation of pharmacokinetics parameters through compartmental modeling approach 5. To understand the BA/ BE studies through statistical design	1. Identify the physicochemical properties of drug influencing absorption 2. Analyze the biopharmaceutical factors influencing ADME. 3. Apply compartmental modeling concepts and derive the pharmacokinetic parameters for a drug following IV/EV route and solve problems based on the same. 4. Integrate the significance of pharmacokinetic parameters in clinical study and understand design protocols in conduct of BA/BE studies

Course	Subject	Course Objectives	Course Outcomes
Third Year B. Pharm. (Semester VII)	5. Clinical Pharmacy **Theory**	1. To monitor drug therapy of patient through medication chart review and clinical review 2. To obtain medication history interview and counsel the patients 3. To identify and resolve drug related problems 4. To detect, assess and monitor adverse drug reaction 5. To interpret selected laboratory results (as monitoring parameters in therapeutics) of specific disease States 6. To retrieve, analyze, interpret and formulate drug or medicine information	1. Reviewing patient's clinical data and solving patient's medication related problems, 2. Provide drug information to community and all healthcare professionals, 3. Manage, assess and report adverse drug reactions 4. Interpret laboratory data with respect to each disease and therapy outcomes, ultimately leading to patient benefits in terms of positive clinical outcomes.

Course	Subject	Course Objectives	Course Outcomes
Third Year B. Pharm. (Semester VII)	6. Pharmacognosy – III **Theory**	1. To impart knowledge on pharmacognostic aspects of natural products and techniques for their extraction, isolation and identification. 2. To familiarize with chemical aspects of phytoconstituents. 3. To understand fundamental principles of Ayurvedic dosage forms. 4. To promote safe use of medicinal plants and phytopharmaceuticals.	1. Understand the biosynthesis and chemistry of phytoconstituents. 2. Comprehend the principles and techniques of extraction, isolation and identification of phytoconstituents. 3. Understand the concept of Ayurved and evaluation of Ayurvedic dosage forms.
	6. Pharmacognosy – III **Practical**	1. Identify the morphological and microscopical characteristics of medicinal plants. 2. Familiarize with the different ayurvedic dosage forms. 3. Isolate the phytoconstituents from the plant extracts.	1. Identify the morphological and microscopical characteristics of medicinal plants. 2. Familiarize with the different ayurvedic dosage forms. 3. Isolate the phyto-constituents from the plant extracts.

Course	Subject	Course Objectives	Course Outcomes
Final Year B.Pharm. (Semester VIII)	1. Medicinal Chemistry – IV **Theory**	1. To impart knowledge of structural requirements of drugs to exhibit the biological activity in order to explain the mechanism of action on a molecular basis. 2. To provide knowledge of drug metabolism, physico-chemical properties and their relationship with the drug action, structure activity relationships. 3. To provide knowledge of therapeutic uses and adverse reactions of various drugs. 4. To apply principles of organic chemistry for synthe sizing various clinically significant drugs. 5. To reinforce the topics studied in anatomy and physiology, biochemistry, organic chemistry and pharmacology.	1. Understand the principles of drug design and QSAR. 2. Describe the different routes of biotransformation and synthesis of important drugs. 3. Demonstrate influence of structural modification on the physicochemical properties and biological activity. 4. Demonstrate the uses and adverse reactions of drugs belonging to different classes.
	1. Medicinal Chemistry – IV **Practical**	1. To prepare medicinal compounds by simple chemical reactions. 2. Structural confirmation of synthesized compounds by spectral analysis. 3. To carry out the monograph analysis of the medicinal compounds and assess the quality of the product. 4. To determine important physico-chemical parameters for QSAR analysis.	1. Apply principles of organic chemistry for synthesis of intermediates and drugs. 2. Apply principles of qualitative and spectral analysis for identification and structural confirmation of synthesized compounds. 3. Correlate QSAR parameters with drug action. 4. Compute, analyze and record the observations

Course	Subject	Course Objectives	Course Outcomes
Final Year B.Pharm. (Semester VIII)	2. Pharmaceutical Analysis – VI **Theory**	1. To impart knowledge about basic concepts of various modern instruments involved in spectroscopic techniques, instrumentation and their applications. 2. To make students aware about the basic principles of immunoassays and their importance.	1. Understand the principles, working and applications of spectroscopic techniques and other modern instruments for analysis of drug/ pharmaceutical products. 2. Develop skills for selection of techniques, method development and validation for analysis of drugs/pharmaceutical products
	2. .Pharmaceutical Analysis – VI **Practical**	1. To develop expertise in the analysis, method development & validation of drugs using sophisticated instruments and advanced techniques. 2. To provide hands on experience for handling of analytical instruments.	1. Enrich knowledge base about working principle, instrumentation and industrial applications of various analytical techniques. 2. Harness technical skills to handle sophisticated instruments for quantitative analysis of bulk drugs and formulations

Course	Subject	Course Objectives	Course Outcomes
Final Year B.Pharm. (Semester VIII)	3. Pharmacology – IV **Theory**	1. To impart knowledge of pharmacotherapy in correlation with physiology and pathophysiology. 2. To identify molecular targets for a drug action. 3. To develop competence on evaluating the efficacy, safety and risk profile of drugs. 4. To comprehend the concepts of chemotherapy.	1. Correlate the mechanism involved in physiology and pathophysiology of various organ systems. 2. Understand the use of appropriate drug with respect to the disease mechanisms. 3. Implicate the uses of individual drugs in various diseases, their adverse effects and drug interactions. 4. Acquaint with the treatment of infectious diseases.
	3. Pharmacology – IV **Practical**	1. To illustrate treatment profiles for diseases. 2. To exemplify the clinical aspect of pharmacology with prescription auditing. 3. To evaluate the efficacy, safety and risk profile of drugs. 4. To demonstrate knowledge on fixed dose combinations. 5. To acquire expertise in in vivo experimental pharmacology.	1. To elucidate treatment profiles for various diseases. 2. To criticize, audit and rewrite prescription with respect to their safety and efficacy profiles. 3. To assess risk benefit ratio in clinical pharmacology. 4. To understand the basis of rational and irrational fixed dose combination of drugs. 5. Perform in vivo experimental pharmacology.

Course	Subject	Course Objectives	Course Outcomes
Final Year B.Pharm. (Semester VIII)	4. Pharmacognosy – IV **Theory**	1. To impart knowledge on pharmacognostic aspects of natural products and techniques for their extraction, isolation and identification. 2. To familiarize with chemical aspects of phytoconstituents. 3. To understand fundamental principles of Ayurvedic dosage forms. 4. To promote safe use of medicinal plants and phytopharmaceuticals.	1. Comprehend the principles and techniques of extraction, isolation and identification of phytoconstituents. 2. Understand the concept of Ayurved and evaluation of Ayurvedic dosage forms.
	4. Pharmacognosy – IV **Practical**	1. To impart knowledge about quality and types of adulteration in crude drugs. 2. To familiarize with chemical aspects of phyto-constituents. 3. To understand fundamental principles of Ayurvedic dosage forms.	1. Know the adulteration of crude drugs. 2. Understand the formulation of ayurvedic dosage forms

Course	Subject	Course Objectives	Course Outcomes
Final Year B.Pharm. (Semester VIII)	5. Drug Regulatory Affairs **Theory**	1. To imbibe Professional ethics 2. To understand the concepts of the pharmaceutical legislation in India 3. To be able to understand the contents of Dangerous Drugs Act, Pharmacy Act and Excise duties Act 4. To impart knowledge on guidelines of international regulatory authorities	1. Apply ethical practices in professional activities. 2. Understand rules and regulations related to drug and drug products. 3. Prepare export dossiers as per international guidelines

Course	Subject	Course Objectives	Course Outcomes
Final Year B.Pharm. (Semester VIII)	6. Pharmaceutical Management **Theory**	1. To impart knowledge on principles of pharmaceutical management 2. To apprise the students of the system approach of managerial process in the pharmaceutical industry and stimulate them for proper understanding of the various responsibilities towards meeting high standards in ISO, GMP and cGMP 3. To self help the students in personification and identify themselves as competent leaders of the next generation.	1. Apply management skills to become competent leaders of the next generation. 2. Transform their aspirations, beliefs and perseverance to attain professional goals. 3. Prepare for audits in pharmaceutical industry

Course	Subject	Course Objectives	Course Outcomes
Final Year B.Pharm. (Semester VIII)	7. Project (Non-Experimental)	1. To familiarize the student about the recent development in thrust areas of research in core subjects of Pharmacy and applied fields. 2. To collect, organize, compile and interpret the data/ literature from various sources of information like library, internet, market survey, hospital visit etc. 3. To present the collected information in systematic and organized manner in the form of thesis. 4. To reproduce the findings of these projects in the form of presentations this built the data collection skills, organization of information and major trends of research in novel areas. 5. Student presents this work in seminar which develops his/ her presentation and communication skills.	1. Familiarize the student about the recent development in thrust areas of research in Pharmacy and applied fields. 2. Collect, organize, compile and interpret the data/ literature from various sources of information like library, internet, market survey, hospital visit etc. 3. Present the collected information in systematic and organized manner in the form of report. 4. Reproduce the findings of these projects in the form of seminar/presentations/ vice voce.

SEMESTER-I

Pharmaceutical Chemistry -I (Inorganic)

(Theory) (3 Hrs/Week)

(42 lectures)

SECTION I

1. Pharmacopoeia and monograph: Different pharmacopoeia, introduction to the study of monographs of official compounds in IP.
2. Purity of Pharmaceuticals and factors affecting purity of Pharmaceuticals, limit tests for chloride, sulphate, iron, arsenic, lead, heavy metals.
3. Electrolytes: Major Extra and intracellular electrolytes and ions - chlorides, phosphate, bicarbonate, Na, K, Ca, Mg. and their Physiological properties and uses.

   Electrolytes used for replacement therapy, Electrolyte combination therapy, Electrolytes used in acid-base theory for maintaining regulatory mechanisms in the body(Physiological acid base balance).Compounds-Sodium chloride, Potassium Chloride, Sodium acetate, Sodium Lactate ,Ringer solution.
4. Acidifying agents: Definition, classification, their official compound- Dilute Hydrochloric acid.

SECTION II

5. Antacids: General introduction, Definition, classification, their official compound- Sodium bicarbonate, Aluminum hydroxide, Calcium carbonate, Milk of magnesia.
6. Protective and adsorbents - General introduction, Definition, ideal properties, their official compounds- Bismuth Sub carbonate, Bismuth sodium tartarate, Kaolin.
7. Cathartics General introduction, Definition, classification, their official compound - Sodium phosphate, Magnesium Sulphate.
8. Essential trace ions Iron, Iodine and Sulphur their official compounds, uses, their role in biochemical function and deficiency symptoms. Compounds- Ferrous sulfate, Iron sorbite Injection, Iodine.

Recommended Books:

1. J.H.Block, E.B. Roche, T.O. Soine,, C.O.Wilson: Inorganic, Medicinal and Pharmaceutical Chemistry (Verghese Puhblication)
2. C.A.Dicher: Modern Inorganic Pharmaceutical Chemistry

3. Bentley & Drivers text-book of Pharmaceutical Chemistry, 8th edition (ELBS London.)
4. Beckett and Stenlake Pratical Pharmaceutical Chemistry Vol. I (C.B.S.)
5. Quantitative in organic analysis by A. I. Vogel (Long man) 4th edition.
6. Indian Pharmacopoeia 66, 85, 96.
7. Remington's Pharmaceutical Sciences (Mack Publishing Co.)

Pharmaceutical Chemistry-I (Inorganic)
Practical (3 Hrs/Week)

1. Identification test (any three)
   i) Ammonium chloride
   ii) Boric acid
   iii) Benzoic acid
   iv) Calcium carbonate
2. Limit test (any 4)
   i) Limit test for Chloride
   ii) Limit test for Sulphate
   iii) Limit test for Iron
   iv) Limit test for Heavy metals
   v) Limit test for Lead
3. Preparation of Inorganic compounds (any3)
   i) Boric acid
   ii) Potash alum
   iii) Barium Sulpahte
   iv) Magnesium sulphate
4. Qualitative analysis of given samples (any 5)

Recommended Books:

1. Pharmacopoeia of India, 1985.

2. Bentley & Drivers text-book of Pharmaceutical Chemistry, 8th Edition (Oxford University Press)
3. A.I. Vogel: Quantitative Inorganic Analysis - (Longman), 4th edition.
4. Remington's Pharmaceutical Sciences (Mack Publishing CO.).
5. Cotton & Wilkinson, Advanced Inorganic Chemistry, 18th edition, (Willey Eastern Ltd, Delhi)
6. Beckett and Stenlake Vol. I (CBS Publishers & Distributors Delhi-32.)

Pharmaceutical Chemistry - II (Organic)
(Theory) (3 Hrs/Week)
(42 lectures)

SECTION I

1. Structure of Organic Molecule
   a) Atomic Orbitals
   b) Hybridization
   c) Sigma and Pi bonds
   d) Intermolecular forces and related properties [polarity of bonds, M. P., B. P., Solubility.
   e) Acids and bases : Lowry Bronsted and Lewis theories
2. IUPAC Nomenclature of organic compounds belonging to following classes : alkanes, alkenes , amines , phenols, alcohols, esters, aldehydes, ketones, carboxylic acids, and cycloalkanes
3. Factors affecting electron availability in a molecule
   a) Inductive effects and its applications
   b) Resonance effects and its applications
   c) Hyper conjugation and its applications
   d) Steric effects
4. Nucleophilic substitution reactions at saturated carbon and aryl carbon atom.
   a) SN1 and SN2 reactions with their kinetics, mechanism, stereochemistry and orientation.

b) Factors affecting Nuclephilic substitution reactions

i) Effect of solvent ii) Effect of Structure

iii) Effect of Nucleophile iv) Effect of Leaving group

c) Application of these in preparation and reactions alkyl halides, alcohols, epox ides.

d) Nucleophilic substitutions at aryl carbon atom.

SECTION II

5. Stereochemistry

Introduction to Isomerism, Geometrical isomerism, Optical isomerism enantiomerism.

6. Reaction Mechanism

a) Types of reagent

b) Types of reactions intermediates

c) Types of Mechanism

d) Collision and transition state theories

7. Aromatic electrophilic substitution

a. Electrophilic attack on benzene

b. Nitration, halogenations, sulphonation, Friedal craft alkylation and acylation, diazo coupling

c. Orientation in Mono-substituted benzene

Pharmaceutical Chemistry- II (Organic)

(Practical) (3 Hrs/Week)

1 Identification of Organic Compounds belonging to the following classes by systemic qualitative analysis, including preparation of suitable derivatives[minimum 12 compounds]

Phenols, amines, amides, carboxylic acids, aldehydes, ketones, esters, nitro compounds, hydrocarbons, alcohols

Reference Books:

1 A text book of practical organic chemistry, A.I.Vogel 4th Edition.

2 Hand book of Organic Analysis (Qualitative and Quantitative), H.T.Cloke (Arnold-Heinemann).

3 The systematic Identification of Organic Compounds, by Shriner, Hermann, Morris, Curtin and Fuson. (Wiley& Sons,Inc)

Modern Dispensing Pharmacy

(Theory) (3 Hrs/Week)

(42 lectures)

SECTION: I

1. Evolution of Pharmacy and Pharmaceutical Literature:

Growth of Pharmacy profession in India: Education, Profession & Industry. History and Features of Pharmacopoeias: Indian Pharmacopoeia, Indian National Formulary, British pharmacopoeia, British Pharmaceutical Codex, United States pharmacopoeia.

2. Prescription:

Various parts of prescription, types of prescription, language of Prescription, Handling of prescription. Medication errors

3. Compounding and Dispensing:

Concept of compounding, dispensing and manufacturing. Types of containers according to dosage form, Dispensing labeling and instructions on label. Storage conditions and primarily signs of instability of drug product.

4. Physico-chemical Incompatibilities:

Physical: insolubility, precipitation, liquefaction, immiscibility, interaction with container.

Chemical: effect of pH, effect of solvent, complexation, redox reactions.

5. Pharmaceutical Calculations:

Percentage solution: allegation methods, isotonic solutions, displacement value.

Posology: Factors affecting, calculations of doses.

SECTION: II

6. Principles and procedures of Dispensing Prescriptions

Principles and concept of formulation, procedures for compounding and dispensing with special emphasis on instructions to patient for following preparations (Formulation design and details about additives is not expected).

7. Liquid preparation:

Solution:

Aromatic waters, Gripe water, Syrups, Elixir, linctuses, mouthwash, gargle, throat paint, nasal drops, ear drops, enemas, lotions and liniments.

Suspensions:

Diffusible and indiffusible type, suspending agents, oral suspensions, inhalations and lotions.

Emulsions:

Two phase emulsions, method of preparation: wet and dry gum and soap emulsions, determination of type.

Semisolid peroration:

Ointment, cream, paste, gels and jellies.

Suppositories:

Types, Suppository bases. Suppositories and pessaries moulded and compressed.

Powders:

Divided and bulk (oral and external) powder. Effervescent granules.

Unit dosage forms: Dispensing of prefabricated tablets, capsules. Filling of hard gelatin capsules.

Novel drugs delivery systems: Concept of product and patient counseling for Sustained release tablets, inhalers, transdermal patches, Insulin

Modern Dispensing Pharmacy
Practical (3 Hrs/Week)

1. Concept of Modern Dispensing Practices:

Two prescriptions to explain prescription reading, patient medication record, product information leaflet, pictograms and patient counseling.

2. Dispening of Pre-fabricated dosage forms:

Using tablets / capsules packed in bulk packs.

3. Compounding and Dispensing (Selection of container, labeling, instructions for patient)

i) Solutions:

For Oral use: Syrups IP/USP, Aromatic water/Gripe water/ Pediatric ferrous sulphate oral solution/ Potassium citrate mixture.

a) Not for oral use mouthwash/Linctus/Throat paint.

b) For instillation into body cavities: Sodium bicarbonate ear drops, Enema.

c) For external use: Antiseptic solution/ Dilution of Marketed preparation for purpose.

ii) Suspensions:

a) Diffusible type: Magnesium trisilicate mixture, pediatric kaolin mixture.

b) Indiffusible type: Pediatric Chalk mixture, Paediatric sulphadimidine mixture.

c) Not for oral use: Menthol and eucalyptus inhalation

iii) Emulsions:

a) Castor oil / liquid paraffin emulsion.

b) Turpentine liniment / oily calamine lotion.

iv) Semisolids:

a) Fusion and trituration method: Sulphur ointment/Whitefield Ointment

b) Paste Lassar's paste/ Unna's paste.

c) Cream : Cetrimide cream

d) Jelly : Lubricating jelly

v) Suppositories :

Medicated suppository using fatty base.

vi) Powders :

i. Bulk powder: Containing Volatile / Eutectic substance/ small amount of liquid/ORS.

ii. Divided powder: minimum weighable and containing potent drug.

iii. Dusting powder

iv. Granules: Sodium sulphate effervescent granules

4. Medication Errors (Case study, 1 out of this oral presentation)

Recommended Books:

1. A.J.Winfield, RM.E. Richarods: Pharmacy practice; J.B.Lippincott Company.
2. Cooper and Gunns; Dispensing for Pharmaceutical Students, 12th edition. C.B.S. Delhi.
3. A.Pawar and R.S.Gaud; Modern Dispensing Pharmacy; Career Publications.
4. H.C. Ansel, N.G.Poporich. L.V. Allen; Pharmaceutical dosage forms and Drug Delivery systems; Williams and Wilkins.
5. Remington: The Science and Practice of Pharmacy; Mack Publishing Company.
6. M.J.Stocklosa, H.C.Ansel; Pharmaceutical Calculation; K.M.Varghese Company.
7. B.M.Mithal; Pharmaceutical Formulation, Vallabh Prakashan.

Pharmaceutical Engineering – I

(Theory) (3 Hrs/Week)

(42 lectures)

SECTION I

1. Flow of fluids :

Fluid statics: Pressure, manometers and pressure gauge. Fluid dynamics: Mechanism of fluid flow, Material and energy balance, measurement of fluid flow, fluid flow through pipe, energy losses in fluid flow, fluid past immersed body, fluid flow through packed beds.

2. Mass Transfer:

Molecular diffusion in gases and liquids, mass transfer in turbulent and laminar flow, theories of interphase mass transfer.

3. Size Reduction:

Theory, mechanism and energy requirement of size reduction, Equipment: hammer, tumbling, fluid energy, roller, end and edge runner and cutter mill, Cryogenic Screw Feed Conveyor. Open and closed circuit milling.

4. Size Separation:

Sieves, sieve bend, effectiveness of screens, and factors affecting screening

SECTION II

5. Mixing :

Liquid mixing: Mechanisms, mechanically agitated vessel, jet, high shear and pipe

mixers, power requirement. Mixing equipment for mixing of solids with liquid Z-blade, planetary, high speed mixers. Mixing of solids mechanisms, degree of mixing, rate of mixing, tumbler and ribbon mixer. Deaeration and defoaming of mixtures.

6. Filtration :

Mechanisms, types of fitration, filter media, theory of filtration, filter aids, filter press, rotary drum, leaf and membrane filters.Ultrafiltration, reverse osmosis, and Air filtration, bag filters, electrostatic precipitators, wet scrubbers and principle and design of HEPA filter.

7. Extraction :

Theory of solid-liquid and liquid – liquid extraction, equilibrium stage determination application of triangular diagram. Extractors.

Recommended Books:

1. W. McCabe, J.C. Smith, P. Harriot; Unit operations of chemical engineering; Mc-Graw Hill.
2. W.L.Badger and J.T. Banchero, Introduction to chemical engineering, McGraw Hill.
3. M.S. Peters, K.D. Timmerhaus; Plant design and economics for to chemical engineers; McGraw Hill.
4. E. Ganderton; Pharmaceutical Unit Operations;
5. Perry's Handbook of Chemical Engineering; Mc-Graw Hill.
6. A. R. Paradkar, Pharmaceutical Engineering, Nirali Prakashan.
7. Atmaram Pawar, Introduction to Pharmaceutics, Career Publication.

Human Anatomy and Physiology-1
(Theory) (3 Hrs/Week)
(42 lectures)

SECTION: I

1. Basic terminologies used in anatomy and physiology.
2. Cell Physiology: Structure of cell, its components- Their structures and functions, movement of materials across plasma membrane, homeostasis.
3. Elementary tissues of human body- epithelial, connective, muscular, and nervous tissues-their subtypes and characteristics.
4. The Blood-composition and functions of blood, RBC, WBC, Platelets,

Haemopoiesis, blood groups, mechanism of Clotting, anemia, disorders of blood (definitions only)

5. Cardiovascular system- Blood vessels-anatomy of heart, conducting elements of heart, cardiac cycle and heart sounds, blood vessels and circulation (pulmonary coronary, systemic and portal), ECG, Blood pressure (Maintenance and regulation), disorders of cardiovascular system (definitions only)

SECTION: II

6. Lymphatic system- Lymph (Formation, composition, functions, circulation), lymph node (structure and functions), spleen and its functions, disorders of lymphatic system (definitions only)
7. Respiratory system- Anatomy of respiratory organs and their functions, mechanism and regulation of respiration, physiology of respiration, transport of gases, respiratory volumes, methods of artificial respiration, and disorders of respiratory system (definitions only)
8. Digestive system- Anatomy and physiology of organs of digestive system, secretions and functions of salivary glands, stomach, liver, pancreas, small intestine, large intestine, role of enzymes in digestion and absorption of food, disorders of digestive system (definitions only)

Recommended Books:

1. Chatterjee, C.C., Human Physiology. Medical Allied Agency, Kolkata.
2. Chaudhari S K. Concise Medical Physiology.New Central Book Agency (P) Ltd., Calcutta.
3. Ganong, W.F., Review of Medical Physiology. Prentice-Hall International, London.
4. Guyton, A.C., Textbook of Medical Physiology. W. B. Saunders Co., Philadelphia, USA.
5. Jain, A.K., Textbook of Physiology. Avichal Publishing Co., New Delhi.
6. Singh, I., BD Chaurasia's Human Anatomy. CBS Publisher and Distributors, New Delhi.
7. Tortora, G.J. and Grabowski, S.R., 2005. Principals of Anatomy and Physiology. Harper Collins College Publishers, New York.
8. Vander, A.J., Sherman, J.H. and Luciano, D.S., Human Physiology. McGraw-Hill Publishing Co., USA.

9. Wagh, A. and Grant, A., Ross and Wilson's Anatomy and Physiology in Health and Illness. Churchill-Livingstone, London.
10. West, J.B., Best and Taylor's Physiological Basis of Medical Practice. Williams and Wilkins, Baltimore, USA.
11. Worwick, R. and Williams, P., Gray's Anatomy. Longman, London.

Human Anatomy and Physiology-I
(Practical)(3 hrs/Week)

1. Determination of Haemoglobin content of blood
2. Determination of RBC count and colour index of blood
3. Determination of blood groups
4. Determination of respiratory volumes
5. Recording of Blood pressure of normal volunteer
6. Osteology-Study of appendicular skeleton
7. Osteology -Study of axial skeleton
8. Study of Joints
9. Study of following systems with the help of models and charts
   a) Cardiovascular system
   b) Lymphatic system
   c) Respiratory system
   d) Digestive system

Recommended Books

1. Chaudhari, A.R., Textbook of Practical Physiology. Paras Publishers, New Delhi.
2. Chaudhari, A.R., Viva in Physiology. Paras Publishers, New Delhi.
3. Chaurasia, B.D., Human Osteology. CBS Publisher and Distributors, New Delhi.
4. Goyal, R.K., Patel, N.M. and Shah, S.A., Practical Anatomy, Physiology and Biochemistry. B. S. .
5. Ranade, V.G., Joshi, P.N. and Pradhan, S., Textbook of Practical Physiology. Pune Vidyarthi Griha Prakashan, Pune.
6. Singh, I., BD Chaurasia's Human Anatomy. CBS Publisher and Distributors, New Delhi.
7. Singh, I., Textbook of Human Osteology. Jaypee Brothers Medical Publishers, New

Pharmaceutical Statistics
(Theory) (3 Hrs/Week)
(42 lectures)

SECTION: I

1. Collection and Organization of data:

   Graphical and pictorial presentation of data, measures of central tendency and dispersion, sampling techniques, sample size, coefficient of variation, mean error, precision and accuracy.

2. Probability:

   robability distributions, normal, binomial and polynomial distributions, continuous data distribution, fiducial limits, probit and logit analysis.

3. Regression:

   Linear regression and correlation, method of least squares, significance of correlation and regression.

SECTION: II

4. Parametric Tests:

Testing hypothesis, types of errors, tests of significance based on normal distribution, test of significance for correlation coefficients.

5. Nonparametric Tests:

Data characteristics and nonparametric procedures, chi-square test, sign test, rank test.

6. Experimental Design:

Randomization, completely randomized and latin square designs, crossover and parallel designs and experimental design for stability studies and optimization.

7. Statistical Quality Control: Concept and statistical control charts.

Recommended Books:

1. Stanford Bolton ; Pharmaceutical Statistics : Marcel Dekker
2. Gupta S.G. ; Applied Statistics; S. Chand & Co.
3. Gupta and Gupta ; Business Statistics, Himalaya Publishing House
4. Alvin Lewis; Biostatistics, Affiliated East and West Press (P) Ltd., Delhi.

Communication Skills
(Practical)(3 hrs/week)

1. Technical Report writing: Technical writing, Features of Technical writing, Types of communications etc.
2. Listening: Hearing Vs Listening, Modes, Advantages, Factors affecting, and Measures to improve listening.
3. Business Letters: Business and general purpose letters, requirements of business letters, structure and format, types of business letters.
4. Technical Writing: Details of different components for technical writing
5, Report Writing; Importance, types of reports
6. Advertising: Definition, classification, purpose etc
7. Effective Presentation; Organization of data, developing a presentation, visual aids
8. Communication without words: Methods of non- verbal communication
9. Interview: Job application, resume, job interviews
10. Speeches: difference between speeches and presentations, purpose, preparation, speeches for special occasions
11. Group discussions: Definition, purpose, features of successful group discussions, effective communication skills, features of group discussions.

Recommended Books

1. Communication skills for Engineers and Scientists, SAngeeta Sharma and Binod Mishra, PHI Learning Pvt Ltd, New Delhi
2. English for Practical purposes Ed. By – Z.N. Patil, B.S., Valke, Ashok Thorat, & Zeenat Marchant Macmillian
3. Speaking English Effectively by Krishna Mohan, Macmillia
4. Writing with a purpose by M.L. Tikku and Prema Nandakumar
5. Developing Skills by Alexander L.G. OL.
6. Developing Communication Skills by Krishna Mohan, Macmillian and Meera Banjerji MacMillian

SEMESTER-II

Pharmaceutical Chemistry-III (Inorganic)

(Theory) (3 Hrs/Week)

(42 lectures)

SECTION I

1. Topical agents: General introduction, classification and mode of action.

Protective: Introduction, classification and mode of action and their official compounds: Talc, Zinc Oxide, Titanium dioxide

2. Antimicrobial agents:

Introduction, classification and mode of action and their official compounds: Hydrogen peroxide and potassium permanganate

3. Astringents:

Introduction, classification and mode of action and their official compounds-Boric acid, Alum

4. Pharmaceutical aids:

General introduction, acid-base theories, buffers: theory, mechanism and pharmaceutical buffer systems, antioxidants, solvent-water: properties of water, hardening of water and types of official water.

SECTION II

5. Expectorants, emetics and antidotes:

General introduction, classification and mechanism of action and their official compounds-Ammonium chloride, copper sulphate, antimony potassium tartarate, sodium nitrite and sodium thiosulphate.

6. Dental Products:

General introduction, classification, dentrifices and mechanism of action and their official compounds-Sodium fluoride, dibasic calcium phosphate

7. Inhahalnts and respiratory stimulants:

Definition,official gases-their preparation, properties,uses and assays for O_2,CO_2,N_2,N_2O,He and ammonium carbonate

8. Radio opaquecontrast media:

General introduction, classification and mechanism of action and their official compounds-Barium Sulphate

Pharmaceutical Chemistry-III (Inorganic)
(Practical)(3 hrs /per week)

1. Assays any five compounds from syllabus
2. Preparation of inorganic compounds (Any 3)
3. Qualitative analysis of a given binary mixture samples (Any 5)

Recommended Books:

1. J.H.Block, E.B. Roche, T.O. Soine,, C.O.Wilson: Inorganic, Medicinal and Pharmaceutical Chemistry (Verghese Puhblication)
2. C.A.Dicher: Modern Inorganic Pharmaceutical Chemistry
3. Bentley & Drivers text-book of Pharmaceutical Chemistry, 8th edition (ELBS London.)
4. Beckett and Stenlake Pratical Pharmaceutical Chemistry Vol. I (C.B.S.)
5. Quantitative in organic analysis by A. I. Vogel (Long man) 4th edition.
6. Indian Pharmacopoeia 66, 85, 96.
7. Remington's Pharmaceutical Sciences (Mack Publishing Co.)

Pharmaceutical Chemistry -IV (Organic)
(Theory) (3 Hrs/Week)
(42 lectures)

SECTION -I

1. Electrophilic addition to C-C multiple bonds :

a) Addition of Halogens

b) Addition of Halogen acid and orientation of addition, Markovnikov and Anti-markovnikov additions

c) Other addition reaction to olefins

i) Hydration ii) Hydroxylation

iii) Hydrogenation iv) Ozonolysis

2. Nucleophilic addition to C=0

a) Methods of preparation of aldehydes and ketones.

b) Reactions of aldehydes and ketones, addition of water, alcohols, thiols, hydrogen cyanide, sodium bisulphite, hydride ion, Derivatives of ammonia.

c) Nucleophilic additions, Aldol condensation, Knoevengel condensation, Dieckman condensation, Roformatski reaction, Cannizaro reaction and Michael condensation.

SECTION -II

3. Elimination reactions

a) Elimination reaction

b) $E1_2$ $E_2$and E_1 (cb) Mechanism

c) Orientation in E_1 and E_2 reactions (Saytzaff and Hofmann elimination)

d) Elimination versus substitution

4. General chemistry : methods of preparation and reactions of

a) Amines

b) Phenols

c) Carboxylic acids

Synthetic application involving transformation of functional group and introduction of One or Two functions.

Reference Books:

1. Organic Chemistry: Morrison and Boyd, (Prentice Hall of India (P) Ltd.
2. Organic Chemistry" Pine, (McGraw Hill, International)
3. Advanced Organic Chemistry (Reaction Mechanism and Structure) Jerry March, (Willey Eastern Ltd.)
4. General Organic Chemistry: Sachin Kumar Ghosh (New Central Book Agency, Calcutta.)
5. Fundamental of Organic Chemistry: T.W. Graham, (Wiley, International, New York.)
6. Organic Chemistry, by John McMurry, Fifth Edn, (Asian Books Pvt. Ltd)

Pharmaceutical Chemistry -IV (Organic)
(Practical)(3 hrs/Week)

Qualitative analysis of binary mixtures (Minimum 12 mixtures).

a) Solid solid mixtures

b) Liquid solid mixtures

Recommended Books :

1 A text book of Practical Organic Chemistry Vogel- Longmann..

2 Practical Organic Chemistry F. G. Mann and Sounders. Orient Longmann , UK

3 Analytical Chemistry, Gray D. Chrisston, (University of Washington) 4th Edition.

4 The Systematic Identification of Organic Coumpounds – Shriner Hermann, Morril, Curtin and Fuson 8th Edition , Wiley

Pharmaceutical Biochemistry - I
(Theory) (3 Hrs/Week)
(42 lectures)

SECTION-I

1. Introduction to biochemistry: Scope of the subject in Pharmaceutical Sciences, Biochemical reactions, Highlights of Prokaryotic and eukaryotic cell metabolism.

2. Principal methods and techniques used in biochemistry. Impact of biochemical study on nutrition, preventive medicine and drug interaction etc. Methods of separation and purification of bimolecules. Precipitations, Chromatographic methods gel filtration, ion-exchange and affinity–chromatography. Electrophoresis.

3. Biomolecules:

Introduction to molecular organization of biological system, study biomolecules.

Proteins: Introduction, functional classification. Amino acids: Classification, Physicochemical properties, optical activity, reaction with ninhydrin, formaldehyde, R-group amino acids. Essential, non- essential amino acids, deficiency. Structure: Peptide bond, end group analysis. ~ Helix, ·:·· sheet structure. Tertiary, Quaternary structure, Globular Protein, Fibrous protein, medicinally important amino acids.

Carbohydrates:

Polysaccharides used in pharmaceuticals, complex carbohydrates, study of structure of Stach, agarose, glycogen etc.

Lipids:

Definition, Classification, Functions, Types of fatty acids and its biological role.

SECTION-II

4. Biomembrane:

Biochemistry of extracellular and intracellular communication structure and function,concept of artificial memebrane and liposome,

fluid mosaic model of membrane

Transport hypothesis:

Active and passive facilitated transport, Na^+, K^+, H^+ pumps. Glucose transport, excitable membrane,Ping –Pong mechanism, concept of co-transport.

Specialized membrane functions transmission on nerve impulse, endocytosis, exocytosis and disease associated with membrane.

5. Enzymes:

Introduction, Classifications, (according to the reaction catalysis and sources)

Structure of enzymes, Co- factor, active sites Km, Vmax, Double reciprocal plot, effect of active substrates, pH ionic strength, conc., temperature on rate of enzymes reactions. Enzyme inhibition (Competitive, Non- competitive, irreversible). Concept of antimetabolites.

Manufacturing of medicinal compounds by enzymatic reactions. Penicillin-acylase for the production of 6-APAacid.Therapeutic uses of enzymes.

Pharmaceutical Biochemistry-I
(Practical) (3 Hours/Week)

1. Isolation of Protein and Characterization by Electrophoresis.
2. Estimation of Vitamin-C
3. Estimation of amino acid by formal titration
4. Estimation of dextrose by hypoiodate method.

5. Determination of acid value of oil.
6. Separation of albumin and globulin from egg white
7. Amino acid identification by color reactions (6 samples) (3 practicals)
8. Separation of amino acid by paper chromatography
9. Introduction to colorimeter.
10. Colorimetric estimation of protein by Biuret method
11. Colorimetric estimation of amino acid (2 Practicals)
12. Use of computer technology to understand three dimensional structure of proteins,Study of protein structure from library of available protein structure.
13. Study of salivary amylase.

Recommended Books:

1. Principles of biochemistry by Albert Lehninger, (CBS Publishers and distributors, Pvt Ltd. Delhi.)
2. Biochemistry by Lubert Stryer, W.H (Freeman and company, New York.)
3. Harpers biochemistry by R.K.Murray, D.K.Granner, P.A.Mayes, (Practical Hall international Inc.).
4. An introduction to practical biochemistry by David T.Plummer, (Tata Mc Graw Hill Publishing Company, Ltd., New Delhi.)
5. Practical clinical biochemistry Harold Varley, (CBS Publishers and distributors, Delhi.)
6. Molecular biology by J.D.Watson, (The Benjamin/Cummings Company.Inc.)

Pharmaceutical Engineering II

(Theory) (3 Hrs/Week)

(42 lectures)

SECTION I

1. Heat Transfer :

Conduction, Convection and Radiation transfer. Dimensional analysis, heat transfer between fluid and solid boundary, heat transfer to boiling liquids, and condensing vapor's. Heat exchangers: types and applications, steam traps.

2. Evaporation :

Theory, Evaporators: pan, tubular, wiped film and centrifugal rotary evaporators. Vapor recompression and scale formation.

3. Distillation :

Vapor – liquid equilibrium, Distillation of miscible systems, boiling point diagram, equilibrium distillation, differential distillation, rectification, fractionating column, heat and material balance, factors influencing plate efficiency, molecular distillation, separation of azeotropes, distillation of immiscible system.

4. Drying:

Mechanism, theory of drying. Factors affecting drying, equipment: tray dryers, fluidized bed dryer, spray dryer, freeze dryer, flash dryer, drum dryer, Infra red drying, radiofrequency Drying.

SECTION II

5. Crystallization:

Crystal form, theories of supersaturation, nucleation, crystal growth, classification of crystallizers, tank Swenson Walker, vacuum, circulating magma, DTB and growth type crystallizer. Caking of crystals.

6. Advances in Particle Engineering:

Principle, techniques and applications for various Techniques of Granulation: - Extrusion, Pelletisation, Fluidized bed granulation, Roller compactor. Melt and Anti-solvent crystallization, Spray drying and congealing, co-crystallization.

7. Machines for large scale manufacturing:

Principle and working of Single punch and rotary tablet compression machine, Capsule filling automatic and semiautomatic machine.

8. Materials for construction and packaging:

Materials of construction and their selection. Techniques and equipment for packaging of solid dosage form, strip, blister and pouch packaging.

Recommended Books:

1. W. McCabe, J.C. Smith, P. Harriot; Unit operations of chemical engineering; McGraw Hill.

2. W.L. Badger and J.T. Banchero, Introduction to Chemical engineering, McGraw Hill.
3. M.S. Peters, K.D. Timmerhaus; Plant design and economics for to chemical engineers; McGraw Hill.
4. E. Ganderton; Pharmaceutical Unit Operating Academic Press
5. Perry's Handbook of Chemical Engineering; McGraw Hill.
6. A. R. Paradkar, Pharmaceutical Engineering, Nirali Prakashan.
7. Atmaram Pawar, Introduction to Pharmaceutics, Career Publication.

Community Pharmacy & Hospital Pharmacy

(Theory) (3 Hrs/Week)

(42 lectures)

SECTION: I

1. Definition, scope, of community pharmacy, Roles and responsibilities of Community pharmacy

2. Community Pharmacy Management

a) Selection of site, Space layout, and design

b) Staff, Materials- coding, stocking

c) Legal requirements & code of ethics

d) Maintenance of various registers

e) Use of Computers: Business and health care soft wares

3. Pharmaceutical care

Definition and Principles of Pharmaceutical care.

4. Patient counseling

Definition, Outcomes, various stages, barriers, Strategies to overcome Barriers, Patient counseling aids. Information leaflets, pictograms, advisory labels. Typical examples of prescription and non-prescription medicines.

5 . Patient medication adherence

Definition, Factors affecting medication adherence, role of pharmacist in improving the adherence.

6. Health screening services

Definition, importance, methods for screening: Blood pressure/ blood sugar/ lung function and Cholesterol testing

7. Responding to symptoms of minor ailments

Common drug therapy and non-pharmacological therapy to Pain, GI disturbances (Nausea, Vomiting, Dyspepsia, diarrhea, constipation), Pyrexia, Opthalmic symptoms, worms infestations.

8. Essential Drugs concept and Rational Drug Therapy

SECTION: II

9. Definition, scope, of Hospital Pharmacy, Standards Roles and responsibilities of Hospital Pharmacist

10. Hospital Pharmacy Management

Types of Hospitals, Space, layout, Organization, Pharmacy procedure manuals.

11. Hospital Drug Policy

Pharmacy and Therapeutic Committee, Hospital formulary, non-formulary medicines. Antibiotic policy.

12. Drug Distribution:

Distribution of charged and noncharged drugs, drug distribution to in-patient, Outpatient and ambulatory patient. Distribution of Controlled Drugs.

13. Inventory Control

Definition, various methods of Inventory Control, ABC, VED, EOQ, Lead time, safety stock

14. Central Sterile Supply Department:

Location, layout, management of CSSD, sterilization techniques, various hospital pharmacy equipments and surgical sets.

15. Special services :

Role of Pharmacists in Chemotherapy, Intravenous Admixture Programme, Radipharmaceuticals (excluding details about formulation and technology).

Recommended Books :

1. Ravikumar and Miglani, Pharmacy Practice, Career.

2. Parthsarathi, Nahata, Clinical Pharmacy Practice, Orient Longman
3. Atmaram Pawar, Handbook for Community Pharmacists, Career,
4. Tipnis and Bajaj Clinical Pharmacy, Career.
5. W.E. Hassan; Hospital Pharmacy; Lee and Febiger.
6. Atwood and Florence; Hospital Pharmacy; (Blackwell Scientific Publication)
7. Merchant and Qadry; Hospital Pharmacy; (B.S. Shah Prakashan Ahmedabad)

Human Anatomy and Physiology-Ii

(Theory) (3 Hrs/Week)

(42 lectures)

SECTION –I

1. Urinary system- Anatomy and physiology of parts of urinary system, structure of nephron, formation of urine, Renin-angiotensin system, Balance (acid base, electrolyte and water), renal clearance tests and physiology of micturition, disorders of urinary system (definitions only)
2. Endocrine system- Anatomy and physiology of hormones of pituitary gland, adrenal gland, thyroid gland, parathyroid gland, pancreas, gonads (testis and ovary), disorders of endocrine system (definitions only)
3. Sense organs- Anatomy and physiology of ear and eye, disorders of eye and ear (definitions only)
4. Muscular system- Characteristics and functions of muscle tissue, neuromuscular junction, physiology of muscle contraction, disorders of muscular system (definitions only)

SECTION II

5. Nervous system- Classification of nervous system, Anatomy and physiology of parts of brain (cerebellum, pons, medulla oblongata, thalamus, hypothalamus, and functional areas of cerebrum), extra pyramidal system, limbic system, Spinal cord (Structure and reflexes), cranial nerves (Names and functions), Autonomous nervous system (sympathetic and parasympathetic), fundamentals of neurotransmitters, process of neuroconduction and neurotransmission

6. Reproductive system- Anatomy and physiology of various parts of male and female reproductive systems, physiology of menstruation, spermatogenesis and oogenesis, disorders of reproductive system (definitions only)
7. Integumentary system: Structure and functions of skin, thermoregulation.
8. Sports physiology: Muscles in exercise, respiration in exercise, CVS in exercise, body heat in exercise, body fluid and salts in exercise

Recommended Books

1. Chatterjee, C.C., Human Physiology. Medical Allied Agency, Kolkata.
2. Chaudhari S K. Concise Medical Physiology.New Central Book Agency (P) Ltd., Calcutta.
3. Ganong, W.F., 2005. Review of Medical Physiology. Prentice-Hall International, London.
4. Guyton, A.C., Textbook of Medical Physiology. W. B. Saunders Co., Philadelphia, USA.
5. Jain, A.K., Textbook of Physiology. Avichal Publishing Co., New Delhi.
6. Singh, I., BD Chaurasia's Human Anatomy. CBS Publisher and Distributors, New Delhi.
7. Tortora, G.J. and Grabowski, S.R., 2005. Principals of Anatomy and Physiology. Harper Collins College Publishers, New York.
8. Vander, A.J., Sherman, J.H. and Luciano, D.S., Human Physiology. McGraw-Hill Publishing Co., USA.
9. Wagh, A. and Grant, A., Ross and Wilson's Anatomy and Physiology in Health and Illness. Churchill-Livingstone, London.
10. West, J.B., Best and Taylor's Physiological Basis of Medical Practice. Williams and Wilkins, Baltimore, USA.
11. Worwick, R. and Williams, P., Gray's Anatomy. Longman, London.

Human Anatomy and Physiology-II
(Practical)(3Hrs/Week)

1. Determination of Total WBC count of blood
2. Determination of Differential WBC count of blood
3. Determination of Bleeding time

4. Determination of Clotting time
5. Recording of respiratory volume of healthy volunteer
6. Study of following systems with the help of models and charts
    a. Urinary system
    b. Endocrine system-
    c. Reproductive system
    d. Nervous system
    e. Sense organs
7. Histology- Study of permanent slides of organs and tissues
8. Study of different family planning devices

Recommended Books

1. Chaudhari, A.R., Textbook of Practical Physiology. Paras Publishers, New Delhi.
2. Chaudhari, A.R., Viva in Physiology. Paras Publishers, New Delhi.
3. DiFiore-Mariano, S.H., Atlas of Human Histology. Lea and Fabiger, Philadelphia.
4. Garg, K., Bahel, I. and Kaul, M., A Textbook of Hiostology. CBS Publishers and Distributors, New Delhi.
5. Goyal, R.K., Patel, N.M. and Shah, S.A., Practical Anatomy, Physiology and Biochemistry. B. S. Shah Prakashan, Ahmedabad.
6. Ranade, V.G., Joshi, P.N. and Pradhan, S., Textbook of Practical Physiology. Pune Vidyarthi Griha Prakashan, Pune.
7. Singh, I., BD Chaurasia's Human Anatomy. CBS Publisher and Distributors, New Delhi.
8. Singh, I., Textbook of Human Histology. Jaypee brothers Medcial Publishers, New Delhi.

Computer Applications
(Practical) (3Hrs/Week)

A. Student should understand following :

a) Information Technology: Software application, browsers, Word processors, Spreadsheets, database, management systems, presentation graphics, software suits.

b) System software: System software, operating systems, utilities, device drivers, language translators.

c) System Unit: System Unit, electronic data and instructions, system board, microprocessor, memory, system clock, bus lines, parts and cables.

d) Input and output : Input devices, output devices and combining input and output devices (storage devices)

e) Connectivity: Communication channels, communication devices, data transmission, networks and their architecture, network types.

B. Compulsory Practical Assignments:

a) To prepare multimedia presentation on any topic related to pharmacy.

b) To use statistics function in Microsoft Excel for calculation of various parameters (Minimum two examples)

c) To use graph function for data presentation (At least 3 types of graphs).

d) To retrieve data from medical databases and websites for various purposes

e) To design a database for patient information.

f) To design labels for pharmaceutical preparation.

Recommended Books

1. Computing Essentials., Timothy J. O'Leary & Linda 1.0 Leary
2. "Pharmaceutical Biostatistics" by Stanford Bolton Marcel Dekker Publication.
3. Pharmaceutical & Medicines Information Management Principles and Practice. Andrew S. Robson, Elsevier Health Sciences

Environment Science
(Theory) (2Hrs /Week)

Unit1 Environmental science and its multidisciplinary nature

Unit 2 Natural resources

Unit 3 Ecosystems

Unit 4 Biodiversity

Unit 5 Pollution

Unit 6 Social issues and the environment

Unit 7 Human population and environment

SEMESTER-III

Pharmaceutical Chemistry-V (Organic)

(Theory) (3 Hrs/Week)

(42 lectures)

SECTION -I

1. Stereochemistry:

a) Geometrical isomerism, E & Z nomenclature, determination of configuration of geometric isomers.

b) Optical activity and Chirality, Symmetry, Asymmetry, and dissymmetry. Fisherprojections. Relative and absolute (R & S nomenclatures) configuration of optical isomers, Diastereomerism.

Resolution of Racemic modifications.

c) Conformational isomerism, Newman and Sawhorse Projections. Conformational isomerism in ethane and n-butane, conformations of cyclohexane, monoalkyl and dialkyl cyclohexanes, Stereo selective and stereo specific reactions, conformation in decalin.

SECTION –II

2. Synthon approach in the synthesis:

Introduction to reterosynthesis. Rules of disconnections. One group disconnection and two group disconnections.

Synthesis of benzene derivatives. Synthesis of some drugs like ibuprofen, aspirin, diclophenac, paracetamol, sulfacetamide, isoniazid, and propranolol.

3. Molecular Rearrangement Reactions:

Rearrangement of electron deficient systems, migration to carbon, oxygen, and nitrogen. Mechanism, kinetics, orientations and stereochemistry of Bayer-Villiger and Dakin oxidations, Wagner, Merewin rearrangements, Wolf and related rearrangements, Pinacol- pinacolone rearrangement. Beckman, Curtius, Lossen, Hoffman and Schmidts rearrangements.

Rearrangements of electron rich system inclusive of Stevens Witting. Sommlet, Favoroski, Neber and Benzilic acid rearrangement. Migration to double and triple bonds. Cope rearrangement to aromatic nucleus including mechanism of Fries, and Claisen rearrangements.

Pharmaceutical Chemistry – V (Organic)
(Practical) (3 Hrs/Week)

1. To study laboratory technique such as recrystallization, TLC, Extraction, and distillation. Analysis of Fats and oils.
   a) Saponification value b) Acid Value
   c) Peroxide Value d) Iodine value
2. Synthesis of at least five compounds involving rearrangement reactions

Recommended Books:

1. A text book of practical organic chemistry, A.I. Vogel 4th Edition
2. Hand book of Organic Analysis (Qualitative & Quantitative), H.T. Cloke (Arnold-Heinemann).

Pharmaceutical Biochemistry-II
(Theory) (3 Hrs/Week)
(42 lectures)

SECTION –I

1. Bioenergetics:

Biological oxidation concept of free energy, standard free energy, high energy, ATP Phosphorylation.

2. Carborhydrate Metabolism:

Anaerobic pathways of glucose metabolism, two phase of glycolysis. Alcohol fermentation, glucogenesis, homeostasis of blood sugar, Pentose Phosphate pathways: Significance and role in RBC.

Glucose metabolism TCA cycle. Disease of carbohydrate metabolism.

Lipid metabolism:

Oxidation of fatty acids, formation of ketone bodies, biosynthesis of fatty acids and cholesterol, HDLP, LDLP, Clinical significance.

Protein metabolism:

Importance of protein in diet. Digestion of proteins, Protein metabolism: Importance of protein in diet. Digestion of proteins, oxidative degradation of amino acids,

Transamination, urea formation. Genetic disorders of amino acid metabolism. Physiologically important substance from amino acids histamine, serotonine, dopamines etc.

3. **Nutrition:**

Energy metabolism: BMR, Role of nutrients, Kwashiorker and Marasmus.

SECTION-II

4. Nucleic acids:

Chemical composition, as generic material nucleosides, nucleotides, structure, biochemical functions, replication, flow of genetic information, transcription, translation, genetic code, gene expression, disorder, recombinant DNA. Mutation molecular basis, point, frame shift mutations.

5. Vitamins:

Structure and biochemical functions of fat soluble and water vitamins deficiency manifestations and RDA.

6. Mineral metabolism, Calcium, Phosphorus, Iron, Iodine.

7. Clinical biochemistry

a. Acid base balance, electrolyte balance.
b. Liver functions tests
c. Kidney function tests
d. Immunochemical methods of diagnosis ELISA
e. Diagnostic PCR- Marker enzymes.

Pharmaceutical Biochemistry – II
(Practical) (3 Hrs/Week)

1. Estimation of serum protein
2. Estimation of serum Alkaline phosphotase
3. Estimation of serum Acid phosphotase
4. Estimation of titrable acidity and ammonia from urine
5. Estimation of bound and free acidity from gastric juice

6. Estimation of serum uric acid
7. Estimation of blood sugar
8. Estimation of blood urea
9. Estimation of serum creatinine
10. Estimation of serum bilirubin
11. Urine analysis, Normal and Abnormal constituents of urine.
12. Estimation of serum cholesterol
13. Estimation of albumin to globulin ratio of serum

Recommended Books:

1. Principles of biochemistry by Albert Lehninger, (CBS Publishers and distributors, Pvt. Ltd. Delhi).
2. Biochemistry by Lubert Stryer, W.H. (Freeman and company, New York).
3. Harpers biochemistry by R.K. Murray, D.K. Granner, P.A. Mayes, (Practical Hall international Inc.)
4. An introduction to practical biochemistry by David T. Plummer, (Tata Mc Graw Hill Publishing Company, Ltd., New Delhi).
5. Practical Clinical biochemistry Harold Varley, (CBS Publishers and distributors, Delhi)
6. Molecular biology by J.D. Watson, (The Benjamin/Cummings Company Inc.)

Pharmaceutical Analysis- I

(Theory) (3 Hrs/Week)

(42 lectures)

SECTION –I

1. Introduction to Pharmaceutical Analysis:

Different techniques of analysis, fundamentals of volumetric analysis, methods of expressing concentrations, expressions of analytical results, errors involved in pharmaceutical analysis, types of errors, minimization or errors, calibration of volumetric apparatus.

2. Aqueous Acid base titrations:

Definition of acid and base, Acid base equilibrium, law of mass action, dissociation constants for strong acids and bases, weak acid and base, hydrolysis of salts, buffer index, neutralization curves, theory of indicators, mixed indicators, preparation of standard solutions, acid base titrations. (Application in assay of Aspirin, Boric Acid).

3. Non-aqueous Acid Base titration :

Theoretical consideration, Limitations, types of solvents and their properties, ionization and dissociation in non-aqueous solvents, determination of weak acid and base, Indicators in non- aqueous titrations, preparation of standard solutions, non-aqueous end point detection.(Application in assay of Norfloxacin, Sodium acetate, determination of amides, imides, barbiturates).

SECTION-II

4. Oxidation reduction titration:

Theory of redox reactions and titrations, measurement of electrode potential, redox curve, redox indicators, titration involving Potassium permanganate, iodine titrations (Iodometry and Iodimetry) and Ceriometric titrations. (Applications in assay of Ferrous sulfate, Hydrogen peroxide).

5. Complexometric titration:

Theory of complex formation and its stability, titration curves, metallochromic indicators, types of EDTA titrations, masking and demasking agents. (Application in assay of Magnesium sulphate and Calcium gluconate).

6. Precipitation titrations:

Theory of Precipitation reaction, factors affecting solubility of a precipitate, Precipitation titration methods, Indicators used in precipitation titration. (Application in assay of Potassium Chloride, Sodium Chloride injection).

Reference Books:

1. Practical Pharmaceutical Chemistry (Part-I & II) A.H. Beckett and J.B. Staenlake, (University of London, Antholone Press).
2. A Textbook of Pharmaceutical Analysis, K.A. Conners, (John Wiley and Sons).
3. Analytical Chemistry, Gary D. Chrisston (Wiley) University of Washington.
4. A Textbook of Quantitative Inorganic Analysis, A.I. Vogel (E.L.B.S.,London)

5. Analytical Chemsitry, J.G.Dick, (International Student Edition)
6. Principles of Pharmaceutical Analysis, H.N.More, K.R. Mahadik & A.V. Kasture Vol-I & II Nirali Prakash, Pune.

Pharmaceutical Analysis- I
(Practical) (3 Hrs. /Week)

1. General directions:

a) Laboratory requirements-apron, notebook, match box, butter paper, weighing box etc.

b) Introduction to lab. Equipments and basic lab. Operations-use and care of glass-ware, techniques of measuring careful reading of meniscus, use of bulb for pipetting, cleaning and drying of apparatus etc.

c) Discussion –concepts of analytical reagent (AR, GR, LR etc) purity and strength requirements, calculations of result etc.

2. Calibration of volumetric apparatus:

Perform the following assays as per IP including preparation and standardization of titrants.

a) Acid Base Titrations: Direct titrations of strong acids and bases, weak acids and weak bases, Back titrations with blank determination.

b) Nonaqueous titrations: Back titration with blank determination.

c) Oxidation-reduction titrations : Permangnate titrations, Iodine titrations.

d) Complexometric Titrations: EDTA titrations.

e) Precipitation titrations: Direct titrations with silver nitrate, ammonium thio-cyanate

f) Gravimetric analysis of sodium sulphate.

Reference Books:

1. Practical Pharmaceutical Chemistry (Part-I & Part-II) A.H. Beckett and J.B. Staen-lake, (University of London, Anthlone Press).
2. A Textbook of Pharmaceutical Analysis, K. A. Conners, (John Wiley and Sons)

3. Analytical Chemistry, Gary D. Chrisson (Wiley) University of Washington 4th edition
4. A Textbook of Quantitative Inorganic Analysis, A.I. Vogel (E.L.B.S., London)

Physical Pharmacy –I
(Theory) (3 Hrs/Week)
(42 lectures)

SECTION - I

1. Intermolecular Forces and Gaseous state of matter:

Binding forces between molecules; Gaseous State: Deviation from gas theory, compressibility factor, van der Waal's equation for real gases, Law of corresponding states (only equation), critical constants and their determination, Liquefaction of gaseous and its application to pharmacy.

2. Phase Rule:

Gibbs phase rule, one component (water), two component (phenol- water and eutectic mixtures) and three component system.

3. Solutions of non-electrolytes:

Properties and types of solutions, ideal and real solutions, various concentration terms, Raoults law and its deviations, colligative properties: elevation of boiling point, depression of freezing point and osmotic pressure. Problems on colligative properties.

SECTION – II

4. Solutions of electrolytes:

Equivalent and specific conductance, conductometric titrations, Arrhenius theory, Debye Hückel theory, colligative properties of electrolytes.

5. Solubility and Distribution Phenomena

Solute solvent interactions, solubility of gases in liquids, liquids in liquids and solids in liquids: solubility of slightly soluble electrolyte, solubility of weak electrolyte, influence of pH, solvents, solubility parameters and combined effect of pH and sol-

vents.Distribution Phenomenon: Nernst distribution law and its limitations, effect of ionic dissociation and association, application in pharmacy.

6. Chemical kinetics :

Reaction theories, rate, order and molecularity, Mathematical treatment of zero, first and second order, determination of order, influence of temperature, Arrhenius equation and activation energy, Decomposition and stabilization of medicinal agents, accelerated stability studies. Problems based on zero, first and second order kinetics.

Physical Pharmacy – I
(Practical)(3Hrs/Week)

1. Determination of molecular weight by Rasts camphor method
2. Two component system: Phenol-water and eutectic system (2 Experiments)
3. Three component system: Ternary phase diagram
4. Determination of solubility of benzoic acid in solvents of different dielectric solvents.
5. Determination of partition coefficient of iodine between carbon tetrachloride and water.
6. Determination of association number of benzoic acid for distribution between benzene and water.
7. Determination of normality of a given acid by conductometric titration.
8. Determination of order of hydrolysis of methyl acetate (first order reaction)
9. To find degree of hydrolysis of second order reaction where a = b.
10. Determination of order of reaction by half life method.
11. Accelerated stability studies and shelf life determination of pharmaceuticals

Recommended Books:

1. A.N Martin; Physical Pharmacy, Lea and Febiger, Philadelphia
2. A.T Florence; Physicochemical Principles in Pharmacy.
3. Glasstone and Lewis; Elements of Physical Chemistry; McMillan Press
4. B.P.Levitt ; Findlay's Practical Chemistry; Longman.

5. A.M. James ; Practical Physical Chemistry; Longman.
6. C.D.Cornwell and J.E. Harrison; Experimental Physical Chemistry; McGraw Hill.
7. H.J.Arnikar, S.S.Kadam and K.N.Gujar,. Essentials of Physical Chemistry and Pharmacy - Orient Longman, Mumbai

Pharmaceutical Microbiology-I

(Theory) (3 Hrs/Week)

(42 lectures)

SECTION-I

1. Introduction to Microbiology:

Scope and applications of pharmaceutical microbiology, Classification of micro-organisms-Whittaker's five kingdom concept, Classification of microbes into bacteria, fungi, rickettsia, viruses, protozoa, algae and actinomycetes. Historical developments- contribution of Louis Pasteur, Robert Koch, Paul Ehrlich in microbiology, Discovery of antibiotics.

2. Microscopy:

Principle and applications of compound microscope, Dark- field, phase contrast and fluorescence microscope. Different parts of compound microscope, resolving power, magnification power, numerical aperture and working distance. Introduction to electron microscopy.

3. Biology of micro-organisms:

a) Bacteria:

Size, shape, structure, cell wall, capsules, spores, flagella and other parts of bacteria. reproduction, genetic exchange, growth, growth requirements, growth curve, culture media, measurements of bacterial growth, counting methods, colony characteristics, methods for isolations. Identification and preservation of microbial cultures, various staining techniques. Characteristics of Staphylococcus, Pseudomonas, Escherichia and Salmonella.

b) Yeasts and moulds:

Introduction, characteristics and applications of Saccharomyces cerevisiae, Candida albicans, Penicillum and Aspergillus.

c) Rickettsia:

Introduction and pathogenesis.

d) Actinomycetes:

Isolation and importance.

SECTION II

4. Biology of micro-organisms:

Viruses:

Introduction, general properties, structure, bacteriophage-lytic and lysogenic growth cycle. Human viruses-cultivation and multiplication.

5. Sterilization:

Different methods- dry heat, moist heat, gaseous, radiation and filtration. Sterilization monitors, Sterilization criteria- D-value, Z-value and others. Designing of aseptic area, laminar air flow, Sterility testing of pharmaceutical products as per I. P.

6. Disinfection:

Chemical classification of different disinfectants, dynamics and factors affecting disinfectant action, selection of disinfectants, methods used for evaluation of disinfectant, Phenol coefficient test.

7. Biohazards:

Importance

Pharmaceutical Microbiology-I

(Practical) (3 Hrs/Week)

1. To study the principle and working of microscope, Laminar air flow, autoclave, hot air oven and incubator and other laboratory equipments.
2. Preparation and sterilization of nutrient broth, nutrient agar, slants, stabs and plates.
3. To study different techniques of Inoculation of culture on different types of media.
4. Isolation of pure culture by streak plate technique.
5. Isolation of pure culture by pour plate technique.
6. Study of fungi with respect to morphology (wet mount).
7. Observation of motility of bacteria by hanging drop technique.

8. Identification of isolated bacteria by simple, negative, gram and endospore staining,
9. To study cultivation and growth characteristics of fungi and bacteria

Recommended Books:

1. Ananthanaryan R. and Panikar C.K. J., Text book of Microbiology Sixth Edition,Orient Longman limited.
2. Baird, R.M., et.al (eds), (2000). Handbook of Microbiological Quality control Pharmaceutical and Medical Devices, Taylor and Francis Inc., London.
3. British Pharmacopoeia, (1993), London, HMSO
4. Cappuccino, J.G. anmd Sherman N., (1992), Microbiology – A Laboratory Manual, Third Edition, The Banjamin/ Cumming Publishing Company.
5. Carter S.J. (1996). Copper and Gunn's Tutorial Pharmacy, CBS Publishers and Distributors, Delhi.
6. Collee J.G. et al., (1996). Mackie and McCartney Practical Medical Microbiology, Fourteen Edition,Churchill Livingstone Publications, New York.
7. Hugo W.B. and Russel A.D., (1998) Pharmaceutical Microbiology, sixth Edition, Backwell Science.
8. Indian Pharmacopoeia, (1996) Govt. of India, Ministry of Health and Family Welfare.
9. Pelczar M.J. et.al., (1986), Microbiology, fifth Edition, MaGraw Hill, New York.
10. Rawlins E. A. (eds), (1992), Bentley's textbook of Pharmaceutics, Eighth Edition, Bailliere Tindall, London.

Pathophysiology

(Theory) (3 Hrs/Week)

(42 lectures)

SECTION I

1. Basic principles of cell injury and adaptation.Causes, pathogenesis and morphology of cell injury. Abnormalities in lipoproteinemia, glycogen infiltration and glycogen storage disease.

2. Basic mechanisms of inflammation and repair – Pathogenesis and mediators in inflammation. Chronic inflammation. Wound repair and healing.
3. Effect of radiation, Environmental carcinogenesis.
4. Pathophysiology of Malignancy Disturbances of growth of cells, general biology of tumors, etiology and pthogeneis of cancer, Invasions, metastasis and spread of cancer.
5. Pathophysiology of allergy, hypersensitivity and autoimmune diseases.

SECTION II

Pathophysiology of common diseases involving various organ systems.

6. Cardiovascular system: Pathophysiology of hypertension, ischemic heart diseases (angina & infarct), congestive cardiac failure, cardiac arrhymias shock.
7. Respiratory system: Pathophysiology of bronchial asthma, pneumonia, tuberculosis, chronic obstructive air way diseases.
8. Digestive system: Pathophysiology of Peptic ulcer, amoebic and bacillary dysentery, hepatitis, typhoid fever.
9. Central nervous system: Pathophysiology of epilepsy, paralysis, psychosis, schizophrenia, depression. Parkinsonism, sleep disorders.
10. Urinary system: Pathophysiology of urinary tract infections, acute and chronic renal failure
11. Reproductive system: Pathophysiology of sexually transmitted diseases including HIV.
12. Endocrine system: Pathophysiology of diabetes mellitus

Recommended Books:

1. General Pathology: Bhende, YM, Deodhare, SG, Kelkar, SS (popular Prakashan)
2. Essential Pathology-Rubin, E, Farber, J (Lippincott)
3. Robins Pathological basis of Diseases, Indian Edition (Prism)
4. A Textbook of Pathophysiology: Bodhankar SL and Wyavahare, NS (Pragati Prakashan, Pune)

SEMESTER-IV

Pharmaceutical Chemistry-VI (Organic)

(Theory) (3 Hrs/Week)

(42 lectures)

SECTION-I

1. Free Radicals:

Stable free radicals, radical ions, radical coupling reactions, substitution at saturated carbons, addition to olefins, and aromatic substation.

2. Chemistry of carbohydrates

Introduction, classification and Chemistry of C5 and C6 sugars and cyclic structures /glycosides. Mutarotation, structures of common diasaccharides and starch.

SECTION-II

3. Chemistry of heterocyclic compounds :

Structures and numbering and corresponding drugs of the following. Heterocyclic compounds : furan, thiophene, pyrrole, pyrazole, thiazole, imidazole, oxazole, isoxazole, hydantoin, pyridine, pyridazine, pyrimidine, indole, benzofuran, benzothiazole, benzimidazole, benzoxazole, quinoline, isoquinoline, cinnoline, purine, xanthine, pteridine, coumarin, synthesis abnd reaction of following compounds: furan, thiophene, pyrrole, indole imidazole, thiazole, pyridine, quinoline and ioquinoline.

4. Chemistry of Amino acids:

Structure of natural amino acids,isoelectric point.

Charcterisation and methods of preparation and reactions of amino acids.Peptide bonds,structures of some biologically important simple peptides, protein classification and structures.

Recommended Books:

1. Stereochemistry of Carbon compounds by E.L. Eliet, (Tata McGraw Hill Publishing Co. Ltd., New Delhi).
2. Stereochemistry by Nasipuri (Wiley Eastern Ltd.,) 1st Edition.
3. Mechanism and Structures in Organic Chemistry, J. March, (Wiley) Eastern Edition) 2nd Edition.

4. Advanced Organic Chemistry, J. March, (Wiley) Eastern Edition) 2nd Edition.
5. Principles of Organic Chemistry by Norman (Chapman & Hall)
6. Organic Chemistry by Morrison Boyd, (Prentice Hall of India (P) Ltd., New Delhi.
7. Heterocyclic Chemistry by Joule and Smith, (E.L.B.S., London)
8. Organic Chemistry, Fieser and Fieser, (Asia Publishing House).
9. Designing Organic synthesis – a synthone approach – by Sturat and Warren John Wiley & Sons.

Pharmaceutical Chemistry-VI (Organic)
(Practical) (3 Hrs/Week)

1. Quantitative determination of reactive groups-Hydroxyl, Primary and Secondary amines, esters, amides and carbonyl phenol.
2. Syntheses of at least five heterocyclic compounds.

Reference Books:

1. A text book of practical organic chemistry, A.I.Vogel 4th Edition.
2. Hand book of Organic Analysis (Qualitative and Quantitative), H.T. Clarke (Arnold Heinemann).

Pharmaceutical Analysis-II
(Theory) (3 Hrs/Week)
(42 lectures)

SECTION-I

1. Introduction :

To instrumental methods.

2. Potentiometry:

Definition of pH, types of indicator and reference electrode, pH glass electrode, construction working pH meter potentiometer, instrumentation applications and calibration.

3. Polarography:

Introduction, principle involved, advantages, disadvantages of dropping mercury electrode, polarographic instrumentation and applications.

4. Amperometry:

Principle involved instrumentation, titration cures, advantages and application.

SECTION-II

5. Polarimetry:

Introduction, theory of plane polarized light, circularly polarized light, measurement of optical rotation, applications and calibration.

6. Refractometry:

Introduction, factors affecting, principle involved, specific refraction, molar refraction, instrumentation, application and calibration.

7. Gravimetric analysis:

Precipitation techniques, solubility product, fractional precipitation, supersaturation, co-precipitation, post precipitation, digestion, filtration, drying and ignition, weighing and calculation. (Application in assay of Calcium as Calcium Oxalate and Magnesium as Magnesium Sulphate).

8. Conductometry:

Introduction, principle, instrumentation, titration curve, determination of end point and applications.

Recommended Books:

1. Practical Pharmaceutical Chemistry (Part-I & II) 3rd Edition A.H. Beckett and J.B. Staenlake, (University of London, Anthlone Press)
2. A Text book of Pharmaceutical Analysis, K.A. Conners, (John Wiley and Sons)
3. Principles of Instrumental Analysis by Doglas A. Skoog
4. A Textbook of Pharmaceutical Chemistry, (Vol. I & II) L.K. Chatten, (Marcel Decker, New York).

Pharmaceutical Analysis-II
(Practical) (3 Hrs/Week)

1. Calibration of pH meter using different buffers
2. Determination of unknown strength of a solution by pH meter
3. Determination of pKa of phosphoric acid
4. Calibration of conductometer

5. Titration of Strong acid strong base by conductometry
6. Titration of Weak acid strong base by conductometry
7. Calibration of Refractometer
8. Determination of RI of oils
9. Determination of specific conductance and unknown concentration of a sugar sample by Polarimetry.
10. Determination of order of reaction of glucose mutuarotation by Polarimetry

Reference Books

1. Practical Pharmaceutical Chemistry (Part-I & II) 3rd Edition A.H. Beckett and J.B. Staenlake, (University of London, Anthlone Press).
2. A Textbook of Pharmaceutical Analysis, K.A. Conners, (John and Wiley and Sons)
3. Indian Pharmacopoeia, British Pharmacopoeia, United States Pharmacopoeia.

Physical Pharmacy -II
(Theory) (3 Hrs/Week)
(42 lectures)

SECTION - I

1. Surface and interfacial Phenomenon :

Surface and interfacial tensions, surface free energy, measurement of surface and interfacial tensions, spreading coefficient, adsorption at liquid-interfaces: Surfactants (Types, HLB scale and its applications including wetting, foaming, anti-foaming and micellar solubilization), soluble monolayer and Gibb's equation, insoluble monolayer and film balance; adsorption at solid interfaces: adsorption isotherms (Langmuir and Freundlich), measurement of surface free area.

Electrical properties at Interfaces: Nernst and Zeta potential, electrical double layer

2. Colloids :

Introduction and types, optical, kinetic and electrical properties of colloids, Stabilization of colloidal system, DLVO theory, Schulze Hardy rule, Hoffmeister series applications in Pharmacy.

3. Coarse dispersions and emulsions:

Interfacial and thermodynamic properties of suspended particles, settling in sus-

pensions, theory of sedimentation, effect of Brownian movement, sedimentation of flocculated particles, sedimentation parameters, wetting of particles, controlled flocculation, emulsions types theories physical stability, preservation of emulsions, rheological properties of emulsions, phase equilibria and emulsions formulation, multiple emulsions. Semisolid dispersions.

SECTION - II

4. Solid State:

Crystal analysis, X-ray diffraction studies, polymorphism: types and significance.

5. Micromeritics:

Introduction and pharmaceutical importance, particle size and distribution, particle shape, particle volume, particle number, surface area, methods for determining particle size, particle volume measurement, specific surface, methods for determining surface area, Derived properties of powder porosity packing arrangement densities, bulkiness-flow properties of powder, angle of repose, factors affecting flow of powders.

6. Compaction and Compression:

Theory, thermodynamics, mechanisms of densification and strength producing, force **distribution during compression, material properties, factors affecting.**

7. Rheology :

fundamentals of rheology, types of flow, quantitative measurement of flow, mechanical models to illustrate flow on viscoelasticity, thixotropy, measurement of thixotropy in formulation, rheology of disperse system, pharmaceutical application of rheology, Methods of viscosity measurements.

Physical Pharmacy-II
(Practical) (3 Hrs/Week)

1. Determination of surface tension
2. Determination of CMC of a surfactant
3. Determination of specific surface area of charcoal by adsorption.
4. Preparation of colloid by condensation method and dispersion method and its analysis (2 Experiments)
5. Determination of derived properties of powders like density, porosity, compressibility angle of repose etc.

6. Determination of particle size distribution by sieve analysis and optical microscopy.
7. Determination of Sedimentation volume and degree of flocculation (2 expts).
8. Determination of molecular weight of polymer by viscosity.
9. Determination of viscosity by capillary and Brookfield viscometer (2 expts.)

Recommended Books:

1. A.N Martin; Physical Pharmacy, Lea and Febiger, Philadelphia
4. A.T Florence; Physicochemical Principles in Pharmacy.
5. Glasstone and Lewis; Elements of Physical Chemistry; McMillan Press
4. B.P.Levitt ; Findlay's Practical Chemistry; Longman.
5. A.M. James ; Practical Physical Chemistry; Longman.
6. C.D.Cornwell and J.E. Harrison; Experimental Physical Chemistry; McGraw Hill.
7. H.J.Arnikar, S.S.Kadam and K.N.Gujar,. Essentials of Physical Chemistry and Pharmacy - Orient Longman, Mumbai

Dosage Form Design – I
(Theory) (3 Hrs/Week)
(42 lectures)

SECTION-I

1. Concept of formulation design

Pre formulation studies: Significance and testing of physicochemical properties in design of non-sterile dosage forms.

Formulation design:

Physicochemical, Therapeutic, biopharmaceutical, cosmetic and aesthetic criteria of formulation.

Microbial contamination in non-sterile products: Total aerobic viable count, control on specific microorganisms.

2. Monophasic Liquid :

Formulation Development: Solubility, solubility enhancers, various additives and factors affecting their selection. Manufacturing: Processing, layout and selection of equipment. In process quality control and quality control parameter.

3. Suspensions : Formulation development:

Crystal characteristics, solubility, stability of drug. Types of suspensions. Selection of additives suspending agent, structured vehicle, flocculating agents, chemical stabilizers, preservatives etc. Manufacturing: Processing and equipment. In process quality control and quality control parameters.

SECTION –II

4. Dry syrups:

Reasons, drug properties and selection of additives, processing, layout, manufacturing and evaluation.

5. Emulsions:

Formulation development: Selection of drug oil phase and additives. Types of emulsion. Formation of emulsion with or without phase inversion. Manufacturing: Processing and selection of equipment. In process quality control and quality control parameters. Packaging and labeling of liquids formulations. Introduction to multiple and microemulsions.

6. Biotechnology based Pharmaceuticals:

Protein structure, mechanism and causes of protein destabilization, formulation approaches to protein stabilization.

7. Suppositories:

Physiological consideration, selection of bases, drug related aspects, manufacturing, packaging, evaluation.

Dosage Form Design-I
(Practical) (3hrs. /Week)

1. Formulation approach: Survey/assignments related to types of marketed liqids/semi-solids formulations,composition,containers,labels,expiry period,economy,acceptance drug products,out of these one oral presenatation.
2. Design of scientific literature/detailing manual and lable for proprietatry products.
3. Preformulation of a drug and excepients
4. An assignment on design of formulation, selection of process ,equipments,pacakaging,lables for a formulation

5. Formulation design, processing, manufacturing and evaluation of following:
   I. Monophasic Liquids (3)
      1. Paracetamol syrup/elixir
      2. Chlorpheniramine Maleate syrup
      3. Piperazine citrate elixir
      4. Paediatric drops
   II. Suspensions
      1. Calamine Lotion
      2. Milk of Magnesia/antacid suspension
      3. Paracetamol suspension
   III. Emulsion
      1. Liquid paraffin and magnesium hydroxide mixture emulsion
      2. Formulation of emulsion (HLB consideration)
      3. White liniment
   IV. Suppository using natural and synthetic bases, compressed suppositories.
   V. Solids: Dry suspension for reconstitution

Recommended Books :

1. Remington : The Science and practice of Pharmacy : Mack Publishing Company.
2. H.C. Ansel, N.G. Prporich, L.V.Allen; Pharmaceutical dosage forms and Drug Delivery Systems; Williams and Wilkins.
3. L. Lachman, H.A. Liberman, J.L.Kanig; The Theory and Practice of Industrial Pharmacy: Verghese Publishing House.
4. Bentley's : Test book of Pharmaceutics; Bailliere Tindal
5. G.S.Banker, R.K.Chalmers; Pharmaceutics and Pharmacy Practice; J.B. Lippincott Company.
6. M.E.Aulton; Pharmaceutics – The science of dosage form Design; Churchill Livingstone.
7. Atmaram Pawar,Introduction to Pharmaceutics,Career Publications.
8. J.Swarbrick, J.C.Boylan; Encyclopedia of Pharmaceutical Technology; Marcel Dekker- the Vol-I.
9. K. Ridgway: hard Capsules Development and Technology ; The Pharmaceutical Press, London.

10. Liberman, Rieser and Banker, Pharmaceutical Dosage forms, Disperse system, Marcel Dekker.
11. James J. Wells, Pharmaceutical Preformulation, ellis Horwood Ltd.
12. H.A. Liberman, L. Lachman and J.B. Schwart; Pharmaceutical dosage forms, Tablets, Marcel Dekker.
13. Ansel and Loyd:Pharmaceutical Dosage Forms and drug delivery systems. B.I.Waverly.

Pharmaceutical Microbiology-II (Including Immunology)
(Theory) (3 Hrs/Week)
(42 lectures)

SECTION I

1. Microbial Spoilage and Preservation of Pharmaceutical Products:

Types of microbial spoilage, Factors affecting the microbial spoilage, Sources and types of microbial contamination, Microbial standards for non-sterile pharmaceuticals, Assessment of microbial contamination and spoilage, Microbial limit tests, Preservative efficacy test: Challenge test.

2. Microbial Assays:

Importance of microbial assays, Assay of antibiotics (Penicillin and Streptomycin) and Vitamin B_{12}.

3. Probiotics:

Properties, Mechanism and Significance of probiotics.

4. Industrial Microbiology:

Isolation of cultures, Screening of industrial important microbes, Strain improvement methods, Inoculum development, Fermentation media, Fermentation– type and design, Downstream process, Biological waste treatment.

SECTION II

5. Fundamentals of Immunology:

Microbial flora, Host-microbe interactions, Microbial virulence, Exotoxins, Endotoxins, Defense mechanism of host-specific and non-specific, Types of Immunity – natural and acquired, Immune response-cellular and humoral, adjuvants, antigens, antibodies - structure and classification.

6. Monoclonal antibodies:

Hybridoma technology, production and applications.

7. Antigen-Antibody reactions:

Introduction, precipitation, agglutation, compliment fixation, neutralization reactions, Immunofluorescence, RIA and Enzyme assay.

8. Hypersensitivity reactions:

Introduction, Immediate and delayed hypersensitivity, type - I, II, III, IV hypersensitivities.

9. Preparation of vaccines and sera:

Introduction, types of vaccines, preparation and quality control of vaccines, BCG, TAB, DPT, Polio, MMR and Rabies vaccines, Tetanus and Diphtheria antitoxins, and diagnostic preparations.

Pharmaceutical Microbiology-II (Including Immunology) (Practical) (3 Hrs/Week)

1. Determination of microbial count of air by any suitable method
2. Determination of thermal death temperature and time
3. Phenol coefficient of disinfectant
4. Sterility testing of different pharmaceutical products
   a) Injections
   b) Ophalthalmic preparations
5. Antibiotic assay – Penicillin and Streptomycin
6. Study of microbial limits of following as per I.P.
   a) Aluminum Hydroxide gel b) Starch
7. Isolation of microbes from soil for production of antibiotics and enzymes
8. Microbial study of water by TPC and MPN
9. Determination of Minimum Inhibitory Concentration (MIC)

Recommended Books

1. Akers M.J., (1994). Parenteral Quality Control, Second Edition, Marcel Dekker Inc., New York.

2. Baird, R.M. et.al. (eds), (2000). Handbook of Microbiological Quality Contrl Pharmaceutical and Medical Devices. Taylor and Francis Inc., London
3. British Pharmacopoeia, (1993), London HMSO.
4. Cappuccino, J.G. and Sherman N., (1992). Microbiology – A laboratory Manual, Third Edition, The Banjamin/cumming Publishing Company.
5. Carter S.J. (1996). Copper and Gunn's Tutorial Pharmacy, CBS Publishers and Distributors Delhi.
6. Hugo W.B. and Russel A.D., (1998), Pharmaceutical Microbiology, Sixth Edition Backwell Science.
7. Indian Pharmacopoeia, (1996), Govt. of India, Ministry of Health and Family Welfare
8. Casida L.E. (2000), Industrial Microbiology, New Age International, Delhi
9. Pelczar M.J. et.al., (1986), Microbiology, Fifth Edition, McGaw Hill, New York
10. Rawlins E., A. (eds)_, 1992. Bentley's textbook of Pharmaceutics, eighth edition, Bailliere Tindall, London.

Pharmacology- I
(Theory) (3 Hrs/Week)
(42 lectures)

SECTION-I

General Pharmacology

a) Introduction, scope and branches of Pharmacology, Sources and active ingredients of drugs

b) Sources and active ingredients of drugs
Routes of drug administration
Absorption & Factor affecting them, Concept of Bioavailability

c) Distribution & Factor affecting them

d) Biotransformation (Metabolism) & Factor affecting them

e) Excretion of drugs and Factor affecting them

f) Mechanisms of Action of Drugs (including Molecular and Biochemical Mechanisms)

g) Factors Modifying drug effects

h) Drug Dependence and Drug abuse

i) Dose-Response Relationships, Time-Response Relationships

j) Adverse Drug reactions (ADR): Epidemiology, Classification, Risk factors, Monitoring and Detecting ADR

Drug interactions: General Considerations and Mechanisms

k) Concept of New drug discovery- Pre-clinical and clinical evaluation, and toxicological studies

SECTION -II

Basic and Clinical Pharmacology of drugs acting on Autonomic Nervous System

a) Autonomic Nervous system-General Considerations
Cholinergic system and drugs

b) Anti-cholinergic drugs

c) Neuromuscular blocking agents

d) Adrenergic system and drugs

e) Anti-adrenergic drugs

Recommended Books:

1. Barar, F.S.K., Essentials of Pharmacotherapeutics; S. Chand and Company, New Delhi
2. Craig, C.R. and Stitzel, B.E.; Modern Pharmacology, Little Brown and Co, Boston
3. Crossland, James and; Lewis,s Pharmacology Basis of Therapeutics, (Pergamon Press, New York)
4. Das, M. M. .and Dutta S. K. : R. Ghosh,s Modern Concepts on pharmacology and Therapeutics, (HILTON and Co. Calcutta)
5. Goodman and Gilman; Pharmacological Basis of Therapeutics, McGraw-Hill
6. Katzung, B.G; Basic and Clinical Pharmacology, Lange Medical Publisher, USA
7. Rang, H.P. and Dale, M.M.; Pharmacology, Churchill Livingston, UK
8. Satoskar , R.S. and Bhandarkar S.D. Pharmacology and Pharmacotherapeutics (Popular Prakashan, Bombay).
9. Sharma H.L. Sharma K. K. General Pharmacology Basic Concepts. Paras Publication.
10. Tripathi K. D. Medical Pharmacology, Jaypee.

Pharmacology- I

Practical (3 Hrs/ week)

Introduction

a) Study of laboratory animals and various preparations of them used in animal experimentation.

b) Study of laboratory equipments and techniques used in experimental pharmacology

c) Study of bioassay

d) Demonstration: To study the different routes of drug administrations

Computer simulations of

i) To study effects of various drugs using isolated frog heart

ii) To study the mydriatic and miotic effects of drug/drugs on rabbit's eye

Experiments Carried Out On Isolated Preparation

To study interpolation bioassay using isolated rat ileum preparation.

Recommended Books:

1. Kulkarni, S.K.; Handbook of Experimental Pharmacology, Vallabh Prakashan, New Delhi
2. Ghosh, M.N.: Fundamental of Experimental Pharmacology, Scientific Book Agency, Calcutta
3. Sheth, U.K, Dadkar, N.K. and Kamat, U.G., Selected Topics in Experimental Pharmacology, (Kothari Book Depot, Mumbai
4. Perry, W.L.M., Pharmacological Experiments on isolated preparations, E&S, Livingston, London
5. Jaju B.P., Pharmacology: A practice Exercise book, Japee Brothers, New Delhi
6. Burn, J.H., Practical Pharmacology, Blackwell Scientific, Oxford, London
7. Lawrence, D.R., and Bacharch, A.L.; Evaluation of Drug Activities, Pharmacometrics, Academic Press
8. Turner, R.A., Screening Methods in Pharmacology, Academic Press, London
9. Thomson. E.B., Drug Bioscreening, VCH, New York
10. Vogel, H.G. and Vogel, W.H.: Drug Discovery and Evaluation: Pharmacological Assays, Springer, New York

SEMESTER-V

Medicinal Chemistry-I

(Theory) (3 Hrs/Week)

(42 lectures)

SECTION-I

1. General considerations :

Physico-chemical parameters like solubility, degree of ionization, partition coefficient affecting drug action, drug absorption, distribution, and elimination, Ferguson's principle, bioisosterism, stereochemical aspects of drug action.

2. Cholinergic agonists and antimuscarinic agents:

Neurotransmitters, generation of nerve impulse, propagation of and release of neurotransmitter in the synapse.

Biosynthesis of acetylcholine, its release and metabolism. Muscarinic receptors with their subtypes and structural features.

Drug design, classification, mode of action, chemistry, SAR studies, therapeutic uses and adverse effects of cholinergic agonists, cholinestrase inhibitors and antimuscarinic agents.

Synthesis of Carbachol, Bathenechol, Demecarium bromide, Dicyclomine hydrochloride.

3. Ganglionic blockers and neuromuscular blockers:

Ganglionic transmission, nicotinic receptors with their subtypes and structural features.

Classification, chemistry, mode of action, adverse effects and therapeutic uses of ganglionic stimulants, ganglionic blockers and neuromuscular blockers.

Synthesis of Mecamylamine hydrochloride, Guanithididne monosulphate, Chlorzoxazone, Dantroline sodium, Gallamine.

SECTION –II

4. Adrenergic agonists and antagonists:

Biosynthesis, release and metabolism of noradrenaline, receptors subtypes and their structural features.

Classification, SAR studies, mechanism of action, adverse effects and therapeutic uses of adrenergic agonists and adrenergic antagonists.

Synthesis of Norepinephrine, Isoproterenol, Naphazoline, Propranonol, Phenoxybenzamine hydrochloride, Salbutamol.

5. Cardiovascular drugs:

Classification, SAR studies, mechanism of action, therapeutic uses and adverse effects of cardiotonic drugs, antianginal agents, antiarrhythmic agents, antihypertensive agents.

Synthesis of Methyldopa, Prazocin, Guanithidine, Terbutaline, Isoxsuprine, Amyl nitrite, Captopril.

6. Diuretic agents:

Classification, SAR, mechanism of action, therapeutic use and adverse effects of water and osmotic diuretics, acidifying salts ,mercurials, sulphonamides, purines and related compounds, endocrine antagonists, miscellaneous agents

Synthesis of Ethacrynic acid,Acetazolamide, Furosemide, Mersalyl, Theophylline, Aminophylline, Chlorthiazide, Hydrochlorthiazide.

Recommended Books:

1. Pharmaceutical Chemistry by Bentley and Driver 8th Edition , (Oxford University Press).
2. Fundamentals of Medicinal Chemistry by
3. Text book of Pharmaceutical and Medicinal Chemistry by Wilson and Gisvold, 8th Edition
4. Medical Chemistry by burger (John Miley and Sons).
5. Principles of Medicinal Chemistry by Kadam, Mahadik and Bothara (Pragati Publication)
6. Organic Chemistry, The fundamental principles Vol.-I 1,2,4 by Ledincer Mistscher
7. The Organic Chemistry of Drug Synthesis, Vol. 1,2,3,4 by Ledincer Mistscher
8. Hansch C, Comprehensive Medicinal Chemistry – Vol-IV

Medicinal Chemistry- I
(Practicals) (3 Hrs/Week)

A. Synthesis and qualitative analysis of

1. Phenytoin from Benzoin (2 Steps)
2. Benzocaine from p-amino benzoic acid

3. 7-Hydroxy-4-methyl coumarine from resorcinol
4. Benzimidazole from o-Phenylene diamine
5. Phenothiazine from diphenylamine
6. Hippuric acid from glycine
7. 2-Methyl benzimidazole from o-phenylene diamine

Recommended Books:

1. Textbook of Practical Organic Chemistry – Vogel Longman, UK
2. Practical Organic Chemistry – FG Mann, BC Saunder, Orient Longman, UK
3. Indian Pharmacopoeia

Pharmaceutical Analysis-III
(Theory) (3 Hrs/Week)
(42 lectures)

SECTION I

1. Introduction to chromatography:

Definition classification , Principles, definition of general terms, distribution co-efficient, effective distribution co-efficient, theories of column efficiency (Rate theory and plate theory etc),elution techniques, selection of chromatography, application of chromatography.

2. Gas Chromatography:

Introduction, principle, instrumentation- types of carrier gas, sample injection, types of columns and stationary phases, detectors etc. applications, advances in GC.

SECTION II

3. Paper chromatography:

Introduction, Principle, technique types of papers, sample preparation, development modes, solvent selection and applications.

Ion Exchange and gel permeation chromatography

4. Electrophoresis:

Introduction, types, capillary electrophoresis, instrumentation and applications.

Pharmaceutical Analysis-III
(Practical) (3 Hrs/Week)

1. Practical based on paper chromatography (Ascending and circular)
   i. Amino acids
   ii. Sugars
   iii. Drugs
   iv. Formulations
2. Demonstration of HPTLC

Recommended Books:

1. Principles of Chromatography, K.R. Mahadik, K.G.Bothara, (Nirali Prakashan, Pune)
2. Introduction to Chromatography (Theory and Practice) V.K. Srivastav and K.K. Srivstav.
3. Person's Analysis of Foods: Ronald Kiek and Ronald Sawyer (Longman)
4. Principles of Instrumental analysis by Douglas A. Skoog (Saunders College Publishing).

Dosage Form Design-II
(Theory) (3 Hrs/Week)
(42 lectures)

SECTION I

1. Semisolid dosage forms

Concept of topical and transdermal formulations, Percutaneous absorption, Ointments, creams, pastes, gels. Formulation development: properties of drug, semisolids bases according to dosage forms, Selection of base and other additives. Manufacturing: Processing, layout and selection of equipment. In process quality control and quality control parameters, skin irritation test. Packaging and labeling.

2. Hard Capsules:

Raw material for capsule shell: Manufacturing of gelatin for capsule. Hard Gelatin Capsules: Preparation of hard gelatin capsule shell and standards and defects thereof.

Formulation development, processing and filling (excluding capsule filling machines). In process quality control and quality control parameters. Problems in capsule filling and remedies thereof.

3. Soft Gelatin Capsules:

Formulation development: Manufacturing processing and equipment. In – process quality control and quality control parameters.

SECTION II

4. Tablets:

a. Formulation of Powders and granules.

b. Tablets: Types of tablets. Tableting properties of drug and additives. Direct compressible additives. Tablet formulation: diluent, binder, disintegrate, lubricant, preservatives, organoleptic agents. Types and methods of granulation, Evaluation of granules.

Manufacturing process (excluding working of tablet compression machines), In-Process quality control and quality control parameters. Problems in tableting and remedies thereof.

5. Specialized tablets:

Chewable, layered, mouth-dissolving. Buccal, Dispersible, sublingual, effervescent tablets.

6. Tablet coating:

Reasons for coating, Types of coating: Sugar coat, film coat, compression coating, coating compositions, techniques, equipment. Problems in tablet coating and remedies thereof.

7. Pharmaceutical Aerosols:

Aerosol component and factors affecting its selection. Fundamentals and principle of aerosol design, Aerodynamics of aerosols, drug substances, physicochemical properties. Aerosol systems: solutions, suspensions and emulsions, filling of aerosol containers.

Therapeutic aerosols: Objectives of therapeutic aerosols, Factors influencing pulmonary deposition.

Metered Dose Inhalers: Applications and testing.

Dry Powder Inhalers: Applications, formulation, device and testing

Dosage Form Design-II
(Practical) (3) Hrs. /week)

1. Semisolids
   Pain balm,
   Creams,
   Gel,
   Ointment of anti-infective drug
2. Capsules 2 (including overages – Two preparations)
3. Tablets:
   Aspirin tablets: effervescent technique and using alcoholic binder solution, Paracetamol Tablet (production technology), specialized tablets.
4. Tablet coating: Sugar and film coating (demonstration)

Recommended Books

1. K.E. Avis, H.A. Liberman and L. Lachman: Pharmaceutical dosage forms: Parenteral Medications, Marcel Dekker)
2. A.J. Hickey; Pharmaceutical Inhalation Aerosol Technology, Marcek Dekker
3. P. Tyle, Drug delivery system; Marcel Dekker
4. I.R. Berry, R.A. Nash Pharmaceutical Process validation; Marcel & Dekker
5. J.Swarbrik, J. Boylan; Encyclopedia of Pharmaceutical Technology, Marcel Dekker
6. D.H. Shah SOP Guidelines; Business Horizons Publishers
7. Indian Pharmacopoeia Vol-I & II.

Cosmeticology
(Theory) (3 Hrs/Week)
(42 lectures)

SECTION I

1. **Introduction:** Cosmetics v/s drug formulation. Types of cosmetics
2. Physiological consideration; Skin,hair in relation to cosmetic application.
3. **Cosmetic products:**
   Formulation,manufacturing and evaluation (including Indian standards)of following cosmetics.

Skin Products:Moisturizing,cleansing,cold and vanishing cream

Hair Products:Shampoo,hair dyes,depilatories and shaving preparations

Oral hygiene products:Tooth paste,tooth powder,mouthwash

SECTION II

4. Cosmetic products:

Formulation, manufacturing and evaluation(including Indian standards)of following cosmetics:

Manicure products: Nail paint and nail paint remover

Eye mascara, eye shadow, eye liner,eye brow pencil

Lip products: Lipstick

Baby cosmetics: baby powder,baby oil

5. Herbal Cosmetics:

Study of utility of herbs used in cosmetics, soap nut, amla, henna(hibiscus, tea, aloe vera, turmeric, sandalwood, Herbal hair, skin and dental preparations.

6. Evaluation of Cosmetics:

Performance, physicochemical, microbiological and psychometric evaluation of cosmetics.

7. Regulatory requirements:

manufacturing and sale of cosmetics.

8. Advances in cosmetics:

Liposomes, multiple and microemulsions, hair waving, cosmetic surgery.

Cosmeticology
(Practical) (3 Hrs/Week)

1. Formulation approach: Survey / assignments related to effectiveness, economy, and acceptance of the marketed skin cosmetic products.
2. Assignment related to performance testing of a skin cosmetic product: Questioner feedback from saloon/ beauty-parlor/ spa.
3. Formulation, preparation and evaluation for cosmetics;

   Shampoo, Tooth Paste, Shaving Cream, Face powder, baby powder, ,moisture lotion/ cream, cold cream, vanishing cream, Lipstick, Nail Lacquer /Nail lacquer remover, Herbal cosmetics

Recommended Books

1. J. Knowlton and S. Rearce, Handbook of cosmetic Sc)ences and!technology, Elsevier schence publisher.
2. J.B. Wilkinson and R.J. Moore, Harry's cosmetology, Longman Science and Technical.
3. S.N.0Katju's Law of(Drugs, Law Publishers (India) Pvt. Ltd.
4. E®G. Thomseen, Modern cosmetics, Universal Publishing Corporation.
5. M.S. Balsam and E. Sagarin, Cosmetics, science and technology, John Wiley & Sons
6. R.L. Elder, Cosmetic Ingredients, their safety assessment, Pathotox
7. H.R. Moskowitz, Cosmetic product testing, Marcel Dekker
8. W.C. Waggoner, T.C.Cheng and V.C. Yang, cosmetic and Pharmaceutical applications of polymers, Plenum
9. C.G. Gebelein, T.C. Cheng and V.C. Yang, cosmetic and Pharmaceutical applications of polymers, Plenum.
10. L.. Appell, The formulation and preparation of cosmetics, fragrances and flavours, Micelle Press.
11. W.A. Pocher, Poucher's Perfumes, cosmetics and soaps, Vol.3, Chapman and Hall.
12. Dr. Laba, Rheological properties of cosmetics and toiletries, Marcel Dekker
13. K.F.De Polo,Ashrt Textbook of cosmetology.
14. Andre O.Barel,Maec Paye,Howard I.Maibach,Handbook of cosmetic sciences and technology, Marcel Dekker
15. Charles Z viak,The Science of Hair Care,Marcel Dekker
16. P.P. Sharma,Cosmetics-Formulation,Manufacturing and quality Control,Vandana Publications.

Pharmacology- II

(Theory) (3 Hrs/Week)

(42 lectures)

SECTION -I

1. Drugs affecting blood and blood formation

a) Haematinics and Erythropoietin

b) Drugs affecting coagulation, bleeding and thrombosis

2. Hypolipoprotenemic drugs

3. Nitric Oxide:

Biosynthesis of nitric oxide and control.

Effect of Nitric oxide

Therapeutic use of nitric oxide and nitric oxide donors.

Role on nitric oxide in clinical conditions

4. Drugs acting on Cardio-vascular system diseases

a) Drugs for Congestive Cardiac Failure (CCF)

b) Anti-arrhythmic drugs

c) Antianginal and other anti-ischemic drugs

d) Anti-hypertensive drugs

SECTION -II

5. Drugs acting on kidney

a) Diuretics

b) anti-diuretics

6. Drugs acting on Respiratory tract

a) Drugs for cough and bronchial asthma

7. Drugs acting on gastrointestinal tract

a) Drugs for peptic ulcers

b) Emetics and antiemetics

c) Drugs for constipation and diarrhea

Recommended Books:

1. Barar, F.S.K., Essentials of Pharmacotherapeutics; S. Chand and Company, New Delhi
2. Craig, C.R. and Stitzel, B.E.; Modern Pharmacology, Little Brown and Co, Boston
3. Crossland, James and; Lewis,s Pharmacology Basis of Therapeutics, (Pergamon Press, New York)
4. Das, M. M. .and Dutta S. K. : R. Ghosh,s Modern Concepts on pharmacology and Therapeutics, (HILTON and Co. Calcutta)
5. Goodman and Gilman; Pharmacological Basis of Therapeutics, McGraw-Hill

6. Katzung, B.G; Basic and Clinical Pharmacology, Lange Medical Publisher, USA
7. Rang, H.P. and Dale, M.M.; Pharmacology, Churchill Livingston, UK
8. Satoskar , R.S. and Bhandarkar S.D> Pharmacology and Pharmacotherapeutics (Popular Prakashan, Bombay).
9. Sharma H.L. Sharma K. K. General Pharmacology Basic Concepts. Paras Publication.
10. Tripathi K. D. Medical Pharmacology, Jaypee.

Pharmacology- II

Practical (3 Hrs/ week)

1. To study effects of various drugs using isolated tissue preparations
2. Prescription auditing and standard treatment protocols for the patient of following diseases: CCF, arrhythmia, angina, Myocardial Ischemia, hypertension, thrombosis, asthma, peptic ulcer, diarrhea, constipation
3. Computer simulations of following experiments
   i. Effects of drugs on guinea pig ileum
   ii. Effects of drugs on frog esophagus
   iii. Effects of drugs on blood pressure
4. An exercises based on evaluation of drug promotional literature

Recommended Books

1. Kulkarni, S.K.; Handbook of Experimental Pharmacology, Vallabh Prakashan, New Delhi
2. Ghosh, M.N.: Fundamental of Experimental Pharmacology, Scientific Book Agency, Calcutta
3. Sheth, U.K, Dadkar, N.K. and Kamat, U.G., Selected Topics in Experimental Pharmacology, (Kothari Book Depot, Mumbai
4. Perry, W.L.M., Pharmacological Experiments on isolated preparations, E&S, Livingston, London
5. Jaju B.P., Pharmacology: A practice Exercise book, Japee Brothers, New Delhi
6. Burn, J.H., Practical Pharmacology, Blackwell Scientific, Oxford, London

7. Lawrence, D.R., and Bacharch, A.L.; Evaluation of Drug Activities, Pharmacometrics, Academic Press
8. Turner, R.A., Screening Methods in Pharmacology, Academic Press, London
9. Thomson. E.B., Drug Bioscreening, VCH, New York
10. Vogel, H.G. and Vogel, W.H.: Drug Discovery and Evaluation: Pharmacological Assays, Springer, New York

Pharmacognosy – I

(Theory) (3 Hrs/Week)

(42 lectures)

SECTION I

1. History, scope & introduction of Pharmacognosy.
2. Natural sources of crude drugs, plant animal & mineral origin.
3. Classification of crude drugs.
4. Collection and processing of crude drug.
5. Evaluation of crude drugs.
6. Plant growth regulators.

SECTION II

7. Primary & secondary metabolites.
8. Plant Biosynthetic Pathways and their medicinal role.
9. Methods for elucidation of biosynthetic pathways.
10. Traditional systems of medicines: Ayurveda, Homeopathy, Unani, Chinese, Aromatherapy.

    General, biosynthesis, chemistry, general methods of isolation, chemical tests of following chemical group and drugs mentioned against them :
11. Drugs containing carbohydrate Isapgol, Pectin, Honey, Agar, Acacia.
12. Drugs containing lipids Castor oil, Arachis oil, Shark liver oil, Cod liver oil, Sunflower oil.

Recommended Books:

1. "Pharmacognosy" C.K.Kokate, A.P.Purohit, S.B.Gokhale Nirali Prakashan, 40th Edition, Pune, 2009.

2. "Trease and Evans Pharmacognosy" W.C. Evans, Elsevier, New Delhi, 2005.
3. "Pharmacognosy and Biotechnology" Ashutosh Kar, New Age International Publishers, New Delhi, 2003.
4. "Pharmacognosy and Biochemistry" J.B.Bruneton Lavoisier Publishers,2003
5. Charaka Samhita, Charkhamba Publishers, Varanasi
6. Shushrut Samhita
7. Ayurvedic Formulary of India, Govt. of India
8. Homoeopathic Materia medica

Pharmacognosy – I

(Practical)(3 Hrs/Week)

1. Study of microscopy
2. Study of different plant organs, their morphology and histological characters.
3. Study of different plant tissues and different staining techniques.
4. Study of stomata, trichomes, starch grains and calcium oxalate with their significance in identification of drugs.
5. Microscopic study of powered herbal drugs
6. Study of organized and unorganized drugs
7. Detection of adulteration in herbal drugs.
8. Quantitative microscopy
   i) Length and width of fibers
   ii) Palisade ratio
   iii) Vein islet and vein termination number
   iv) Stomatal number and stomatal index.

Recommended Books:

1. Practical Pharmacognosy, Khandelwal K.R., 8th Edition, Nirali Prakashan, Pune
2. Practical Pharmacognosy, Kokate C.K. Vallabh Prakashan, New Delhi
3. Pharmacopeia of India, Govt. of India
4. Anatomy of crude drug : Iyengar and Nayak.

SEMESTER-VI

Medicinal Chemistry-II

(Theory) (3 Hrs/Week)

(42 lectures)

SECTION-I

1. Drug metabolism

Phase-I metabolic pathways (oxidation, reduction and hydrolysis) and Phase-II (conjugation) metabolic pathways (glucuronic acid conjugation, glycine/glutamine conjugation, glutathione conjugation, acetylation, methylation), factors affecting drug metabolism, significance of drug metabolism studies in drug development.

2. CNS stimulant drugs

a) Analeptics and respiratory stimulants:

Classification, chemistry, mechanism of action and therapeutic uses.

b) Hallucinogens:

classification, chemistry, mechanism of action, and therapeutic uses.

***Synthesis of Nikethamide, Pipradol.**

3. CNS Depressant drugs

a) General anaesthetics:

Various stages of anaesthesia and theories of general anaesthesia, classification, chemistry, mechanism of action, adverse effects and therapeutic uses.

***Synthesis of Ketamine hydrochloride, Methohexital sodium,Thiamylal sodium.**

b) Sedative- hypnotics:

Classification, SAR, mechanism of action and therapeutic uses.

***Synthesis of Barbituric acid, Phenobarbital sodium, Thiopental sodium**

c) Anticonvulsants:

Classification, SAR, mechanism of action, and therapeutic uses and adverse effects.

***Synthesis of Phenytoin sodium, Trimethoprim, Phensuximide**

SECTION-II

4. Local anaesthetic agents:

Types of local anaesthetics, classification, SAR, mechanism of action, adverse effects and therapeutic uses.

***Synthesis of Benzocaine, Procaine hydrochloride, Lignocaine hydrochloride, Dibucaine hydrochloride.**

5. Psychotherapeutic agents:

Classification, SAR studies, mechanism of action, adverse effects and therapeutic uses of :

a) Antipsychotic agents

b) Antidepressant agents: Tricyclic antidepressant and MAO inhibitors

c) Anxiolytic agents

***Synthesis of Imipramine, Doxepin, Diazepam, Chlorpromazine, Haloperidol, Meprobamate.**

6. Prodrug concept:

Principles of prodrug design, classification of prodrugs, pharmaceutical, pharmacokinetic and pharmacodynamics applications of prodrugs, limitations and drawbacks.

Recommended Books:

1. Pharmaceutical Chemistry by Bentley and Driver, 8th Edition, (Oxford University Press)
2. Fundamentals of Medicinal Chemistry by Foye, 3rd Edition (Varghese)
3. Text Book of Pharmaceutical and Medicinal Chemistry by Wilson & Gisvold, 8th Edition.
4. Medicinal Chemistry by burger (John Miley and Sons)
5. Principles of Medicinal Chemistry by Kadam, Mahadik and Bothara (Pragati Publication)
6. Organic Chemistry, The Fundamental Principles Vol-I and II ; (Finar (ELBS)
7. The Organic Chemistry of Drug Synthesis, Vol-1,2,3,4 by Ledincer Mistscher
8. Hansch C, Comprehensive Medicinal Chemistry- Vol-IV
9. Medicinal Chemistry by Ashutosh Kar,3rd Edition, New Age International Publishers, New Delhi.

Medicinal Chemistry-II
(Practicals) (3 Hrs/Week)

A. Synthesis, purity check by TLC and qualitative analysis of:
   1. Barbituric acid from Diethyl malonate and Urea
   2. Dibenzyledene acetone from Benzaldehyde and Benzophenone
   3. p-Nitroacetanilide from acetanilide
   4. p-Nitroaniline from p-nitroacetanilide
   5. Benzhydrol from Benzophenone
   6. Benzophenone oxime from Benzophenone
   7. Benztriazole from o-Phenylene diamine

Recommended Books

1. Textbook of Practical Chemistry – Vogel Longman, UK
2. Practical Organic Chemistry – FG Mann, BC Saunder, Orient Longman, UK
3. Indian Pharmacopoeia

Pharmaceutical Analysis-IV
(Theory) (3 Hrs/Week)
(42 lectures)

SECTION I

1. HPLC – Introduction, advantages, instrumentation- pumps, sample injection, columns, detectors etc. application, trouble shooting.
2. Thin layer chromatography: Introduction, Principle, technique – types of adsorbents preparation of TLC plate, modes of development, Aids for visualization, applications.

SECTION II

3. HPTLC : Introduction sample preparation, selection of layer pre wishing, conditioning sample application, Instrumentation, detection of spot, scanning, documentation and application

4. Supercritical Fluid Chromatography-Principle, instrumentation and operating variables, working and applications.
5. Food Analysis – Analysis of vegetables, spices, dairy products.

Pharmaceutical Analysis-IV
Practical (3 Hrs/Week)

1. Practical's based on TLC
   i. Amino acids
   ii. Sugars
   iii. Drugs
   iv. Formulations
2. Demonstration of HPLC
3. Food analysis-tests for adulterants in Milk, Ghee, Turmeric, Clove, Cardamom and Tea.

Recommended Books:

1. Principles of Chromatography, K.R. Mahadik, K.G.Bothara, (Nirali Prakashan, Pune)
2. Introduction to Chromatography (Theory and Practice) V.K. Srivastav and K.K. Srivstav.
3. Person's Analysis of Foods: Ronald Kiek and Ronald Sawyer (Longman)
4. Principles of Instrumental analysis by Douglas A.Skoog (Saunders College Publishing)

Dosage Form Design-III
(Theory) (3 Hrs/Week)
(42 lectures)

SECTION-I

1. Concept of formulation design

Preformulation studies: Significance and testing of physicochemical properties in design and sterile dosage forms.

Formulation design: Physicochemical, Therapeutic, biopharmaceutical including routes of administration.

2. Sterilisation and Sterile product Facility:

Area planning, batch vs continuous operation, environmental control zones, filling areas design, utility distribution systems, air handling units and HVAC systems, HEPA filters testing and rating, laminar flow area working, clean in place and steam in place systems, development of facility layout. Sterility tests, pyrogen testing, study of Floor plan.

3. Formulation of Small Volume Parenterals:

Formulation principles and various additives. Drug characteristics, types and selection of vehicles, water treatment: methods to remove pyrogens and endotoxins, container effects on formulation.

Special types of SVPs like suspensions, dried forms, freeze dried products, sustained release parenteral formulations.

Stability evaluations and protocols, quality control tests.

SECTION II

4. Large volume Parenterals :

Formulation principles, physiological, formulation and packaging parameters, stabilization of LVPs.

Formulations containing electrolytes, carbohydrates, parenteral nutrition, IV admixtures. Processing conditions affecting formulation of LVP,

Special types of LVPs-TPN, dialysis fluids, cost effectiveness of LVPs.

5. OphthalmicProducts:

Formulation of Eye drops, Eye ointments, contact lens solutions.

6. Blood and related products:

Constituents of blood, plasma and its fractions, Concentrated RBC, plasma substitutes other biological products from pancreas and endocrine glands.

7. Packaging of Parenterals:

Glass Containers: Types, compositions and selection: Chemical, mechanical and optical performance, Quality control.

Plastic containers: Types, composition and selection. FFS technology: extrusion

technique, flat sheet and blown film extrusion. Quality control.

Elastomeric closures: vial closures and syringe plungers. Classification of elastomers. Rubber additives and compounding. Testing of elastomers.

Product-packaging interactions.

Dosage Form Design-III
(Practicals) (3 Hrs. /Week)

1. Pharmacopoeial evaluation of glass and plastic containers, and rubber closures used for injectables. (Minimum five experiments)
2. Preformulation of drug and additives.
3. Assignment based on
   a) Layout design of a parenteral section
   b) Schematic presentation of water treatment and air treatment.
4. Preparation and evaluation of following preparation:

   Sterile water for Injection, Ascorbic Acid Injection, Atropine Sulphate Injection, Calcium Gluconate Injection, Intraperitoneal dialysis fluid, Sodium chloride and Dextrose infusion, Ringer solution, Ringer lactate solution, Dextrose 5 % solution, TPN, Two ophthalmic preparations.

Recommended Books

1. K.E. Avis, H.A. Liberman and L. Lachman: Pharmaceutical dosage forms: Parenteral Medications, Marcel Dekker)
2. P. Tyle, Drug delivery system; Marcel Dekker
3. I.R. Berry, R.A. Nash Pharmaceutical Process validation; Marcel & Dekker
4. J.Swarbrik, J. Boylan; Encyclopedia of Pharmaceutical Technology, Marcel Dekker
5. D.H. Shah SOP Guidelines; Business Horizons Publishers
6. Indian Pharmacopoeia Vol-I & II
7. ME Aulton,Pharmaceutics,Inform Healthcare.
8. Banker and Rodes,Modern Pharmaceutics, Informa Healthcare.

Pharmacology-III

(Theory) (3 Hrs/Week)

(42 lectures)

SECTION-I

1. Drugs acting on Central Nervous system

a. General anesthetics

b. Sedative and Hypnotics

c. Antiepileptic drugs

d. Anti-Parkinsonian drugs

e. Drugs used in Mental illness (Psychopharmacological drugs) – antipsychotic, anti-anxiety, antidepressant, anti-mania drugs.

f. Opioid analgesics and antagonists

g. CNS stimulants and Cognition enhancers

2. Local Anesthetics

SECTION-II

3. Autacoids and Related drugs

a. Eicosanoids (Prosraglandins, Leukotriences, Thromboxane etc.) and drugs related to it.

b. Anti-inflammatory (Steroidal and non steroidal), antipyretics and analgesic drugs.

c. Drugs for Rheumatoid arthritis and Gout.

4. Principles of Toxicology

a. General principles of treatment of acute toxicity and acute poisoning

b. Sings, symptoms and treatment of acute and chronic poisoning due to Barbiurate heavy metals (Lead, Mercury, Arsenic,) and Insecticides)

Recommended Books

1 Barar, F.S.K. Essential of Pharmacotherapeutics; S. Chand and Company, New Delhi

2 Craig, C.R. and Stitzel, B.E.; Modern Pharmacology, Little Brown and Co. Boston

3 Crossland, James and : Lewis,s Pharmacology Basis of therapeutics, (Pergamon Press New York).

4 Das, M.M. and Dutta S.K. : R. Ghosh,s Modern concepts on Pharmacology and therapeutics, (Hillton and Co. Calcutta).

5 Goodman and Gilman; Pharmacological Basis of therapeutics, McGraw-Hill.

6 Katzung, B.G. Basic and Clinical Pharmacology, Lange Medical Publisher, U.S.A.

7 Range, H.P. and Dale M.M. Pharmacology, Churchil Livingston, UK

8 Satoskar, R.S. and bhandarkar S.D. Pharmacology and Pharmacotherapeutics (Popular Prakashan, Bombay).

9 Sharma H.L. Sharma K.K. General Pharmacology Basic concepts, Paras Publication.

10. Tripathi K.D. Medical Pharmacology, Jaypee

11. Pillay,V.V.Modern Medical Toxicology, Jaypee Publications

Pharmaceutical Biotechnology (Including Molecular Biology)

(Theory) (3 Hrs/Week)

(42 lectures)

SECTION I

1. Introduction to Pharmaceutical Biotechnology

Scope of subject, various rDNA products, national and international scenario of rDNA products, different manufacturers with their product profiles.

2. Molecular Biology

Molecular biology concepts with reference to central dogma of life, review of processes such as translation, transcription, replication, recombination, transduction and transformation, genetic manipulation.

3. Genetics

A) Techniques in the gene recombination such as separation methods, isolation, fragmentations, characterization, molecular hybridization.

B) Genetic recombination with reference to production of rDNA products such as insulin, erythropoietin, tumor necrosis factor, plasminogen activator, stability of therapeutic biomolecules.

SECTION II

4. Protein Engineering

Scope, need, concept of protein engineering, production of single cell protein.

5. Enzyme Technology

Techniques of immobilization, factors affecting enzyme kinetics, study of enzymes such as hyaluronidase, penicillinase, streptokinase and streptodornase. Amylase, immobilization of bacterial cell, applications.

6. Bioreactor Designing

Factors affecting design, energy and mass transfer in bioprocesses, consideration of different types of bioreactors such as stirred tank reactor, fluidized bed, plug flow reactor .

Pharmaceutical Biotechnology (Including Molecular Biology) (Practicals) (3Hrs/Week)

1. Isolation of DNA and characterization
2. Extraction of Lecithin
3. Demonstration of Polymeric Chain Reactor (PCR)
4. Experiment on Fermentation
5. SDS – PAGE
6. Alternate to animal studies – Techniques for cell culture, blood leucocy culture or macrophage culture.
7. Immunofluoroscent staining techniques.

Recommended Books:

1. Biotechnology, KeshaveTrehan, Wiley Eastern Ltd, 1990
2. T/B of Biotechnology By Gupta P.K.
3. Methods of Enzymology, Academic Press.
4. Industrial Microbiology , Prescott and Dunn.
5. Molecular Biology, Watson, J.D., Benjamin Publishing.
6. Gene, Levvin, Oxford University Press.
7. Biotechnology and Genomics, PK Gupta, Rastogi Publications, Meerut.

Pharmacognosy-II

(Theory) (3 Hrs/Week)

(42 lectures)

SECTION I

1. Methods of extraction and types of extracts and their standardization. Maceration, percolation, infusion decoction, continuous hot extraction, successive solvent extraction, and newer techniques like supercritical microwave assisted extraction. Extraction techniques of Phytopharmaceuticals representing various groups of secondary metabolites.

2. Different techniques like TLC, HPTLC, HPLC, Column chromatography etc. in herbal drug analysis.
3. Nutraceuticals (Herbs and Health foods): Introduction, history, current status in commerce and study of Arnica, cucumber, fenugreek, garlic and onion.

SECTION II

4. Herbal cosmetics. Introduction, skin and hair care products, production and their quality controls.
5. WHO guidelines for standardization and quality control of herbal drugs and regulatory affairs related to herbal drugs.
6. Medicinal Plant Biotechnology

   History, introduction, organization of tissue culture laboratory

   Totipotency, Nutritional requirement for in vitro plant cell growth (Culture media), Types of culture, Cell suspension and Growth parameters. Strategies for enhanced production of phyto-pharmaceuticals from plant cells.

Recommended Books:

1. "Pharmacognosy" C. K. Kokate, A. P. Purohit, S. B. Gokhale Nirali Prakashan, 40th Edition, Pune, 2009.
2. "Trease and Evans Pharmacognosy" W.C. Evans, Elsevier, New Delhi, 2005.

3. Medicinal Plant Biotechnology,A.G.Namdeo,Career Publications,Nasik,2010
4. "Pharmacognosy and Biotechnology" Ashutosh Kar, New Age International Publishers, New Delhi, 2003.
5. "Pharmacognosy and Biochemistry" J.B.Bruneton Lavoisier Publishers 2003
6. "Plant Tissue Culture" S.Narayanswami
7. " Plant Tissue Culture" Dixon

Pharmacognosy-II
(Practical) (3 Hrs/Week)

1. Experiments on standardization of herbal drugs as per WHO guidelines/ IP 2007 like; loss on drying, extractive values, ash value, crude, fiber swelling index.
2. Proximate chemical analysis of herbal drugs.
3. Preparation of TLC plates and Development of TLC chromatograms of some extracts.
4. Demonstration of HPTLC and HPLC techniques.
5. Preparation of culture medium and its sterilization.
6. Demonstration of Aseptic transfer
7. Preparation of some Herbal cosmetic formulations for Hair care and Skin Care.

Recommended Books:

1. Practical Pharmacognosy, K.R.Khandelwal, 8th Editiin, Nirali Prakashan, Pune
2. Practical Pharmacognosy, Kokate C.K., Vallabh Prakashan, New Delhi
3. Thin Layer Chromatography, Egon Stahl, Springer Verlag, Berlin
4. Phytochemical Methods, Harborne J.B.
5. Pharmacopoeia of India, Govt. of India
6. Medicinal Plant Biotechnology, A.G.Namdeo,Career Publications,Nasik,2010

SEMESTER–VII

Medicinal Chemistry- III
(Theory) (3 Hrs/Week)
(42 lectures)

SECTION-I

Chemotherapeutic Agents:-

1. Synthetic antibacterial agents :

i) Topical antibacterial agents

ii) Systemic agents antibacterial- Nitrofurazone, Nitrofurantoin, Furazolidone, hexyl resorcinol.

2. Antiprotozoal agents :

Antimalarials :-Life cycle of malarial parasite, classification of drugs, SAR and synthesis.

Pyrimethamine, Chloroquine, Hydroxychloroquine, Amodiaquine, Primaquine, Choloroguanide , Quinacrine.

Antiamebic agents: Iodoquinole, Diloxanide, Metronidazole, Tinidazole

Introduction to amebiasis and chemotherapy

Trypanosomicidal drugs, drugs action against Leishmaniasis.

Anthelmintics: Mebendazole, albendazole, Thiabendazole, Niridazole, Piperazine, Diethylcarbamazine, Pyrantel, Niclosamide, Bephenium, Bithionol.

3. Antimycobacterial agents :

i) Antitubercular agents: Isoniazid, Ethambutol, Pyrazinamide, Ethionamide, Paramino salicylic acid

ii) Antileprotic agent: Dapsone and their derivatives

Mycobacteria, Nature of the disease, Laboratory models for screening drugs and chemotherapy

4. Antiviral agents :

Properties, classification of viruses, Antiviral testing systems and clinically active antiviral drugs. Anti AIDS drugs. Amantadine.

5. Antineoplastic agents :

Introduction, classification of Antineoplastic agents. Methotrexate, Thioguanine, Fluorouracil, Mechlorethamine,Chlorambucil,melphalan,cyclophosphamide,ifosfamide,thiotepa,busulfan,lomustine,mitotane,procarbazine.

SECTION-II

6. Drugs acting on G.I.T.:

Antacids, Emetics, Antiemetics, Digestants, Puragatives, Antiflatulence agents.

7. Sulfonomides:

Introduction, Classification, synthesis and uses. Sulfadiazine, Sulfaguanidine, Sulfamerazine, Sulfamethoxazole, Sulfadoxine, Sulfapyridine, sulfacetamide, trimetoprim.

8. Quinolones:

Nalidixic acid,Norfloxacin

9. Antifungal agents:

Fungal disease, Antifungal agents and novel approaches to antifungal therapy Miconazole, Clotrimazole, Tolnaftate

10. Oxazolidinediones:

11. Antibiotics:

Beta Lactam antibiotics: (Penicillins and Cephalosporins), Aminoglycosides, tetracyclins, macrolides, lincomycins, polypeptides, Lactamase inhibitors and Unclassified antibiotics (Chloramphenicol, Cephalexin), 6-APA, Methicillin, oxacillin, amoxicillin, carbenicillin, cefalotin, cepapirin, chlramphenicol.

Medicinal Chemistry-III
Practicals (3 Hrs/Week)

1. Synthesis of following :

i) Benzil
ii) Benzillic acid
iii) Phthalimide from phthalic anhydride
iv) Anthralinic acid
v) O iodo benezoic acid
vi) 2 hydroxy 4 methyl quinoline

vii) Aspirin
viii) Methyl paraben
ix) Sulfanilamide

2. Spectral Analysis of synthesized compounds (any five).
3. Establishing pharmacopoeial standards of drugs from course content (any two)

Recommended Books :

1. Pharmaceutical Chemistry by Bentley and Driver, 8th Edition, (Oxford University Press)
2. Fundamentals of Medicinal Chemistry by Foye, 3rd Edition, (Varghese)
3. Text Book of Pharmaceutical And Medicinal Chemistry by Wilson and Gisvold, 8th Edition (J.B.Cippincolt Company)
4. Medicinal Chemistry by Burger (John Wiley and Sons)
5. Principles of Medicinal Chemistry by Kadam, Mahadik and Bothara (Pragati Publication)
6. Organic Chemistry, The Fundamental Principles Vol.I and II, : Finar (ELBS)
7. The Organic Chemistry of Drugs Synthesis, Vol.I and II, : Final (ELBS)
8. QSAR: Hansch Analysis and related approaches by Hugo Kubingi(Vol.I)
9. Practical Applications of Computer Aided Drug Design Ed. Paul S. Charifson (Marcel Dekker. In New York)
10. Hansch C, Comprehensive Medicinal Chemistry-Vol-IV

Pharmaceutical Analysis – V
(Theory) (3 Hrs/Week)
(42 lectures)

SECTION-I

1. Electromagnetic radiations (EMR), Interaction of EMR with matter, electromagnetic spectrum.
2. Instruments for optical spectroscopy, Types of methods, Radiation sources, Wavelength selectors, Sample cells, radiation detectors, signal processor and read out.
3. Ultraviolet and Visible spectroscopy: Fundamental laws of absorption, Theory of UV – Visible spectroscopy, techniques for colour comparison instrumentation, Spectrophotometric titrations, Applications of UV- Visible spectrometry.

SECTION-II

4. Infrared Spectroscopy: Origin of IR spectra, Molecular vibrations, fundamental bands, vibrational frequency, instrumentation, applications, important spectral regions, and Raman spectroscopy.
5. Nephhelmetry and Turbidimetry: Introduction, Instrumentation, Turbidometric Titrations, and Applications,.
6. Fluoriemetry and phosphorimetry : Fluorescence and phosphorescence, measurement of fluorescence, Instrumentation, advantages and disadvantages, applications.

Recommended Books:

1. Instrumental methods of analysis by Willard, Merrit, (CBS Publishers and Distributors)
2. Principles of Instrumental Analysis, Douglas, A Skoog, Saunders (Golden Sunburst Series)
3. A Text – book of Pharmaceutical Chemistry, L.G.Chatten, Vol.I and II, (Marcel Dekker, New York)
4. Instrumental Methods of Chemical Analysis by G.W.Ewing, (McGraw-Hill Book Company)
5. Applications of Absorption Spectroscopy of Organic Compounds, I.R. Dyer, (Prentice Hall Inc.)
6. Organic Spectroscopy: William (English Language Book Society, Mc Milan.)
7. Pharmaceutical Analysis by Higuchi.
8. Pharmaceutical Analysis : Modern Methods, James W. Munson (Dekker)

Pharmaceutical Analysis – V
(Practical) (3Hrs/Week)

1. Recording of UV-visible spectrum and location of max, calculation of E 1% and molar absorbance value, colorimetric analysis of some drugs, spectrophotometric analysis of some drugs.
2. Turbidometric analysis.
3. Fluorimetric analysis e.g. Thiamine, Quinine.
4. Analysis of multi ingredient Pharmaceutical formulations.

Recommended Books:

1. Instrumental methods of analysis by Willard, Merrit, (CBS Publishers and Distributors)
2. A Text-book of Pharmaceutical Chemistry, Chatten, Vol.I & II, Marcel Dekker, New York)
3. Applications of Absorption Spectroscopy of Organic Compounds, I.R.Dyer(Prentice Hall Inc.)
4. Indian Pharmacopoeia, Latest edition.
5. British Pharmacopoeia. Latest edition.
6. United States Pharmacopoeia.

Dosage Form -IV
(Theory) (3 Hrs/Week)
(42 lectures)

SECTION-I

1. Controlled Drug Delivery systems
2. Oral controlled drug delivery:
   Principle and typical design of matrix and reservoir concept,drug release profiles.
3. Transdermal drug delivery systems:Principle,formulation(elemnatary)
   nasal drug delivery,implants,vaginal,liposomes,niosomes,nanoparticulate systems.
5. Microencapsulation:
   Introduction,methods of microencapsulation,polymers used and apllications.

SECTION-II

6. Good manufacturing practices: Concept and application of GMP and CGMP,GLP,Brief account of CGMP in Pharma Industry.
7. Total Quality management
   Concept of TQM, QM, QA and IPQC and related documentation and formats
8. Manufacturing, operation and control:
   Sanitization of manufacturing premises, mixups and cross contamination, processing of intermediate and bulk products, packing operations, IPQC in manufacturing and

pacakaging, release of fimished product drug product inspection, production record review and related documentation and formats

9. Pharmaceutical validation

   Concept of validation of building and facilities, equipment process cleaning, specific dosage forms, master plans and related documentation and formats.

10. Stability testing:

    Reasons for instability, ICH stability guidelines for drugs and drug product. Stability testing, Photo stability, stress testing, assemement of preservative activity during stability testing.

Dosage Form Design-IV
(Practical) (3 Hrs. /Week)

1. Microencapsulation and evaluation of microcapsules
2. Dissolution study of marketed CR and IR dosage forms
3. Design of controlled release tablets and their evaluation
4. In vitro drug diffusion study of transdermal therapeutic systems
5. Validation of equipment and facilities(two experiment)
6. Validation of aseptic area
7. Accelerated stability testing

Recommended Books

1. K.E. Avis, H.A. Liberman and L. Lachman: Pharmaceutical dosage forms: Parenteral Medications, Marcel Dekker)
2. A.J. Hickey; Pharmaceutical Inhalation Aerosol Technology, Marcek Dekker
3. P. Tyle, Drug delivery system; Marcel Dekker
4. I.R. Berry, R.A. Nash Pharmaceutical Process validation; Marcel & Dekker
5. J.Swarbrik, J. Boylan; Encyclopedia of Pharmaceutical Technology, Marcel Dekker
6. D.H. Shah SOP Guidelines; Business Horizons Publishers
7. Indian Pharmacopoeia Vol-I & II.

Biopharmaceutics and Pharmacokinetics

(Theory) (3 Hrs/Week)

(42 lectures)

SECTION I

1. Introduction to Biopharmaceutics

Definition Scope, Historical perspective of Biopharmaceutics, Pharmacokinetics, Pharmacodynamics, bioavailability, the concept of bioequivalence, plasma concentration vs time profile.

2. Biopharmaceutic Principles

Absorption of drugs:

Transport of drug across the cell membrane, Factors affecting absorption: Physicochemical factors, pharmaceutical factors and patient related factors, Absorption of drugs from non per os extravascular routes,

Distribution:

General principles, Physiological barriers to distribution, factors affecting distribution, Volume of distribution

Protein Binding of drugs:

Factors affecting protein drug binding, significance of protein / tissue binding, kinetics of protein drug binding

Metabolism:

Introduction to biotransformation and its effect on bioavailability with illustrative examples, first pass effect, Factors affecting biotransformation

Elimination:

Renal excretion, Factors affecting renal excretion, dose adjustment in renal failure, non-renal routes of drug excretion, concept of clearance, and extraction ratios.

SECTION II

3. Pharmacokinetic Principles:

Plasma concentration time profile, basic kinetic principles, Mathematical expressions

for zero, first second complex, order reactions and their applications to biological systems and, approximate integration including trapezoidal rule, various types of graphical representations and statistical treatment thereof, , introduction to various pharmacokinetic parameters and their correlations.

4. Compartmental modeling:

Concept and mathematics of compartment model, physiological model and its significance in pharmacokinetic studies. One compartment model, two compartment model for intravenous and oral routes. Introduction to two compartment model

Non Compartmental Analysis:

Introduction, Statistical moments, AUC &AUMC

3 Bioavailability and bioequivalence:

Studies and therapeutic effects, time course of pharmacological response, methods of assessing bioavailability. Blood and urinary data calculations for various pharmacokinetic profiles. Absolute and relative bioavailability, significance of bioavailability studies in animals. Invitro dissolution testing models, in vitro in vivo correlation, Bioequivalence study parameters and study protocols, Latin square and cross over design, methods of enhancing bioavailability

Note: Problems based on Pharmacokinetics and compartmental modeling concepts included

Recommended Books

1. D.M.Brahmankar, S.B. Jaiswal, Biopharmaceutics and Pharmacokinetics Treatise; Vallabh Prakashan.
2. J.B. Blanchard, R.J. Sawchul and B.B.Brodie, Principle and Perspectives in Drug bioaailability; K. Karger Publication.
3. M. Gibaldi and Perrier; Pharmacokinetics, Marcek Dekker.
4. Clinical Pharmacokinetics: Concepts and applications, Rowland & Tozer, Lea & Febriger
5. ME Aulton,Pharmaceutics the science of dosage forms,Elsveir
6. Banker and Rhodes Modern Pharmaceutics,Informa Healthcare

Clinical Pharmacy

(Theory) (3 Hrs/Week)

(42 lectures)

SECTION I

1. Definitions, development and scope of clinical pharmacy

2. Activities of a clinical pharmacist

Drug therapy monitoring, Ward round participation, Adverse drug reaction management, Drug information and poisons information, Medication history

Patient counseling, Drug utilisation evaluation (DUE) and review (DUR), Quality assurance of clinical pharmacy services

3. Medical Terminology

Understanding common medical abbreviations and terminologies used in clinical practices.

4. Principle and significance of Clinical laboratory tests

Haematological, Liver function, Renal function, thyroid function tests, Tests associated with cardiac disorders, Fluid and electrolyte balance, Microbiological culture sensitivity tests.

SECTION II

5. Drug & Poison information

Introduction to drug information resources available, Systematic approach in answering DI queries, Critical evaluation of drug information and literature, Preparation of written and verbal reports, Establishing a Drug Information Centre

Poisons information- organization & information resources.

6. Pharmacovigilance

Definition and aims of pharmacovigilance.

Adverse drug reactions - Classification, mechanism, predisposing factors, Reporting, evaluation, monitoring, preventing & management of ADRs, Importance for approval and withdrawal of drugs. Role of pharmacist in management of ADR.

7. Design and conduct of clinical trials:

Brief introduction covering phases of clinical trial, GCP. Role of clinical pharmacist in clinical trials.

Recommended Books:

1. Central Drugs Standard Control Organization. Good Clinical Practices-Guidelines for Clinical Trials on Pharmaceutical Products in India. New Delhi: Ministry of Health; 2001.
2. Textbook of Clinical Trials edited by David Machin, Simon Day and Sylvan Green, March 2005,John Wiley and Sons.
3. Ravikumar and Miglani, Pharmacy Practice, Career.
4. Parthsarathi, Nahata, Clinical Pharmacy Practice, Orient Longman
5. Tipnis and Bajaj Clinical Pharmacy, Career Publications,Nasik

Pharmacognosy – III

(Theory) (3 Hrs/Week)

(42 lectures)

SECTION I

Generalities, biosynthesis, chemistry, general methods of isolation, chemical tests of following chemical group and drugs mentioned against them :

1. Phenolics : Bearberry, Rosemary, Peru balsam, Tolu balsam, Sumatra benzoin.
2. Coumarins and its types: Khellin, Psoralea.
3. Lignans and its types: Podophyllum, Silymarin.
4. Shikimates: Turmeric, Ginger.
5. Flavonoids (Detailed chemistry and therapeutic uses): Citrus fruits, Gingko.
6. Anthocyanines : Cranberry
7. Tannins : Pale catechu, Hirda (Terminalia chebula)
8. Quinones (Different types): Senna, Aloe, Henna, St. John's wort.
9. Phloroglucinols : Hops.

SECTION II

Generalities, biosynthesis, chemistry, general methods of isolation, chemical tests of following chemical group and drugs mentioned against them :

A) Terpenoids:

1. Monoterpenes and Iridoids : Mentha,Valerian
2. Sesquiterpenes : Arnica
3. Essential Oils : Dill, Lavendar, Patchouli, Clove
4. Diterpenes : Yew (Taxus), Coleus
5. Triterpenes and Steriods : General chemistry
6. Saponins : Liquorice
7. Cardiac glycosides : Digitalis
8. Other triterpenes/ Steroids: Guggul, Neem.

B) Alkaloids: Chemistry, Extraction.

1. Tropane : Belladona
2. Piperidine amides : Black pepper
3. Phenylethylamines : Ephedra
4. Isoqunioline : Opium
5. Phenethylisoquinoline : Colchicum
6. Tryptophan : Ergot, Catharanthus, Rauwolfia
7. Quinoline : Cinchona
8. Imidazole : Pilocarpus
9. Diterpenoid and Steroidal : Aconite, Veratrum
10. Purine Bases : Tea, Kola

Recommended Books:

1. "Medicinal Natural Products, A biosynthetic approach", Paul M.Dewick , Second Edition, John Wiley & Sons, Ltd. England 2001.
2. "Pharmacognosy" C.K.Kokate, A.P.Purohit, S.B.Gokhale Nirali Prakashan, 40th Edition, Pune, 2009.
3. "Trease and Evans Pharmacognosy" W.C. Evans, Elsevier, New Delhi, 2005.

4. "Pharmacognosy and Biotechnology" Ashutosh Kar, New Age International Publishers, New Delhi, 2003.
5. "Pharmacognosy and Biochemistry" J.B.Bruneton Lavoisier Publishers
6. "Phytochemistry" J.B.Harborne

Pharmacognosy III
(Practicals) (3Hrs. /Week)

1. Identification of following drugs by morphological studies
   a. Phenolics and others:

      Bearberry, Rosemary, Peru balsam, Tolu balsam, Sumatra benzoin, Khellin, Psoralea, Podophyllum, Turmeric, Ginger, Pale catechu, Hirda, Senna, Aloe, Henna.

   b. Terpenoids:

      Arnica, Mentha, Valerian, Dill, Lavendar, Patchouli, Clove, Coleus, Liquorice, Guggul, Neem.

   c. Alkaloids

      Belladona, Black pepper, Ephedra, Colchicum, Ergot, Catharanthus, Rauwolfia, Cinchona, Pilocarpus, Aconite, Veratrum, Tea, Kola
2. Identification of following drugs by microscopical methods

   Turmeric, Ginger, Senna. Dill, Clove, Liquorice, Neem. Black pepper, Ephedra, Colchicum, Ergot, Catharanthus, Rauwolfia, Cinchona.

Recommended Books:

1. Practical Pharmacognosy, K.R.Khandelwal, 8th Editiin, Nirali Prakashan, Pune
2. Practical Pharmaciognosy, Kokate C.K., Vallabh Prakashan, New Delhi
3. Thin Layer Chromatography, Egon Stahl, Springer Verlag, Berlin
4. Phytochemical Methods, Harborne J.B.
5. Pharmacopoeia of India, Govt. of India
6. Pharmacognosy & Phytochemistry,V.D.Rangari,Career Publications,Nasik

SEMESTER–VIII

Medicinal Chemistry-IV

(Theory) (3 Hrs/Week)

(42 lectures)

SECTION I

I. General principle of drug design: Object of drug design, common approaches used in drug design. Physico-chemical properties and drug design. Quantitative structure activity relationships (QSAR). Methods of QSAR, Molecular modeling. Simple correlation equations and interpretation regression analysis. An application of QSAR is drug discovery.

II. Synthetic procedure of selected drugs, mode of action (biochemical and molecular basis whenever applicable) SAR including physico-chemical properties of the following classes of drug and synthesis of drug mentioned:

1. Steroid : Nomenclature, Stereochemistry, adrenocortocoids,sex hormones, androgens and anabolic agents,antiandrogens, estrogens and anti-oestrogens progestational agents.diethyl stibesterol,dienestrol,progesterone,oestrogen and ethinyl oestradiol,16 DPA and testosterone.
2. Antihistaminics : Structural features of histamine/receptor. Subtypes and their structural features, H1 blockers and H2 blockers (classification, SAR, Mechanism of action and uses) proton pump blockers. Chlorpheniramine, tripelennamine, pyralamine, antazoline, cyclizine, meclizine, terfenadine, cimetidine,ranitidine,famotidine.
3. Eicosanoids, prostaglandin analogs, nomenclature, chemistry and uses.
4. Narcotic analgesics: Classification, SAR studies, mechanism of action and narcotic antagonists, uses of important compounds, methadone, meperididne, diphenoxylate.

SECTION –II

Synthetic procedure of selected drugs, mode of action (biochemical and molecular basis whenever applicable) SAR including physico-chemical properties of the following classes of drugs

5. Non-narcotic analgesics:

Classification, SAR mechanism of action and uses of important compounds. Aspirin, Diflunisal, Phenylbutazone, Sulfinpyrazone ,acetaminophen, flufenamic acid, mefe-

namic acid, meclofenamic acid, ibuprofen, fenprofen, diclofenac, tolmetin, piroxicam.

6. Hormones:

Thyroid and antithyroidal agents, Insulin and oral antidiabetic agents. Synthesis of Levothyroxine, Methimazole,Carbimazole, Tolbutamide, Chlorpropamide, acetohexamide, Tolazamide, Glyburide, Glipizide.

7. Diagnostic agents:

Radio opaque diagnostic agents, agents for organ function test, Miscellaneous diagnostic agents.

8. Anticoagulants, antiaggregants, thrombolytics and hemostatics:

Blood coagulation process, heparin and heparionoids, defrinating agents, oral anticoagulants, inhibitors of platelet aggregation, fibrinolytic agents, hemostatic agents. Synthesis of dicoumarol, warfarin, phenprocoumon, pheindione, ticlopidine

9. Brief introduction to combinatorial chemistry:

Medicinal Chemistry-IV
(Practical) (3 Hrs/Week)

1. Synthesis of following (any Six)
   - i) p-nitro acetanilide
   - ii) p-nitro aniline
   - iii) p-nitro phenol
   - iv) p-amino salicylic acid from p-nitro salicylic acid
   - v) Dichloramine T.
   - vi) Chloramine T
   - vii) Anthrone
   - viii) Isonicotinic acid from –picoline
   - ix) p-bromo acetanilide
   - x) p- bromoaniline
   - xi) p- bromo Phenol
   - xii) Dimethylamino propiophenone (Mannich reaction)

2. Spectral Analysis of synthesized compounds (any five)
3. Determination of partition coefficient, dissociation constant, molar refractivity of compounds for QSAR analysis.

Recommended Books:

1. Pharmaceutical Chemistry by Bentley and Driver, 8th Edition, (Oxford University Press)
2. Fundamentals of Medicinal Chemistry by Foye, 3rd Edition (Varghese)
3. Text Book of Pharmaceutical and Medicinal Chemistry by Wilson & Gisvold, 8th Edition.
4. Medicinal Chemistry by burger (John Miley and Sons)
5. Principles of Medicinal Chemistry by Kadam, Mahadik and Bothara (Pragati Publication)
6. Organic Chemistry, The Fundamental Principles Vol-I and II ; (Finar (ELBS)
7. The Organic Chemistry of Drug Synthesis, Vol-1,2,3,4 by Ledincer Mistscher
8. QSAR: Hansch Analysis and related approaches by Hugo Kubingi (Vol-I)
9. Practical Applications of computer Aided Drug Design Ed. Paul S. Charifson (Marcel Dekker, In New York).
10. Hansch C, Comprehensive Medicinal Chemistry- Vol-IV
11 V.M.Kulkarni Drug Design, Nirali Prakashan, Pune

Pharmaceutical Analysis –VI

(Theory) (3 Hrs/Week)

(42 lectures)

SECTION-I

1. Nuclear magnetic resonance (NMR) : Spectroscopy Theory, chemical shift, shielding applications,Spin-spin coupling applications and simple structure determination.
2. Atomic absorption spectroscopy : Theory instrumentation, Analytical applications
3. Flame Photometry : Origin of spectra, instrumentation, Qualitative and Quantitative applications

SECTION –II

Thermal methods: Instrumentation and applications, DTA, TGA and DSC

1. Mass spectrometry : Introduction, Theory, instrumentation, resolution and applications
2. Radioimmunoassay and other immunoassays, ELISA
3. Validation of analytical methods.

Recommended Books:

1. Instrumental methods of analysis by Willard, Merrit, (CBS Publishers and Distributors).
2. Principles of Instrumental Analysis, Douglas, A skoog, Saunders (Golden Sunburst Series)
3. A Text book of Pharmaceutical Chemistry, L.G. Chatten, vol.I & II (Marcel Dekker, New York).
4. Instrumental Methods of Chemical Analysis by G.W. Ewing, (McGraw- Hill book) Co.
5. Applications of Absorption Spectroscopy of Organic Compounds, I.R. Dyer, (Prentice Hall Inc.)
6. Organic Spectroscopy: William Kemp (English Language book Society, Mc Milan).
7. Pharmaceutical Analysis by Higuchi
8. Pharmaceutical Analysis: Modern methods, James W. Munson (dekker)

Pharmaceutical Analysis-VI
(Practical) (3 Hrs. /Week)

1. Analysis of multigradient pharmaceutical formulations
2. Sodium potassium calcium determination (Flame Photometry)
3. Formulation analysis
4. Validation of analytical methods
5. Estimation using nepheloturbidimeter
6. Demonstration of DSC,TGA

Recommended books:

1. Instrumental methods of analysis by Willard, Merrit, (CBS Publishers and Distributors).
2. A Text book of Pharmaceutical Chemistry, L.G. Chatten, Vol.I & II (Marcel Dekker, New York).
3. Applications of Absorption Spectroscopy of Organic Compounds, I.R. Dyer, (Prentice Hall Inc.)
4. Indian Pharmacopoeia, Latest edition
5. British Pharmacopoeia, Latest edition
6. United States Pharmacopoeia.

Pharmacology-IV
(Theory) (3 Hrs/Week)
(42 lectures)

SECTION I

1. Chemotherapy

a) Introduction of Chemotherapy
b) Sulfonamides and Co-trimoxazole
c) Penicillins and Cephalosporins
d) Tetracyclines and Chramphenicol
e) Macrolide Aminoglycosides , Polyene and Polypeptide antibiotics
f) Quinolones and Fluoroquinolones
g) Antifungal agents
h) Antiviral agents
i) Chemotherapy of Tuberculosis, Leprosy, and Malaria
j) Chemotherapy of Protozoal infections (amoebiasis, Giardiasis)
k) Pharmacology of antihelmintic drugs
l) Chemotherapy of neoplastic diseases (Anticancer drugs)

2. Drugs in special Population

a) Pediatric patients
b) Geriatric patients
c) Pregnant and breast-feeding woman

SECTION –II

3. Peptides and Proteins as mediators:

General Principles of peptide pharmacology.

Biosynthesis and regulation of peptides.

Peptide antagonists

Protein and peptide as drugs.

4. Basic and Clinical Pharmacology of Hormones and Hormones antagonists

a) Anterior and Posterior Pituitary hormones

b) Corticosteroids

c) Thyroid and thyroid inhibitors

d) Insulins, Oral hypoglycemic agents, glucagon

e) Gonadal hormones and Oral contraceptives

f) Oxytocin and drugs acting on uterus

5. Immunopharmacology

a) Pharmacology of immunosuppressants and stimulants

6. Chronopharmacology

Recommended Books

1. Barar, F.S.K., Essentials of Pharmacotherapeutics; S. Chand and Company, New Delhi
2. Craig, C.R. and Stitzel, B.E.; Modern Pharmacology, Little Brown and Co, Boston
3. Crossland, James and; Lewis,s Pharmacology Basis of Therapeutics, (Pergamon Press, New York)
4. Das, M. M. .and Dutta S. K. : R. Ghosh,s Modern Concepts on pharmacology and Therapeutics, (HILTON and Co. Calcutta)
5. Goodman and Gilman; Pharmacological Basis of Therapeutics, McGraw-Hill
6. Katzung, B.G; Basic and Clinical Pharmacology, Lange Medical Publisher, USA
7. Rang, H.P. and Dale, M.M.; Pharmacology, Churchill Livingston, UK
8. Satoskar , R.S. and Bhandarkar S.D> Pharmacology and Pharmacotherapeutics (Popular Prakashan, Bombay).
9. Sharma H.L. Sharma K. K. General Pharmacology Basic Concepts. Paras Publication.
10. Tripathi K. D. Medical Pharmacology, Jaypee.

Pharmacology-IV
(Practical) (3 hrs/week)

1. To study effects of various drugs using isolated tissue preparations
2. Prescription auditing and standard treatment protocols for the patient of following Diseases: Central nervous system diseases, Inflammation, Rhumatoid arthritis, Gout
3. Demonstrations/Computer simulations of Experiments carried out using intact animals:
   i) To study the hypnotic property of drug / drugs using mice/rats as experimental animals
   ii) To study the drug induced motor activity using actophotometer
   iii) To evaluate analgesic activity by writhing method/tail flick method
   iv) To evaluate anticonvulsant activity of the drug
   v) To evaluate anti-inflammatory activity of drug
   vi) To study drug induced catalepsy using bar test in mice.

Recommended Books

1. Kulkarni,S.K.: Handbook of Experimental Pharmacology, Vallabh Prakashan, New Delhi.
2. Ghosh, M.N.: Fundamental of Experimental Pharmacology, Scientific Book
3. Agency, Calcutta.
4. Sheth, U.K., Dadkar, N.K. and Kamat, U.G., Selected Topics in Experimental
5. Pharmacology, Kothari Book Depot. Mumbai.
6. Perry, W.L.M., Pharmacological Experiments on isolated preparations, E&S, Livingston, London
7. Jaju B.P., Pharmacology: A practice Exercise book, Japee Brothers, New Delhi.
8. Burn, J.H., Practical Pharmacology, Blackwell Scientific, Oxford, London
9. Lawrence, D.R., and Bacharch, A.L.; Evaluation of Drug Activities, Pharmacometrics, Academic Press
10. Turner, R.A., Screening Methods in Pharmacology, Academic Press, London
11. Thomson, E.B., Drug Bioscreening, VCH, New York
12. Vogel, H.G. and Vogel, W.H.: Drug Discovery and Evaluation: Pharmacological Assays, Springer, New York

Pharmacognosy – IV
(Theory) (3 Hrs/Week)
(42 lectures)

SECTION I

Methods of preparation and evaluation of following Ayurvedic dosage forms:

1. Rasayana Drugs: Ashwagandha, Giloye, Gokhru
2. Juices/ Kwath: Amla/ Tulsi, Karela, Lauki, Neem, Carrot
3. Avaleha: Chawanprash
4. Bhasma: Swarn bhasma, Rajat bhasma, Loha bhasma, Shankh bhasma, Tamra bhasma
5. Arishta:Ashokarisht, Pancharisht, Dashmularisht
6. Asawa: Draksh asawa, Kumari Asawa
7. Churna: Triphala churna, Sitopladhi churna, trikatu churna
8. Others: Lahsun, Brahmi, Shatavari, Guggul, Kawach beej

SECTION II

Phytopharmaceuticals: Introduction, importance, methods of isolation, detailed chemistry, therapeutic profile of following phytopharmaceuticals:
Taxol, Vinblastine, Camptothecin, Etoposide, Digoxin, Guggulipids, Valepotriates, Boswellic acid, Artemisinin, Resveretral, Silymarin, Hypericin, Omega-3 fatty acids, Colenol, alpha hydroxy citric acid, Streptokinase, Serratiopeptidase.

Recommended Books:

1. "Ayurvedic Formulary of India" Govt. of India
2. "Pharmacopoeial Standards for Ayurvedic Preparations"
3. "Herbal Physicians Desk Reference" U.S.A.
4. "Pharmacognosy" C.K.Kokate, A.P.Purohit, S.B.Gokhale Nirali Prakashan, 40th Edition,
5. "Trease and Evans Pharmacognosy" W.C. Evans, Elsevier, New Delhi, 2005.
6. "Pharmacognosy and Biotechnology" Ashutosh Kar, New Age International Publishers,
7. "Pharmacognosy and Biochemistry" J.B.Bruneton Lavoisier Publishers

8. "Pharmacological Basis of Herbal Medicine" Manuchair Ebadi CRC U.S.A. 2007.
9. "Manual of Pharmacology and Therapeutics" Goodman, Gilman, McGraw Hill Medical,
10. Pharmacognosy & Phytochemistry,V.D.Rangari,Career Publications, Nasik

Pharmacognosy IV
(Practicals) (3 Hrs. /Week)

1. Identification of following drugs by morphological and histologial methods Ashwagandha, Giloye, Gokhru, Amla, Tulsi, Karela, Lauki, Neem, Carrot, Lahsun, Brahmi, Shatavari, Guggul, Kawach beej
2. Preparation of some Ayurvedic formulations those mentioned in the syllabus like.
   Juice: Amla, Tulsi, Karela, Lauki, Neem, Carrot
   Churna: Triphala churan, Sitopladhi churan, Trikatu churan
   Arista: Ashokarisht, Pancharisht, Dashmularisht
   Aswa: Draksh aswa, Kumari Asawa
3. Extraction of different natural drug molecules

Recommended Books:

1. Practical Pharmacognosy, Khandelwal K.R., Nirali Prakashan, Pune.
2. Ayurvedic Formulary of India, Govt. of India
3. Pharmacognosy and Biotechnology: Ashutosh Kar, New Age India Publishers, New Delhi 2004.

Drug Regulatory Affairs
(Theory) (3 Hrs/Week)
(42 lectures)

SECTION-I

1. The Pharmacy Act 1948
2. Drugs and Cosmetics Act 1940 and Drugs and Cosmetics Rules 1945 (also amendments).

   Administration of the Act. The controlling and licensing regulation at state level and

central level (the organization, function and duties of state and central drug control authorities.)

Drugs and cosmetics Act Rules the provisions related to:

3. The manufacture of drugs (other than homeopathic) including schedule C, C(1), F, F(1) and X drugs and cosmetics.
4. The scale and distribution of drugs (other than homeopathic) including schedule C, C (1), F, F(1) and X drugs and cosmetics.

Drugs and Cosmetics Act Rules:

5. i) The import and export of drugs and cosmetics
   ii) Labelling and packaging requirements for all categories of drugs and cosmetics.
6. i) List of schedules to the Drugs and Cosmetics Rules
   ii) Detailed study of schedule M (GMP), T and Y

SECTION-II

7. Code of Pharmaceutical Ethics
8. Narcotic and Psychotropic substances Act 1985
9 Medicinal and toilet preparations (Excise Duties) Act 1955
10. Drugs and magic Remedies (Objectionable Advertisements) Act 1954
11. Indian Patent Act 1970 and amendments to the Act (upto date with reference to WTO Agreement).
12. Drug Price Control Order (latest)
13. Pharmaceutical Policy (Latest)
14. General Idea of International Drug Regulatory Guidelines
15. Preparation of Drugs,ASU drugs Export Dossiers.

Books Recommended:

1. Text book of Forensic Pharmacy : N.K.Jain,Vallabh Prakashan ,NewDelhi 1998
2. All the relevant Bare acts published by Govt. of India.
3. Text book of forensic Pharmacy : Kuchekar, Khadtare,Nirali Prakashan,1995

4. Handbook of Drugs laws :M.L.Mehra,The University Book Agency,Allahabad,Sixth New addition,1990
5. Websites on ISO & ICH guidelines
6. Pharmaceutical Jurisprudence:Shyam Chnadak,Padmini Prakashan, Akola (Maharashtra 2010.
7. Official website on relevant international regulatory guidelines

Pharmaceutical Management

(Theory) (3 Hrs/Week)

(42 lectures)

I. Concept of Pharmacy Profession

History of Pharmacy profession, current status of pharma industries in India, Influence of GATT, WTO, Dunkel Text on Pharmacy profession.

II. Meaning and concept of Management

A. Concept of Management, differentiation between management, administration and organization.

B. Management as an art, science and profession

C. Functions of management

i) Planning – Classification, steps in planning, management by objectives, its benefits and weakness.

ii) Staffing : Manpower planning, sources of recruitment, selection process, training and development, performance appraisals technique, Manager and his role, motivation and theories of motivation. Leadership and theories of leadership.

iii) Organizing : Organization structures, Departmentation, Decentralization and delegation of authorities.

iv) Direction : Characteristics and importance, Control techniques and their importance, Policies, procedures and strategies.

D. Management models like BEP techniques, PERT CPM Inventory Control, techniques of inventory control, Economic Order Quantity.

SECTION II

III. Pharmaceutical Production Management

Organization of Pharma Industry, various departments and their role

Importance of GMP, CGMP, GLP, ISO 9000, WHO GMP SOP and SCP and its relation to quality of pharmaceutical products.

Methods of increase the productivity in Pharmaceuticals

Standardization, validation calibration, audits in Pharma Industry.

Recommended Books:

1. Principles and methods of Pharmacy Management by Harry A.Smith, Lea and Febiger, Philadelphia, USA
2. Essentials of Management: An International Perspective, Harold Koontz Heinz Weihrich,6th Edition,Tta Mc Graw Hill Publishing Co.Ltd, India.
3. Pharmaceutical management by Sachin Itkar, Nirali Prakashan, Pune,India
4. Pharmaceutical Industrial management by G.Vidya Sagar, Pharma Book Syndicate, Hyderabad, India
5. Quality system development Hand book by David Hoyle, Butterworth Heinemann Ltd, U.K.
6. Pharmaceutical Marketting in India by S.V.R Rao, Asian INSTITUTE OF Pharmaceutical Markettng, Hyderabad, India.

Project

(Non-Experimental)

The project work will be completed by student on a topic allotted to him by his guide. The student should use all the resources like libraries, scientific journals, internet etc to collect the information. He should submit four copies of his project to the college for examination.