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Appendix-(2)
Encl: to Item No.(19)
A.C. on 29-05-2007

DR. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY, AURANGABAD.

REVISED SYLLABUS BACHELOR OF PHARMACY SECOND YEAR

[With Effect from -- June, 2007 onwards]

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad.

Equivalence for students who have passed/ failed ATKT at FY B Pharm Old Course Syllabus and Admitted to Second Year B.Pharm New Revised Course –2007-08 Onwards

1. These students will have to appear and pass the subjects of Pharmaceutical Organic Chemistry I, and Computer Application of First Year B.Pharm New Revised Course before seeking admission at Third Year B.Pharm.

2. Candidates admitted directly at Second Year B.Pharm Revised Course 2007-08 onwards, need not appear for Industrial Psychology.

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad.

REVISED CURRICULUM
BACHELOR OF PHARMACY
(B. PHARM.)
(Including amended regulations, structure and scheme of examination)

0.527 There shall be four Examinations leading to the Degree of Bachelor of Pharmacy namely:-

(i) The First B. Pharm . Examination at the end of the First Year :
(ii) The Second B. Pharm. Examination at the end of the Second Year :
(iii) The Third B. Pharm. Examination at the end of the Third Year :
(iv) The Final B. Pharm. Examination at the end of the Final Year :

0.528 The examination specified above shall be held twice a year at such places and on such dates as may be fixed by the University.

0.529 An applicant for admission to an examination specified in ordinance shall complete a regular course of study in the courses prescribed for Examination concerned for not less than one academic year in the college of Pharmaceutical Sciences recognized by the Dr Babasaheb Ambedkar Marathwada University.

0.530 A candidate shall be admitted to the First B. Pharm. Course if he has: -

(i) Passed the HSC (Std. XII) examinations of Maharashtra State Board of Secondary and Higher Secondary Education or its equivalent examination with

- English is one of the subjects
- Both subjects mentioned under Group – I and
- Any one of the subjects mentioned under Group – II

Group-I 1. Physics 2. Chemistry

Group-II 1. Mathematics 2. Biology 3. Biotechnology 4. Computer Science

(ii) Secured minimum 50% marks (45% for backward class candidates from Maharashtra State only) in Physics, Chemistry and the subject of maximum marks amongst the 4 subjects of Group-II, added together.

(iii) Appeared for Maharashtra Pharmacy Common Entrance Test (MAH-PH-CET) conducted by the competent authority for the academic year and secured non zero MAH-PH-CET score.

The above eligibility criteria may be subject to change depending upon the rules and regulations of the Govt. of Maharashtra.

0.531 A candidate shall be admitted to the Second B. Pharm if he has passed the First B.Pharm. Examination, to the Third B. Pharm. If he has passed the First and Second B. Pharm. Examination and to the Final B. Pharm. If he has passed First to Third B. Pharm examination.

0.532 An applicant for admission to an Examination shall satisfy the head of the Department/Principal in the terminal and other Test conducted during the academic year regarding his suitability to take the Examination.

0.533 Every candidate shall be require to undergo at least one months Practical training (continuous or in Parts) at any time after the end of the Second year B. Pharm Examination, in a Recognized Pharmaceutical Manufacturing Concern or in an Analytical Laboratory or in a Chemical Manufacturing Unit or Pharmaceutical Research Organization or Hospital (Clinical Pharmacy) failing which, he/she will not be eligible for conferment of degree by the university.

0.534 No person shall be admitted to any of the Examinations if he has already passed the same examination or equivalent examinations of any other statutory university.

R.646 The structure of B.Pharm Course, scheme of Examination including the maximum marks allotted to the Sessional Examination in each paper, the written part and the practical part for each of the Four examinations, the project work and practical/ industrial training shall be as indicated in appendices A and B.

R.647 The scope of the subject shall be as indicated in the syllabus.

R.648 The Head of the Department of Pharmaceutical Sciences/ Principal shall maintain, in his office, a complete record of the marks obtained by the candidates in the sessional Examinations.

R.649 The head of the Department/Principal shall send final sessional marks sercured by the candidates to the Controller of Examinations, in a sealed cover not less than 15 days before the commencement of examination.

R.650 In order to pass an examination, an examinee must have obtained –

(i) At least 40% of the marks in Theory (excluding Sessional Marks i.e. 32 out of 80 and 40 out of 100) and 45% of the marks in Practical (excluding

Sessional Marks i.e. 36 out of 80 and 45 out of 100) Separately in each subject and

(ii) Must have obtained at least 50% of the total marks assigned to that examination.

R.651 (i) There shall be no classification of successful examines at the First, Second and Third B. Pharm.

(ii) The rank in order of merit of first **three** students shall be declared on the basis of the aggregate marks obtained at the Third and Final B. Pharm Examinations.

R.652 Division of successful examinee at the final B. Pharm Examination shall be declared on the basis of the aggregate marks obtained at the Third and Final B. Pharm Examinations taken together.

R.653 The following shall be the mode of Award of Class at an examination

(i)Candidate obtaining 75% or more of Grant Total: First Class with Distinction

(ii)Candidates obtaining 60% or more but less than 75% of Grant Total: First Class

(iii)Candidate obtaining 50% or more but less than 60% of Grant Total: Second Class

R.654 Only those candidates who have passed an examination in one attempt will be eligible for any prize or scholarships to be awarded for that examination.

R.655 (i) A candidate at the First B. Pharm examination, who fails to secure the prescribed minimum marks in not more than **two** theory papers and not more than **two** practical examinations may at, his/her option, be admitted to a subsequent examination in that paper or practical only on payment of fresh fee. An examinee under this provision shall be allowed to keep terms in the next higher class. He may take both examinations simultaneously, but his result at the higher examination shall not be declared unless he is declared successful at the lower examination.

(ii) A candidate at the Second or Third B. Pharm examination, who fails to secure the prescribed minimum marks in not more than **two** theory papers and not more than **one** practical examinations or in not more than **one** theory papers and not more than **two** practical examinations may at, his/her option, be admitted to a subsequent examination in that paper or practical only on payment of fresh fee. An examinee under this provision shall be allowed to keep terms in the next higher class. He may take both examinations simultaneously, but his result at the higher examination shall not be declared unless he is declared successful at the lower examination.

R.656 An examinee failing in more than the number of theory papers and more than the number of practical papers specified under R.655 (i) for First Year B.Pharm and R655 (ii) for Second and Third Year B.Pharm, may at his/ her option, appear as an ex-student at subsequent examination in the subject in which he has failed, on payment of fresh fee.

If he clears the subjects in which he has failed he shall be declared to have passed the examination. An examinee availing of the exemptions under the provisions of these Regulations shall not be allowed to keep terms at the next higher class.

R.657

(i) At least, three Sessional examinations will be held by the teaching institute every year for the purpose of internal assessment. Sessional marks will be calculated as the average of the best two performances at these examinations.

(ii) A candidate failing in any subject at the University examinations may, at the discretion of the Head of the Department/Principal be permitted, for an Improvement Sessional examination in the theory paper or practical in which he/she has failed as the case may be, in such a case the Head of the Department/Principal shall awarded to him/her fresh Sessional marks on the basis of his/her fresh performance.

(iii) The revised curriculum (including regulations, structure and syllabi) will be in force for academic year 2006-2007 onwards for First Year B. Pharm, for academic year 2007-2008 onward for Second Year B. Pharm for academic year 2008-2009 and onward for the Third Year B. Pharm, and for academic year 2009-2010 and onward for Final Year B. Pharm.

A candidate failing in an examination with old course will have to clear that examination with old course only. He/she will have to take the subsequent higher examinations as per the equivalence decided by the University.

Appendix A

STRUCTURE OF B. PHARM COURSE.

The following will be the course structure of First Year, Second Year, Third Year and Final Year B. Pharm.

FIRST YEAR B. PHARM

Sr. No.	Subject	Theory Hours per week	Practical Hours per week
1.1	Pharmaceutics-I	3	3
1.2	Biochemistry	3	3
1.3	Anatomy Physiology and Health Education	3	3
1.4	Pharmaceutical Inorganic Chemistry.	2	--
1.5	Dispensing of Medication and Hospital Pharmacy.	3	3
1.6	Pharmaceutical Mathematics	2	--
1.7	Computer Application	1	1 D
1.8	Pharmaceutical Organic Chemistry-I	3	3
	TOTAL	20	16

SECOND YEAR B. PHARM

Sr. No.	Subject	Theory Hours per week	Practical Hours per week
2.1	Pharmaceutics-II (Physical Pharmacy)	3	3
2.2	Pharmaceutical Microbiology	3	3
2.3	Pharmaceutical Organic Chemistry II	3	3
2.4	Pharmacognosy-I	2	--
2.5	Pathophysiology and Clinical Biochemistry.	3	3
2.6	Pharmaceutical Analysis -I	3	3
2.7	Pharmaceutical Engineering	3	--
	TOTAL	20	15

THIRD YEAR B. PHARM

Sr. No.	Subject	Theory Hours per week	Practical Hours per week
3.1	Pharmaceutical and Cosmetic Technology	3	3
3.2	Pharmacognosy II	3	3
3.3	Medicinal Chemistry- I	3	3
3.4	Pharmacology and Toxicology	3	3
3.5	Biopharmaceutics and Pharmacokinetics	2	--
3.6	Pharmaceutical Analysis II	3	3
3.7	Biotechnology	3	-
TOTAL		20	15

FINAL YEAR B. PHARM

Sr. No.	Subject	Theory Hours per week	Practical Hours per week
4.1	Dosage Form Design	3	3
4.2	Pharmacognosy and Phytochemisty	3	3
4.3	Medicinal Chemistry- II	3	3
4.4	Pharmacology and Bioassay	3	3
4.5	Pharmaceutical Management	3	--
4.6	Quality Assurance Techniques	3	3
4.7	Pharmaceutical Jurisprudence and Intellectual Property Rights	3	--
TOTAL		21	15

Appendix B

SCHEME OF EXAMINATION

First Examination for Degree of Bachelor of Pharmacy Four Year Integrated Course.

Sr. No.	Subject	Theory Examination				Practical Examination			
		University		Sessional	Total Marks	University		Sessional	Total Marks
		Hrs.	Marks	Marks		Duration Hrs.	Marks	Marks	
1.1	Pharmaceutics-I	3	80	20	100	4	80	20	100
1.2	Biochemistry	3	80	20	100	4	80	20	100
1.3	Anatomy Physiology and Health Education	3	80	20	100	4	80	20	100
1.4	Pharmaceutical Inorganic Chemistry.	3	80	20	100	--	--	--	--
1.5	Dispensing of Medication and Hospital Pharmacy.	3	80	20	100	4	80	20	100
1.6	Pharmaceutical Mathematics	3	80	20	100	--	--	--	--
1.7	Computer Application	3	40	10	50	--	--	--	--
1.8	Pharmaceutical Organic Chemistry-I	3	80	20	100	4	80	20	100

Second Examination for Degree of Bachelor of Pharmacy Four Year Integrated Course.

Sr. No.	Subject	Theory Examination				Practical Examination			
		University		Sessional	Total Marks	University		Sessional	Total Marks
		Duration Hrs.	Marks	Marks		Duration Hrs.	Marks	Marks	
2.1	Pharmaceutics-II (Physical Pharmacy)	3	80	20	100	4	80	20	100
2.2	Pharmaceutical Microbiology	3	80	20	100	4	80	20	100
2.3	Pharmaceutical Organic Chemistry II	3	80	20	100	4	80	20	100
2.4	Pharmacognosy-I	3	80	20	100	-	-	-	-
2.5	Pathophysiology and Clinical Biochemistry.	3	80	20	100	4	80	20	100
2.6	Pharmaceutical Analysis -I	3	80	20	100	4	80	20	100
2.7	Pharmaceutical Engineering	3	80	20	100	--	--	--	--

Third Examination for Degree of Bachelor of Pharmacy Four Year Integrated Course.

Sr. No.	Subject	Theory Examination				Practical Examination			
		University		Sessional	Total Marks	Unviersity		Sessional	Total Marks
		Duration Hrs.	Marks	Marks		Duration Hrs.	Marks	Marks	
3.1	Pharmaceutical and Cosmetic Technology	3	80	20	100	4	80	20	100
3.2	Pharmacognosy II	3	80	20	100	4	80	20	100
3.3	Medicinal Chemistry- I	3	80	20	100	4	80	20	100
3.4	Pharmacology and Toxicology	3	80	20	100	4	80	20	100
3.5	Biopharmaceutics and Pharmacokinetics	3	80	20	100	--	--	--	---
3.6	Pharmaceutical Analysis II	3	80	20	100	4	80	20	100
3.7	Biotechnology	3	80	20	100	--	--	--	--

Final Examination for Degree of Bachelor of Pharmacy Four Year Integrated Course.

Sr. No.	Subject	Theory Examination				Practical Examination			
		University		Sessional	Total Marks	Unviersity		Sessional	Tot Mar
		Hrs.	Marks	Marks		Duration Hrs.	Marks	Marks	
4.1	Dosage Form Design	3	80	20	100	4	80	20	10
4.2	Pharmacognosy and Phytochemisty	3	80	20	100	4	80	20	10
4.3	Medicinal Chemistry- II	3	80	20	100	4	80	20	10
4.4	Pharmacology and Bioassay	3	80	20	100	4	80	20	10
4.5	Pharmaceutical Management	3	80	20	100	--	--	--	--
4.6	Quality Assurance Techniques	3	80	20	100	4	80	20	10
4.7	Pharmaceutical Jurisprudence and Intellectual Property Rights	3	80	20	100	--	--	--	--

The university Theory Question paper of 80 marks will be set according to the following pattern

Section – I (40 Marks)

Compulsory question	
Question No. 1	10 Marks
Optional questions (Solve any two)	
Question No. 2	15 Marks
Question No. 3	15 Marks
Question No.4	15 Marks

Section – II (40 Marks)

Compulsory question	
Question No. 5	10 Marks
Optional questions (Solve any two)	
Question No. 6	15 Marks
Question No. 7	15 Marks
Question No. 8	15 Marks

The University Practical Question paper of 80 marks will be set according to following pattern

Question No. 1 Synopsis	10 Marks
Question No. 2 Viva	10 Marks
Question No. 3 Practical (Major and /or Minor)	60 Marks

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad.

SECOND YEAR B. PHARM SYLLABUS

SUBJECT INDEX

SECOND YEAR B. PHARM

Sr. No.	Subject	Theory Hours per Week	Practical Hours per Week
2.1	Pharmaceutics – II (Physical Pharmacy)	3	3
2.2	Pharmaceutical Microbiology	3	3
2.3	Pharmaceutical Organic Chemistry II	3	3
2.4	Pharmacognosy – I	2	--
2.5	Pathophysiology and Clinical Biochemistry.	3	3
2.6	Pharmaceutical Analysis – I	3	3
2.7	Pharmaceutical Engineering	3	--
	TOTAL	20	15

2.1 PP-T Pharmaceutics – II (Physical Pharmacy)
Theory

SECTION 'A'

Sr. No.	Topic	No. of Lectures
1.0	**Basic Principles** 1.1 State of Matter 1.1.1 Binding Forces 1.1.2 Gaseous State 1.1.3 Liquid State 1.1.4 Solids & Crystaline State 1.1.5 Phase Equilibria & Phase Rule 1.1.6 Condensed System (Two & Three Components)	4
	1.2 Thermodynamics 1.2.1 First Law of Thermodynamics 1.2.2 Thermochemistry 1.2.3 Second Law of Thermodynamics 1.2.4 Third Law of Thermodynamics 1.2.5 Free Energy Functions and Applications	5
	1.3 Physical Properties of Molecules 1.3.1 Molecular Structure And Physical Properties 1.3.2 Additives And Constitutive Properties 1.3.3 Dielectric Constant And Induced Polarization 1.3.4 Permanent Dipole Moment, Refractive Index And Molar Refraction 1.3.5 Interaction Of Matter With Electromagnetic Radiation 1.3.6 Related problem on above from 1.3.1 to 1.3.5	4
2.0	**Equilibrium Phenomenon** 2.1 Non-electrolytes 2.1.1 Types of Solutions 2.1.2 Concentration Expressions 2.1.3 Ideal & Real Solutions 2.1.4 Colligative Properties 2.1.5 Molecular Weight Determination 2.1.6 Related problem on above from 2.1.1 to 2.1.5	4
	2.2 Solution of Electrolytes 2.2.1 Properties of Solutions of Electrolytes 2.2.2 Arhenius Theory of Weak Electrolytes 2.2.3 Theory of Strong Electrolyte 2.2.4 Coefficient for Expressing Colligative properties 2.2.5 Related problem on above form 2.2.1 to 2.2.4	3

	2.3 Ionic Equilibria 2.3.1 Theories of Acids & Bases 2.3.2 Acid Base Equilibria 2.3.3 Concept of Ph 2.3.4 Acidity Constants	3
	2.4 Electromotive Force & Redox Reaction 2.4.1 Nernst Equation & Its Applications 2.4.2 Redox Reactions In Pharmaceutical Sciences	1
	2.5 Buffer & Isotonic Solution 2.5.1 Buffer Equations & Capacity 2.5.2 Applications 2.5.3 Buffered Isotonic Solutions 2.5.4 Methods of Adjusting Tonicity & Ph	3
	2.6 Solubility & Distribution Phenomenon 2.6.1 Solubility Expressions 2.6.2 Solvent – Solute Interactions 2.6.3 Gas Solubility 2.6.4 Liquid Solubility in Liquid 2.6.5 Solid Solubility in Liquid 2.6.6 Distribution Phenomenon	5
	2.7 Complexation & Protein Binding 2.7.1 Types of Complexes 2.7.2 Methods of Analysis 2.7.3 Protein Binding	3

SECTION 'B'

3.0	**Kinetic Phenomenon** 3.1 Diffusion 3.1.1 Importance, Steady State, Diffusion Through Membranes 3.1.2 Methods of Studying Drug Diffusion 3.1.3 Biological Diffusion 3.1.4 Elementary Drug Release 3.1.5 Fick's Law	2
	3.2 Drug Release & Stability 3.2.1 Terminology 3.2.2 Basics 3.2.3 Methods	4
	3.3 Chemical Kinetics & Stability 3.3.1 Fundamentals And Concentration Effects 3.3.2 Temperature Effects 3.3.3 Other Factors 3.3.4 Stability of Pharmaceuticals	5

4.0	**Dispersion System** 4.1 Interfacial Phenomenon 4.1.1 Liquid Interface 4.1.2 Adsoption at Liquid Interface 4.1.3 Adsorption at Solid Interface 4.1.4 Application of Surface Active Agents 4.1.5 Electrical Properties of Interfaces	4
	4.2 Colloids 4.2.1 Types of Colloids 4.2.2 Optical, Kinetic and Electrical Properties 4.2.3 Solubilisation 4.2.4 Applications 4.2.5 Advanced Thermodynamics of Micellisation	4
	4.3 Coarse Dispersion 4.3.1 Suspensions 4.3.2 Interfacial Properties of Suspended Particles 4.3.3 Settling in Suspension 4.3.4 Formulation 4.3.5 Emulsion 4.3.6 Theories of Emulsion 4.3.7 Semisolids	4
5.0	**Drug Delivery** 5.1 Micromeritics 5.1.1 Particle Size and Size Distribution 5.1.2 Methods for Determining Particle Size 5.1.3 Particle Shape and Surface Area 5.1.4 Methods for Determining Surface Area 5.1.5 Pore Size and Derived Properties of Powders	3
	5.2 Rheology 5.2.1 Newtonian and Non-Newtonian Systems 5.2.2 Thixotropy 5.2.3 Determination of Rheological Properties	4
	5.3 Biomaterials 5.3.1 Molecular Weight and Confirmation 5.3.2 Polymers in Solution and Solid State 5.3.3 Fabrication 5.3.4 Polymers in Drug Delivery	3
	5.4 Drug Delivery Systems 5.5 Classification and Definitions	2
6.0	**Problems related to above Chapter No. 1 to 5**	

Reference

- Patrick J. Sinko, Martin's, Physical Pharmacy and Pharmaceutical Sciences, 5th ed. (2006), Lippincott Williams & Wilkins Philadelphia.
- Alfred Martin, Physical Pharmacy, 4th Edition (2003), Lippincott Wilams and Wilkins, Philadelphia.
- Alfred Martin, Pilar Bustamante, Problem solving: Physical pharmacy (1993) Lea & Febiger Philadelphia.
- Cherng-ju-Kim, Advanced Pharmaceutics Physicochemical Principles (2004), CRC Press Washington, D.C.
- Raymond Chang, Physical Chemistry with Applications to biological system, Collier Mecmillan International Edition.
- Kenneth A Connors, Thermodynamics of Pharmaceutical Systems. An introduction for students of Pharmacy (2002), Wiley-Inter science, A John Wiley & Sons, Inc., Publication.
- Hadkar, Practical Physical Chemistry. CBS publications & Distributors, New Delhi.
- Subramaniam, Practical Physical Pharmaceutics, CBS Publications & Distributors, New Delhi.

2.1 PP-P Pharmaceutics – II (Physical Pharmacy) Practical

Sr. No.	Topic	Hrs./ Practical
1.	To determine the molecular weight of (Anthrasin / phenanthrin) by Backman's thermometer method.	3 Hrs
2.	To determine the molecular weight nitrobenzene / toluene / aniline by steam distillation method.	3 Hrs
3.	To determine the upper convolute temperature and composition of phenol water system.	3 Hrs
4.	To construct the ternary phase diagram of water chloroform acetic acid system.	3 Hrs
5.	To determine the heat of neutralization of strong acid and strong base.	3 Hrs
6.	To determine the refractive index and refracore of given sample having molecular weight.	3 Hrs
7.	To determine the wave length of maximum absorption of given die using visible spectrophotometer.	3 Hrs
8.	To determine the molecular weight of given sample using Lands Berger apparatus.	3 Hrs
9.	To determine the molecular weight of given sample by Rast's camphor method.	3 Hrs
10.	To determine the pKa of (Benzoic acid / salicylic acid /any solid amine) by acid base titration.	3 Hrs
11.	To determine the solubility of benzoic acid in given solvent.	3 Hrs
12.	To determine partition coefficient of benzoic acid / salicylic acid / iodine in chloroform / benzene water system.	3 Hrs
13.	To determine the effect potassium iodide on the solubility of iodine.	3 Hrs
14.	To study the diffusion profile of brilliant green through cellophane membrane.	3 Hrs
15.	To study the hydrogen peroxide degradation by volumetric measurement of oxygen.	3 Hrs
16.	To determine the energy of activation of methyl / ethyl acetate hydrolysis.	3 Hrs
17.	To determine the surface tension and parachore of given sample using stalagnometer.	3 Hrs
18.	To determine the specific surface of charcoal using acetic acid adsorption.	3 Hrs
19.	To determine critical micellar concentration (CMC) of given ionic surfactant by conductometric measurement.	3 Hrs
20.	To determine the effect surfactant (Tween 80) on solubility of salicylic acid.	3 Hrs
21.	To determine the effect of electrolyte on sedimentation of calamine suspension.	3 Hrs
22.	To determine the particle size distribution of an emulsion using optical microscopy.	3 Hrs

23.	To determine the particle size distribution using sieve analysis.	3 Hrs
24.	To study the effect of lubricant on flow property of given powder.	3 Hrs
25.	To determine the various densities and porosity of given powder system.	3 Hrs
26.	To determine the viscosity and refracore of given sample of liquid.	3 Hrs
27.	To determine the molecular weight of PVP .OVA using Oswald's viscometer.	3 Hrs
28.	To determine the optical rotation of given substance.	3 Hrs
29.	To demonstrate viscosity measurement using Brookfield's viscometer.	3 Hrs

Reference

- Farrington Daniel, J.W. Williams, Paud Bender, Robert A. Alberty, C. Saniel Cornwell, John E. Harriman., Experimental Physical Chemistry (International Students Edition) (1970), Mc Graw-Hill Kogakusha Ltd., Tokyo.
- R.S. Gaud, G.D. Gupta., Practical Physical Pharmacy (2001), CBS Publishers & Distributors, New Delhi.
- David P. Shoemaker, Carl W. Garland, Joseph W. Nibler, Experiments in physical Chemistry 5th ed. (1989), McGraw-Hill Book Company, New Delhi.
- Hadkar, Practical Physical Chemistry. CBS Publishers & Distributors, New Delhi.
- Subramaniam, Practical Physical Pharmaceutics, CBS Publications & Distributors, New Delhi.

2.2 PM-T Pharmaceutical Microbiology
Theory

SECTION 'A'

Sr. No.	Topic	No. of Lectures
1.	**Introduction to Microbiology:** Scope and application to pharmacy field. Whittaker's Five Kingdom concept, historical development – biogenesis vs. a biogenesis, Germ theory of fermentation, Germ theory of disease, contribution of Leeuwenhoek, Robert Koch, Jenner, Louis Pasteur and ehrlich.	2
2.	**Microscopy and staining techniques:** Principle, ray diagram, construction, working and applications of light compound, dark field, phase contrast, Fluorescence & electron microscope. Concept of resolving power, Magnification power, numerical aperture and angular aperture and working distance. Principle application of oil immersion microscopy.	4
	Theory of staining, principle and technique of staining procedure – Monochrome, Gram, acid fast, negative, capsule, endospore.	2
3.	**Biology of Microorganisms:** Cultural characteristics, pure culture techniques. a) Bacteria – Morphology and fine structure of bacteria, Nutritional requirement and type of culture media, growth and growth curve of bacteria, physical condition for growth, measurement of bacterial growth (Counting Methods), Reproduction in bacteria, genetic exchange Transformation, conjugation and transduction, development of drug resistance by recombination and mutation, preservation of bacterial culture.	7
	Biochemical properties (sugar fermentation and IMVIC test) pathogenesis of staphylococcus, Mycobacterium. Salmonella Introductory study of disease causing rickettsia, importance of actinomycetes in antibiotic production.	2
	b) **Fungi:** Introduction, general characteristics, morphology, industrial and medical significance of Saccharomyces Cerevisae, Penicillium and Aspergillus, Candida Albicans, Epidmohpyton and trichophyta.	2

	c) **Viruses:** Introduction, structure and general properties Bacteriophages – Lytic and Lysogenic cycle, Epidemiological uses of Bacteriophages, human viruses – Cultivation and Multiplication virus host cell interaction, pathogensis of HIV and Prions, types of Tumour viruses.	4
4.	**Aseptic Technique:** Omnipresence of microorganisms, importance of asepsis, sources of contamination and methods of prevention, Principle, construction & working of laminar airflow bench.	3
5.	**Sterilization & Disinfection:** a) Concept and classification, principle and methods of sterilization, Mechanisms of cell injury. b) Construction working & applications of moist heat & dry heat sterilizer, gamma radiation sterilizer, filtration sterilizer indicators of sterilization, microbial death, kinetic terms-D value, z value. c) Terminology of chemical antimicrobial Agents, Chemical classification of different disinfectants, characteristics of ideal disinfectants, factors affecting action of disinfectants, evaluation methods (RW Coeff), Kelsey Sykes test, Chick martin test.	8
6.	Microbial spoilage: Types of spoilage, factors affecting spoilage of pharmaceutical products.	2

SECTION 'B'

Sr. No.	Topic	No. of Lectures
7.	**Immunology and health:** a) Host parasite Relationship:- Normal microbial flora of human body, infection vs. disease, pathogenicity vs. Virulence, Koch & Rivers Postulates, Reservoir of infection sources of infection, Portals of Entry, Portals of exit, vectors of infection, communicability of disease, recognized symptoms of microbial disease, classification of immunity.	4
	• External defense mechanism of host:- Skin, Mucus membrane, chemical secretions, Naturally occurring microbial flora. • Internal defense Mechanism:- Inflammation, fever, natural killer cells, phagocytic cells, soluble mediators-complement Lymphokines, Interferons.	3
	b) Immune response: • Specific immunity & immune response • Humoral immunity antibody response, mediators of Humoral immunity, basic structure of antibody, antibody classes &	4

	functions, maturation of immune response, immunologic memory • Antigens:- Specificity & Immunogenicity, Natural vs. artificial Antigens, Soluble vs. cellular antigens, thymus independent antigen, adjuvant. • Hypersensitivity: - - Immediate-type or anaphylaxis (Type-I) - Compliment mediated or cytolytic hypersensitivity (Type-II) - Immune complex or Arthur's hypersensitivity (Type-III) - Delayed or cell mediated hypersensitivity (Type-IV) • Cellular immunity - Transplantation immunity - Cellular immunity to viruses - Implications of T-cell response • Acquisition of specific immunity: natural vs. passive acquisition c) Practical aspects of immunity • Measurement of Humoral immunity (antibodies) - Precipitation tests, Agglutination tests, RIA, ELISA, Immunofluourescence • Production of monoclonal antibodies • Measurement of cell mediated immunity - Intradermal tests, tests for migration, Mixed lymphocyte reaction (MLR), Cell mediated toxicity (CMT)	2 5 1 1 4 1 2
8.	**Vaccines & Sera:** Manufacturing (seed lot system) and quality control of bacterial vaccines & Toxoids (Tetanus, TAB, Cholera, BCG, DPT), Viral vaccine (Polio- Salk Sabin, Rabies, MMR, Hepatitis, Chickenpox, influenza), Antisera (diphtheria tetanus), antiviral antisera (rabies). Preparation of allergenic extracts & diagnostics	8
9.	**Micorbial Assay:** Importance, General methods of assay of antibiotics (Cup & plate Method, Paper disc Method, Turbidometry, dilution methods), methods for fungicidal & antiviral Compounds, Assay, Microbial limit tests	2

2.2 PM-P Pharmaceutical Microbiology Practical

Sr. No.	Topics	Hrs./ Practical
1.	To demonstrate the omnipresence of microorganisms.	3 Hrs
2.	To study the principle and working of microscope and other laboratory equipments.	3 Hrs
3.	To study the principle and working of laminar airflow.	3 Hrs
4.	To study cultural characteristics of microorganisms.	3 Hrs
5.	Identification of isolated bacteria by simple, negative, gram staining and spore staining.	3 Hrs
6.	Study of Aspergillus and penicillium with respect to morphology (Wet mount techniques).	3 Hrs
7.	Observation of motility of bacteria by hanging drop techniques.	3 Hrs
8.	Preparation and sterilization of nutrient broth, nutrient agar, slants, stabs and plates.	3 Hrs
9.	To study different techniques of Inoculation of culture on different types of media.	3 Hrs
10.	Isolation of pure culture by streak plate technique.	3 Hrs
11.	Isolation of pure culture by pour plate technique.	3 Hrs
12.	To study growth of Fungi on Sabroud's agar and Czpexodox agar medium.	3 Hrs
13.	Determination of microbial count of air by any suitable method.	3 Hrs
14.	Determination of thermal death temperature and time.	3 Hrs
15.	Phenol coefficient of disinfectant by P.W. coefficient.	3 Hrs
16.	Study of sterility testing of following as per. I.P. a) Water for injection. b) Ophthalmic preparations.	3 Hrs
17.	Antibiotic assay – penicillin and Streptomycin.	3 Hrs
18.	Assay vitamin B12 Bioassay.	3 Hrs
19.	MIC (Minimum Inhibitory concentration)	3 Hrs
20.	To study antimicrobial activity of any medicinal plant. a) Antibacterial b) Antifungal	3 Hrs
21.	Study of microbial limits of following as per I.P. a) Aluminum hydroxide gel b) Starch. C) Talc	3 Hrs
22.	Demonstration of Serological test (Widal Test, VDRL Test)	3 Hrs

References

- Pharmaceutical Microbiology: By Hugo and Russel, Blackwell science.
- Tutorial Pharmacy: By Cooper and Gunn, CBS publication.
- Indian Pharmacopoeia Volume – II and I.
- Microbiology: By Pelczar, Tata McGraw-Hill publishers.
- Fundamentals of Microbiology: By Frobishar.
- Remington's Pharmaceutical sciences Vol. II and I.
- Theory and Practice of Industrial Pharmacy: By Leon Lachman, Varghese publisher.
- Textbook of Microbiology: Anantnarayan, Orient Longman.
- Microbiology: Presscott, harley, Klein WCB publication.
- Medical Microbiology: By McCartney, Swain, Duguid. ELBS Book.
- Dispensing for pharmaceutical students: Cooper & Gunn's.
- Microbiology concepts and applications by Pelczar et al., International Edition.
- General microbiology Vol II: Powar & Daginawala.
- Bentley's textbook of Pharmaceutics.
- Microbiology & immunology by: Blackwell and Momcagordni et al.
- Industrial microbiology by Casida (Jr) Willey publication.
- Pharmaceutical biotechnology by: Jain & Vyas.

2.3 POC-II-T Pharmaceutical Organic Chemistry- II
Theory

SECTION 'A'

Sr. No.	Topics	No. of Lectures
1	**Stereochemistry** a. Definition of terms like configuration, conformation b. Isomerism and its types Geometrical Isomerism Z and E nomenclature Adv. Over cis and trans naming Cahn-Ingold-Prelog system for assigning Z and E Physical and chemical methods for determining the configuration of geometrical isomers. Optical Isomerism Definition of dextrorotatory, laevorotatory, enantiomers, chirality and Representations of a chiral center – Dotted – Line – Wedge, fischer Yormula, Saw horse and Newman. D and L and R and S nomenclature for one and two chiral centers Resolution of racemic mixture c. Conformation Potential energy for ethane and n-butane. Conformation of cyclohexane. Potential energy curve. Number of stereoisomers and relative stabilities of disubstitued cyclohexanes.	12
2.	**Stereoslectivity and stereospeciticity – Definition** a. Stereochemistry of SN^1, SN^2 reactions and Sni reactions. b. Syn and Anti Elimination – E1, E2, E1cb eliminations pyrolysis of esters, Chugaev elimination (Tschuzaeff), Cope elimination (emphasis on stereochemistry). c. Syn and Anti Addition Reactions-catalytic hydrogenation of alkenes and alkynes, addition of halogens, hydroxylation, hydroboration (emphasis on stereochemistry).	12
3.	**Free Radicals** Structure and Stereochemistry, Stability. Generation of free-radicals-thermal decomposition photochemical, oxidation reduction and electrolysis. Radical anions and cations – definitions and some organic reaction s involving them as intermediates. Free redical reactions-Kolbe electrolysis, Hunsdiecker reaction, Sandmeyer reaction, Gomberg reaction.	6

4.	**Chemistry Structure** (Structure, Synthesis and reactions) of polycyclic compounds like naphthalene, anthracene and phenanthrene involving substituents.	6

SECTION 'B'

5.	**Molecular Rearrangements** – Mechanism and Stereochemistry a. Rearrangement of electron deficient systems, General Theory, Whitmore- 1,2 shift, Wagner-Meerwein rearrangement, Pinacol rearrangement, Wolff rearrangement, Beckmann, rearrangement, Hofmann rearrangement, Lossen rearrangement. Curtius rearrangement, Schmidt rearrangement, Baeyer-villiger oxidation. b. Election-rich rearrangement Stevens rearrangement, Witting rearrangement, Neber reaction, Benzilic acid rearrangement, Dakin oxidation, Sommelet rearrangement, Favourskii rearrangement. c. Migration of aromatic rings Fries rearrangement, Claisen rearrangement, Willgerodt reaction d. Migration involving double and triple bonds, Cope rearrangement.	15 1 1 3
6.	**Chemistry (Structure, Synthesis, reactions and applications)** of heterocyclic compounds like furan, pyrrole, thiophene, indole, pyridine, quinoline, isoquinoline, imidazole, thiazole, oxazole and pyrimidine, diazepam both the parent compounds and also substituted compounds.	15
7.	**Oxidation and Reduction:** Use of the following reagents: $KMnO_4$ $K_2Cr_2O_7$, H_2O_2, MnO_2, Hydrogenation catalysts, $NaBH_4$, $LiAlH_4$, NH_2-NH_2, H_2-Pd/c.	4

References

- Pine, Hendrickson, Cram and Hammond – Organic Chem (McGraw H III).
- Allinger, Cava De Jough, Johnson, Lebel, Stevens-Organic Chemistry (Worth).
- Neckers and Dolye-Organic Chemistry (John Wiley).
- Morrison and Boyd – Organic Chemistry (Prentice Hall).
- Agronomov et al-Problems and exercises in Organic Chemistry (Mir).
- Organic Chemistry-Streliweiser and Heathcock (Academic press).
- D. Nasipuri-Stereochemistry of Organic compounds-Principles and Applications-(Wiley Eastern Ltd.).
- Peter Sykes-The search for Organic reaction pathways. (Longman Group Ltd.).
- Gurdeep Chatwal Synthetic Organic Chemistry (Himalaya Publishing House).
- Finar-Problems and their solution in Organic Chemistry. (Longman Goroup Ltd.).
- Criddle and Ellis-Spectral and Chemical characterization of Organic compounds. A laboratory handbook. (John Wiley and Sons).
- Ernest Eliel., "Stereochemistry of carbon compounds", student edition, john wiley Y sons, New York.
- Reinhard Bruckner., "Advanced Organic Chemistry – Reaction Mechanisms", Academic Press, 2003, New Delhi.
- Gupta, "Heterocyclic Chemistry", Part II, Springer publications, New Delhi.
- Norman & Coxon, "Principles of Organic Synthesis", III ed., Chapman & Hall, London.

2.3 POC-II-P Pharmaceutical Organic Chemistry- II Practical

Sr. No.	Topics	Hrs./ Practical
1.	Purification and separation of liquids by distillation (demonstration).	3 Hrs.
2.	Separation of binary mixtures by physical and chemical methods i.e. using acidity/basicity, solubility in water and ether and volatility. Characterization and identification of the individual components followed by preparation of a suitable derivative (10 binary mixtures).	3 Hrs./ Practical
3.	**Quantitative Analysis (Estimation of functional groups).** a. Hydroxy group in alcohols (by acetic anhydride) and phenols (by acetic anhydride and hydrolysis). b. Amino group in aliphatic amines (by acetylation) and aromatic amines (by acetylation and iodometry). c. Carboxyl group (Volumetric and gravimetric (silver salt method).	3 Hrs./ Practical
4.	**Synthesis** 1. Anthranilic acid from phthalimide. 2. Benzilic acid from benzil. 3. Benzanilide from benzophenone (Beckmann rearrangement). 4. Electrophilic substitution reactions of Naphthelene/ Anthracene (nitration, sulphonation or any other two).	3 Hrs./ Practical

Reference

- Practical Organic Chemistry by F.G. Mann et-al publishers Orient Longman.
- An Introductory course in Practical Organic Chemistry by F.D. Crenstone et-al.
- A textbook of practical Chemistry for B.Sc. by V.V. Nadkarny publisher Popular Prakashan.
- Introduction to Organic Laboratory Techniques a contemporary approach by D.L. Pavia publisher Saunders Golden Sunburst.
- Furniss B.S. & other-Vogel's Textbook of practical Organic Chemistry pub. ELBS.
- Clanke & others- A handbook of Organic analysis-Quantitative & Qualitative –5th edition, Publisher-Arnold Mernenman.
- Williamson K.L. Macroscale and Microscale Organic Experiments Pub. D.C. Health & Camb.
- Advanced General Organic Chemistry by S.K. Ghosh, New central book agency.
- Organic Chemistry by L.G. Wade, 5th edition, published by Pearson Education (Singapore) Pvt. Ltd.
- Stereochemistry, Conformation and Mechanism by P.S. Kalsi, 6th edition, new age international Pvt. Ltd.
- Organic Chemistry and Reactions and Reagents by O.P. Agrawal, 38th edition, Krishna Prakashan Media Pvt. Ltd.

2.4 P'nosy-I T **Pharmacognosy - I**

Theory

Sr. No.	Topics	No. of Lectures
1.	Definition, History, scope and development of pharmacognosy.	2
2.	Sources of Crude drugs: Biological, marine, mineral, animal and plant tissue culture as sources of drugs.	1
3.	Classification of Crude drugs (organized & unorganized): Alphabetical, morphological, taxonomical, chemical and pharmacological classification of crude drugs.	3
4.	Plant taxonomy: Study of following families with special reference to medicinal important plants of apocynaceae, Solanaceae, rutaceae, umbelliferae, leguminosae and liliaceae, Morphology of roots, stem, bark, leaf, fruits, flowers and modifications of roots and stems and Study of different tissues in plants.	4
5.	Cultivation, collection, processing and storage of crude drugs: Factors influencing cultivation of medicinal plants. Types of soils and fertilizers of common use. Pest management and natural pest control agents. Plant hormones and their applications. Polyploidy, Mutation, hybridization with reference to medicinal plants and its role in Phytopharmaceuticals.	5
6.	Quality control of crude drugs: Adulteration of crude drugs and their detection by organoleptic, microscopic, physical, chemical and biological methods of evaluation, instrumental Methods of crude drug analysis.	5
7.	An introduction to active constituents of Carbohydrates, Proteins Lipids, Glycosides, Alkaloids, Volatile Oils & Tannins and their general isolation and classification.	6
8.	Introduction to alternative system of medicine, with special emphasis given on Ayurveda, Siddha, Unani, Homeopathy. Holistic concept of drug administration in traditional systems of medicine and introduction to ayurvedic preparations like Aristas, Asavas, Gutikas, Tailas, Churnas, Lephas and Bhasmas.	7
9.	Studies of traditional drugs: Common vernacular names, botanical sources, morphology, chemical nature of chief constituents, pharmacology, categories and common uses and marketed formulations of following indigenous drugs like Amla, Kantakari, Shatavari, Tylophora, Bhilawa, Kalijiri Buch, Rasana, Punarnava Chitrak, Apamarg, Gokhru, Shankhpushpi, Bramhi, Adulsa, Arjuna, Ashoka, Fenugreek, Garlic, Palas, Guggul, Gymnema, Shilajit, Nagarmotha and Neem.	11
10.	Natural Allergens and photosensitizing agents and fungal toxins.	3
11.	Plants bitters and sweeteners.	3

Reference

- Text Book of Botany, A.C. Dutta, Oxford University Press, Calcutta
- Pharmacognosy, Trease & Evans, Harcourt Brace & Company Asia PTE Ltd.,
- Pharmacognosy, Brady & Tylor Lea & Fibiger, Philadelphia.
- Text Book of Pharmacognosy, Gokhle, Kokate & Purohit, Nirali Prakashan.
- Pharmacognosy, J.S. Kadri B.S. Shah Prakashan, Ahamadabad.
- Essentials of pharmacognosy, S.H. Ansari.
- Quality standard for Medicinal plant Material, WHO publication 1999.
- Medicinal plants of India, Indian Council of Medical Research, New Delhi.
- Indian Herbal Pharmacopoeia, IDMA Publication, Mumbai.
- Cultivation and collection of Medicinal Plants, By Atal C.K. and Kapur B.B., RRL Jammu Publication.
- Cultivation and Utilization of Aromatic Plants, By Atal C.K. and Kapur, B.M. RRL Jammu Publication.
- Textbook of Pharmacognosy, T.E. Wallis CBS publisher and distributors.
- Pharmacognosy, Pharmacobiotechnology, Ashutosh Kar New Age International (P) Ltd., Publisher.
- Handbook of pharmacognosy and phytochemistry, Brain and Turner.
- Handbook of pharmacognosy and phytochemistry, by Khandelwal.
- Textbook of pharmacognosy by Vinod Rangari Career Publication.

2.5 PPCB-T Pathophysiology and Clinical Biochemistry
Theory

SECTION 'A'

Sr. No	Topics	No. of Lectures
1.	**Introduction to pathophysiology and clinical biochemistry:** definition of pathology, health and diseases, terminologies in pathology, patient, lesions, morphology, etiology, pathogenesis, symptoms, physical science, diagnosis, prognosis, treatment and prevention, evolution of pathology from religious beliefs to rational approach. Era of gross pathology, Era of technology development and cellular pathology, modern pathology, subdivision of pathology: histopathology, hematology, chemical pathology, immunology, experimental pathology, geographic pathology, medical genetics and molecular pathology, concept of core biochemistry tests like renal fuction test, liver fuction test, hormone specific tests, special tests like HIV etc., clinical enzymologist – analytical, diagnostic uses of enzymes	5
2.	**Techniques for the study of pathology:** autopsy pathology, surgical pathology, special stains, enzyme histochemistry, basic microscopy, immunofluroscence, immunohistochemistry, electron microscopy, cytogenetics, molecular pathology, flow cytometry, cell proliferation analysis and role of computers in pathology.	2
3.	**Cell Injury and cellular adaptation:** etiology, pathogenesis, morphology of cell injury, intracellular accumulation, pigments, irreversible cell injury, cell death, apoptosis, theory of aging.	4
4.	**Immuno pathology:** components of immune system, HLA system, diseases of immunity, AIDS, hypersensitivity reactions, autoimmune diseases, transplant rejection, amyloidosis: physical and chemical nature, pathogenesis, classification, staining and diagnosis.	2
5.	**Heamodynamic disorders:** internal environment: water and electrolyte balance, acid base balance, pressure gradient and fluid exchanges, disturbances of body fluid and electrolytes, edema, types, pathogenesis, morphology, over-hydration and dehydration., disturbances of electrolytes: Combined sodium and water deficiency, abnormalities of pH of blood, heamodynamic disturbances: disturbances in the volume of circulating blood, congestion hemorrhage, shock, circulatory disturbances, thrombosis, ischemia, infraction.	4

6.	**Inflammation and healing:** acute inflammation: vascular and cellular evens, chemical mediators of inflammation, regulation, factors determining variation, system effects of acute inflammation, chronic inflammation: types, general Features. Granulomatous inflammation: example including tuberculosis, leprosy, syphilis, actinomycosis, sarcoidiosis, healing: regeneration repair, wound healing and healing in specialized tissue.	5
7.	**Infectious and parasitic disease:** diseases caused by bacteria, spirochetes and mycobacteria: plague, anthrax, whopping cough, measles, staphylococcal infection, steptococal infection, clostedial disease, diseases caused by fungi., diseases caused by virus: heamorrhagic fever, SARS, varicella zoster, herpes simplex infection, lymphogranuloma, rabies. Disease caused by parasites: amoebiasis, malaria, filariasis, cysticercosis, torch complex.	8
8.	**Neoplasia:** nomenclature, classification, characteristics of tumors, metastasis, grading and staging of cancer, carcinogenesis: etiology, pathogenesis, molecular, genes, chemical, physical, biologic, viral, clinical aspects and diagnosis of cancer.	10
9.	**Environmental and nutritional diseases:** introduction, environmental pollution, chemical and drug injury, therapeutic and non therapeutic toxic agent, alcoholism, lead poisoning, carbon monoxide poisoning, drug abuse, injury by physical agents, nutritional disease: starvation, obesity, protein energy malnutrition, disorders of vitamins, trace elements, diseases carbohydrate, lipids and protein metabolism. diseases related to carbohydrate, protein, lipid metabolism.	5

SECTION 'B'

10.	**Cardiovascular and lymphatic disorders:** atherosclerosis, arthritis, aneurysms, varicosities, thrombophelebities, lymphagitis, benign tumors and tumor like lesion and hamartomas., heart disease: congenital heart disease, heart failure, ischemic heart disease, hypertension, rheumatic fever, valvular disease, tumors of the hearts and cardiac interventions., heamatopoietic disorders: types of anemia, abnormalities of RBCs, WBCs, platelets, blood transfusion, heamolytic diseases, lymphaoid system: reactive lymphadenitis, malignant lymphomas, Hodgkins disease, multiple myloma, splinomegaly, splinic rupture.	8
11.	**Respiratory system:** respiratory distress syndrome, pulmonary infections, atelectasis, COPD, lung abscess, asthma.	4
12.	**Gastrointestinal disorders:** congenital anomalies, inflammatory lesions, hematemesis of esophegial, stomach, intestinal origin, malabsorption syndrome. Liver, bilary tract and exocrine pancreas: hepatitis, liver function test, Reyes syndrome, portal venous obstruction. Portal hypertension, congenital anomalies, cholelithiasis, pancreatitis, chronic liver failure. Gastric function tests, pancreatic	8

	fuction tests.	
13.	**Urinary system: renal** function test, congenital malformations, glomerular diseases, tubular diseases, renal vascular diseases.	4
14.	**Reproductive system:** congenital anomalies, inflammation and infection, tumors	2
15.	**Endocrine system:** diabetes mallitus, hypertension, hypo and hyper thyroidism, thyroid function tests.	4
16.	**Musculo-skeletal system:** Osteomalytis, osteoarthritis, rheumatic arthritis, myasthania gravis, myopathic disease, neurogenic disease, osteoporosis.	2
17.	**Nervous system:** Meningitis, encephalitis, hydrocephalus, ischemic brain disease, trauma, intracranial hemorrhage, demylinating disease, tumors, epilepsy.	5

Reference

- Pathophysiology, Concept of Altered Health status, Carol Mattson Porth, Lippincott Williams and Wilkins.
- Physiology, Guyton,
- Human physiology, V.D. joshi,
- Robbins Pathological basis of diseases
- Test Book of Pathology, Harsh Mohan, Jaypee Publication
- Text Book of pathology by IAPM, Ed. J.M. Naglotimath, V.H. Talib, K.P.Deodher
- Clinical chemistry tests, Value and implications, Springhouse.
- Practical Clinical Biochemistry, Alan H Goenlock, CBS publishers
- Medical Laboratory Technology, Method and Interpretations, Ramnik Sood, Jaypee Brothers.
- Basic Medical biochemistry, A Clinical Approach, Colleen Smith, Allan D. Marks, Micheal Liberman, Lippincott Williams and Wilkins.
- Practical Clinical Biochemistry, Harold Varley, A.H Gomerlock and Maurice Bell. CBS publishers and Distributors.
- Human Physiology Volume II& I, C.C. Chatergy, .
- Clinical Chemistry in diagnosis and treatment, J.F.Ziwa, P.R.Pannall and P.D.Mayne, Edward Arrnil Publication.
- Clinical Chemistry (Principles, procedures corrections) ed. M.L.Bishop, J.L. DUBER, Von Laugen, Edward P.Fody.
- Clinical Biochemistry, F.A.Gowan, Churchill Livingstin.
- Clinical Chemistry, Marshall

2.5 PCBC-P Pathophysiology and Clinical Biochemistry Practical

Sr. No.	Name of Practical	Hrs./ Practical
1.	**Introduction:** good laboratory and clinical practices, safety and precautions to be followed in laboratory. Basic laboratory operations use and care of laboratory glassware's, plastic wares, use of bulb and micro pipetteing use gloves, mask and safety wares.	3 Hrs.
2.	**Instruments:** care, handling and calibration of pathology laboratory instruments and equipments like microscope, colorimeter, biochemical analyzer, flame photometer, balance, centrifuge, vortex mixture, hot air oven, autoclave, magnetic stirrer, incubator, etc.	3 Hrs.
3.	**Basic techniques:** basic techniques, procedures, precaution to be take, storage of blood, urine, sputum, throat swab, stool, cerebrospinal fluid, hair, nail and skin scrapings samples.	3 Hrs.
	Hematology:	
4.	Method of collection of blood sample, various anticoagulants used, storage of blood sample techniques of preparation of blood plasma and serum from blood sample.	3 Hrs.
5.	Routine hematological test and their clinical signification (explanation with demonstration).	3 Hrs.
6.	Quantitative estimation of sugar contents from serum/ plasma by Biuret or any other suitable method, using glucometer and by using biochemical analyzer and study of its clinical significance.	3 Hrs.
7.	Quantitative estimation of total protein and albumin contains from serum/ plasma using Biuret method, Kjeldahl Nesslerization method and by using biochemical analyzer and study of its clinical significance.	3 Hrs.
8.	Quantitative estimation of total cholesterol and triglycerides contents from serum/ plasma by Lieberman-Burchard method and by using biochemical analyzer and study of its clinical significance.	3 Hrs.
9.	Quantitative estimation of urea, uric acid and creatrinie contents from serum/ plasma using suitable method and by using biochemical analyzer of its clinical significance.	3 Hrs.
10.	Quantitative estimation of inorganic phosphorus, chloride, calcium contents from serum/ plasma using suitable method and study of its clinical significance.	3 Hrs.
11.	Preparation and study of stained blood smear of differential count and cell morphology, with their clinical significance, eosinophil count, abnormal cells and its clinical significance.	3 Hrs.
12.	Different blood coagulation tests (prothrombin time, thrombin time, thromboplastin time, plasma recalcification time, fibrinogen etc.) and its clinical significance	3 Hrs.

	(Explanation with demonstration)	
13.	Visit to a blood bank / pathology laboratory and understudying its working.	3 Hrs.
	Urine Analysis:	
14.	Routine examination of urine including color, pH, odor, appearance, specific gravity, presence of normal constituents by qualitative analytical tests.	3 Hrs.
15.	Microscopic examination of urine sediments for RBC, WBC, epithelial cell, casts, fat bodies, microorganism, calcium oxalate crystals etc.	3 Hrs.
16.	Qualitative analysis of urine sample for abnormal constituents like protein, glucose, ketone bodies, blood, bile salts and bile pigments etc.	3 Hrs.
17.	Quantitative analysis of urine sample for glucose and protein using suitable quantitative method or biochemical analyzer and study of its clinical significance.	3 Hrs.
18.	Detection of sodium, potassium and calcium contents of urine sample using flame photometric techniques.	3 Hrs.
	Microbial Analysis:	
19.	Microbial examination of pathogens, systematic grouping of pathogenic bacteria, classification of enterobacteriaceae	3 Hrs.
20.	Culture and antimicrobial susceptibility test using antibiotic and antibacterial disc for used from wound exudates, blood, pus and sputum	3 Hrs.
21	Examination of swab from upper respiratory tract nose, throat, nasophrynx and their clinical significance – (explanation with demonstration).	3 Hrs.
22.	Examination of nose and ear exudates and skin flora – (explanation with Demonstration.)	3 Hrs.
	Enzymology:	
23.	SGOT, SGPT and Lactic dehydrogenase using suitable kit	3 Hrs.
24.	Serum alkaline and acid phosphatase using suitable kit	3 Hrs.
25.	Serum/ plasma amylase	3 Hrs.

Important Note:

- Good laboratory practices and Good clinical practices must be followed as per the standard guidelines during the practical of subject pathophysiology and clinical biochemistry. The subject in charge, Head of department, the principal of the institute should look in the matter for effective implementation of the same.
- The syllabus framing committee, University (Dr. Babasaheb Ambedkar Marathwada University, Aurangabad), Board of studies or any such authority does not accept any liability for any consequence to any human being in or outside laboratory before, during or after the practical of the subject pathophysiology and clinical biochemistry.

Reference

- Manual of clinical laboratory procedures for non routine problems, S. Winstem and F. Dalal, CRC press.
- Clinical Laboratory methods, John D Baver, Philip G. Ackermann, Gelson Toro publisher, C. Mosby.
- A work book of clinical chemistry, Philip D. Marne, Andhrew P. Day, Edward Kent E. Opheim, Lea & Febiger Philadelphia.
- Clinical Chemistry, Interpretation and techniques, Alex Kaplan, Laurence L. Szaba, Kent E. Opheim, Lea & Febiger Philadelphia.
- Flurometric techniques in clinical chemistry, Levitch Franklin R.
- Text Book of clinical (Medical) biochemistry and immunology, Dr. S.Ramakrishnan, Dr. Raji Swami, T.R. Publications.
- An introduction to practical biochemistry, Plummer, Tata McGraw Hill publication
- Practical clinical enzymology, J. King, D. Van Nostrand Co. Ltd. London
- Hand book of Experimental physiology and Biochemistry, P.V.Chandha, Jaypee Brothers Delhi
- Medical Laboratory technology vol. I, II AND III, Kinari L., Tata McGraw publishing Co. Ltd.
- Clinical chemistry tests, Value and implications, Springhouse.
- Practical Clinical Biochemistry, Alan H Goenlock, CBS Publishers and Distributors.
- Medical Laboratory Technology, Method and Interpretations, Ramnik Sood, Jaypee Brothers.

2.6 PA-I-T Pharmaceutical Analysis - I
Theory

SECTION 'A'

Sr. No.	Topics	No. of Lectures
1.	Definition, scope of Pharmaceutical Analysis. Introduction to analytical techniques-volumetric, gravimetric, gasometric and instrumental techniques.	1
2.	Study of contents of official monographs in detail (monographs of aspirin & calcium gluconate powder to be studied).	3.
3.	Introduction to Statistics in Pharm analysis Classification, types and minimization of errors, concepts of accuracy, precision. Methods of expressing precision (mean, median, average deviation, standard deviation, coefficient of variation, standard error), significant figures, rounding of figures, comparison of results (students' t-test, F-test, Method of least squares, Q-test for rejection of data), and problems related to it.	8
4.	Safety in analytical laboratory- Types of hazards, prevention of harm (precautionary labels, safety materials, charts, warning signs for hazardous chemicals), laboratory first aid treatment.	3
5.	Standardization- Specifications for quality control, manufacturing variations, storage & dating of products, conditions of use, dosage forms. Significance of physical constants- milting point, boiling point, optical rotation, refractive index, specific gravity, light absorption, infrared absorption, viscosity, jelly strength, swelling power, polymorphism, particle size. Assays- tolerances, sampling procedures and errors, limit test (specificity, sensitivity, control of personal errors, general limit test for non- specific impurities.	9
6.	Theoretical basis of quantitative analysis- Concept of solute, solvent, solution, molarity, molality, normality, formality, equivalent weight calculations in reactions mentioned below, parts per thousand/million/billion, expression in %, primary, secondary standards and problems related to it. Calibration – methods, calibration of volumetric apparatus, balances, weights. Calculation of factor in neutralization, complexation, precipitation and redox reactions.	9
7.	Nitrogen estimation by Kjeldahl's methods	1
8.	Oxygen flask combustion technique	1

9.	**Sodium nitrite titration:** Principle and theory Assays of . suphamethoxazole, calcium aminosalicylate, isocarboxazid, phthalylsulphathiazole.	2

SECTION – 'B'

Types of Volumetric Analysis:

10.	Aqueous acid – base titrations: Law of mass action and its applications (Problems related to it), acidimetry and alkalimetry with their standardization, end point detection, neutralization indicators (structures to be included). Assays of aspirin, ibuprofen, boric acid, benzoic acid, borax, zinc oxide, milk of magnesia, lithium carbonate, benzyl benzoate, tolbutamide, probenecid.	8
11.	Non-aqueous titration: Principle, theory, types of non-aqueous solvents, titration of alkali metals salt of organic acids, titration of amines and amine salts of organic acids, titration of halogen acid salt of bases & titration of acidic substances. Assays of codeine phosphate, ephedrine HCL, ethosuximide, phenobarbitone, pilocarpine nitrate. Methods for determination of water, Karl Fischer titrimetry.	6
12.	Complexometric titrations: Principle, theory, end point detection using pM indicators (catechol violet, erichrome black T, xylenol orange, murexide-chemical structures to be included), disodium edetate titrations and standardization, masking & demasking agents.	6
13.	Oxidation-reduciton titrations: Principle & theory, redox indicators, Study of following types and their standardization: a) Permanganometry-assays of ferrous sulphate, hydrogen peroxide, potassium bromide. b) Cerimetry-Assays of ferrous sulphate, ferrous gluconate, acetaminophen. c) Iodimetry-ascorbic acid, dimerecaprol, analgin tablets. d) Iodometry-isoniazid, chlorinated lime, copper sulphate. e) Potassium iodate titrations-determination of potassium iodide, assay of weak iodine solution or aqueous iodine solution. f) Titanous chloride titrations : Principle and theory, assay of methylene blue.	9
14.	Argentimetric titrations: Principle and theory, Mhor's method, Volhard's method, Fajan's method, indicators used in argentimetry. Assays of Saline or Sodium chloride injection and potassium chloride injection, ammonium chloride, yellow mercuric oxide.	3

15.	Gravimetric analysis: Unit operations, calculations and problems related to it. Assays of aluminum in alum, barium in barium chloride.	6

References

- Beckett A.H, Stenlake J.B., "Practical Pharmaceutical Chemistry – Part One", IV edition, CBS Publishers and Distributors, New Delhi.
- Jeffery G.H., Bessett J., mendham J., Denney R.C., "Vogel's Textbook of Quantitative Chemical Analysis", V Edition, ELBS Publications, London.
- Kar Ashutosh, "Pharmaceutical Drug Analysis", II edition, New Age International publisher, New Delhi.
- Sheorey S., Honrao M., "Pharmaceutical Analysis-I (Practical)", I edition, Career publications, Nashik.
- Connors K.A., "A textbook of pharmaceutical Analysis", III edition, John Wiley, New York.
- Mann & Saunders, "Practical Organic Chemistry", IV edition, Orient Longman publications.
- Higuchi et al., "Pharmaceutical Analysis", CBS publishers, New Delhi.
- Garratt D.C., "The Quantitative Analysis of Drugs", III edition, CBS publishers, New Delhi.
- Kennedy J.H., "Analytical Chemistry-Principles", II edition, sunders, New York.
- Atherden L.M., "Bentley & Driver's Textbook of pharmaceutical Chemistry", VIII edition, Oxford University press, Mumbai.
- Pharmacopoeia of India, Vol. I & II Controller of publications, Govt. of India, New Delhi.

2.6 PA-I-P Pharmaceutical Analysis - I Practical

Sr. No.	Topics	Hrs./ Practical
1.	Remarks and other directions- a. Laboratory requirements: Laboratory note book, match box, scissors, watch glass, washing brush, wash bottle, fevicol, china marking pencil, butter paper, pair of tongs, weighing bottle, policeman, etc. b. Introduction to lab equipments and basic lab operations: Use and care of laboratory glassware and plastic ware, volumetric and non-volumetric glassware, techniques of measuring, careful reading of meniscus, pipettes and drainage tanks, use of bulb for pipetteing, use and care of Bunsen burner. Technique of filtration, use of fluted filter paper, lab reagents (regular/ Inflammable/ poisonous/ Photosensitive/ hygroscopic)-Proper storage, shelf life and labeling, use of safety eye shower and bath shower. c. Laboratory techniques: Cleaning and drying of laboratory apparatus, sampling, use of balance and its adjustments using rider and precision of balance. d. Concepts of validation, chemical reagent grades (AR, LR, GR, etc.), purity and strength requirements, calculation of results and errors, rejection of results, significant figures and rounding of figures.	3 Hrs
2.	Introduction to various terms used in quantitative analysis.	3 Hrs
3.	Methods of calibration: Pipettes, burettes, volumetric flask, weighing balance, set of weights.	3 Hrs
4.	Determination of viscosity of solution of one of the following substances: gelatin or gum acacia or alcohol.	3 Hrs
5.	Acid-base titration: Preparation and standardization of 0.1N HCl, 0.1NaOh, 0.1N H2SO4. Assay of any one or more of the following drugs: aspirin or ibuprofen or acetaminophen.	3 Hrs
6.	Non-aqueous titration: Preparation and standardization of 0.1N perchloric acid. Assay of any one or more of the following drugs: Atenolol or Salbutamol sulphate or Mebendazole or Norfloxacin.	3 Hrs

7.	Precipitation titration a) Preparation and standardization of 0.1N silver nitrate (Mohr's method)- assay of saline or sodium chloride injection or powder or potassium chloride. b) Preparation and standardization of 0.1N ammonium thiocyanate- assay of saline or sodium chloride or ammonium chloride. c) Preparation and standardization of 0.1N silver nitrate (Fajan's method) – assay of sodium chloride.	3 Hrs/ Practical
8.	Permanganometric titration: Preparation and standardization of 0.1N potassium permanganate. Assay of ferrous sulphate or hydrogen peroxide or potassium bromide.	3 Hrs
9.	Cerimetric Titration: Preparation and standardization of 0.1M ceric ammonium sulphate. Assay of any one or more of the following drugs; ferrous sulphate or ferrous gluconate or acetaminophen.	3 Hrs
10.	Iodimetric titration: Preparation and standardization of 0.1N iodine. Assay of any one or more of the following drugs; ascorbic acid or dimercaprol or analgin tablets.	3 Hrs
11.	Iodometric titration: Preparation and standardization of 0.1N /0.1M sodium thiosulphate. Assay of any one or more of the following drugs; isoniazid or chlorinated lime or copper sulphate.	3 Hrs
12.	Potassium iodate titration: Preparation and standardization of 0.05M potassium iodate and .1M sodium thoisulphate. Assay of any one or more of the following: potassium iodide or weak iodine solution or aqueous iodine solution.	3 Hrs
13.	Sodium nitrite titrations: Preparation and standardization of 0.1N sodium nitrite. Assay of any one or more of the following drugs; sulphamethoxazle or calcium aminosalicylate or isocarboxazid or phthalysulphathiazole or any relevant sulpha drug.	3 Hrs
14.	Complexometric titrations: Preparation and standardization of 0.01N sodium edetate. Assay of any one or more of the following drugs; calcium carbonate or calcium gluconate or zinc oxide or calcium chloride or magnesium sulphate.	3 Hrs
15.	Gravimetric analysis: Estimation of aluminium in alum or barium in barium chloride.	3 Hrs

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- Beckett. A.H., Stenlake J.B, "Practical Pharmaceutical Chemistry – Part One", IV edition, CBS Publishers and Distributors, New Delhi.
- Jeffery G.H., Bassett J., Mendham J., Denney R.C., "Vogel's Textbook of Quantitative Chemical Analysis", V Edition, ELBS Publications, London.
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- Pharmacopoeia of India, Vol. I & II, controller of Publications, Govt. of India, New Delhi.

2.6 PE-T Pharmaceutical Engineering
Theory

SECTION 'A'

Sr. No.	Topics	No. of Lectures
1.	**Introduction** Pharmaceutical Unit Operations and Dimensional analysis	4
2.	**Fluid flow** Fluid statics, Manometers, Mechanism of fluid flow, Reynold's number, Bernoulli's theorem, Fluid heads, Friction in pipes, Measurement of fluid device like orifice, venturi, pilot tube, rotameter and current meters.	4
3.	**Transportation of fluids** Pipe fittings and joints, Valves (Plug cocks, Globe valves, Gate vales, Check valves, Automatic control valves, Pumps (Reciprocating, piston, diaphragm)	2
4.	**Flow of Heat** Classification of heat-flow processes, Fourier's law, Thermal conductivity, compound resistance in series, Heat flow through a cylinder, Temperature gradients in forced convection, Over-all coefficients. Heaters, tubular heaters, heat interchangers, double-pipe heat interchangers.	4
5.	**Evaporation** Evaporators types, Factors influencing rate of evaporation, Steam jacketed kettle, Horizontal-tube evaporator, Vertical-tube evaporator, Basket-type evaporator, long tube evaporator, short tube evaporator, forced circulation evaporator and Multiple-effect evaporator, evaporator accessories, entrainment separators and foam.	5
6.	**Distillation** Boiling-point diagram, Raoult's law, Relative volatility, Henery's law, Constant-boiling mixtures, Equilibrium diagrams, Binary mixture of miscible liquids, simple or differential distillations of immiscible liquids (Steam distillation), Binary mixtures of miscible liquids, simple differential distillation, Rectification or Fractional distillation, construction of rectifying columns, types of downcomers, McCabe-Thiele diagram, Plate efficiency, Murphree plate efficiency. Introduction of Azeotropic, Extractive, Flash and Molecular distillation.	7

7.	**Humidity and Air Conditioning** Humidity and air conditioning, Humidity charts, determination of humidity.	4
8.	**Drying** General principles, rate of drying, the mechanism of moisture movement during drying, drying equipments, Classification and selection of dryers, Introduction to tray, tunnel, fluidized bed, spray, drum, rotary and freeze-drying.	5
9.	**Extraction** Equipment for leaching coarse solids, the fixed-bed or Robert diffusion battery, Silver continuous diffuser, Basket extractor, Rotocel extractor, Dorr agitator, Podbielniak extractor.	4

SECTION 'B'

10.	**Crystallization** Crystal forms and habits, classification of crystallizers, Operation and design of Tank crystallizer, Agitate batch crystallizer, Swenson-Walker crystallizer, Vaccum crystallizer, Krystal crystallizers to produce large crystals, Miers supersaturation theory and its limitation, caking of crystals and prevention of caking.	5
11.	**Conveying** Brief introduction of Belt conveyors, chain conveyors, Screw conveyors and pneumatic conveyors.	2
12.	**Water Purification** Deionization, reverse osmosis, distillation process and large scale manufacturing of water in pharma industry.	2
13.	**Boilers** Introduction classification of boilers, requirements, of good boilers, boilers detail, Cochran, Babcock Wilcox, Lancashire and industrial boiler (Water tube boiler, FBB, Waste heat recovery boiler, Electric Boiler)	3
14.	**Material Technology** a) Corrosion: Fluid corrosion (General and localized), Mechanism of corrosion. Types of corrosion and ageing, factors influencing corrosion and methods of combating corrosion. b) Materials of Construction: Factors considered for selection of material, Classification into Metals and non-metals. Ferrous and non-ferrous metals, Inorganic nonmetallic, Organic nonmetallic, Thermoplastics.	5

15.	**Safety and loss prevention** Intrinsic and extrinsic safety, the hazards, Dow fire and explosion index, Hazard and operability studies, hazard analysis, acceptable risk and safety priorities, safety checklist.	2
16.	**Mechanical Engineering** Basics of engineering drawing, introduction to various projection (Orthographic projection, auxiliary projection, isometric projection, oblique projection, perspective projection, advanced free hand sketching.)	3
	Introduction, Principle and Application: Basic tool, tool box, files, saws, hammers, pliers, spanners, screw drivers, drills, micrometers, measuring tapes, vernier calipers, wire guage, dial guage, drawing instrument (drawing board, T square, set square, compass, divider, scale, protactor, French curve, drawing pencils, eraser, drawing pins, inking machine, drafting machine, duster, sand paper, beven square, combination set with spirit level, calipers and dividers.	2
17.	**Introduction Machine Parts** Various types of gears, belts and chains, bearing, couplings, threaded fasteners, clutches, springs, flywheel, cam and lub and common machine parts presenting various Pharma machineries	2
18.	**Electrical Engineering** Transformers: Various Types of transformers, their application, brief working (No numerical), emphasis on isolation transformers, power transformers, potential and current transformers. Motors: Types of motors: Types of motors (A.C, D.C), Single phase, three-Phase) and their application brief working (No numerical) Switch gear and wires: Types of fittings, wires and cables, types of specification of lighting, types of switch gear (Circuit breaker, ICTP, isolator, switches).	5
19.	**Basic electronics** Resistor: Types of resistors, resistance measurement by color code, resistance measurement by using multimeter, symbols of capacitor and inductor. Voltage source and current source, definition and symbol of A.C. and D.C. electronic components symbols and principle in brief of P-N diode, Zener diode, transistor (NRP and PNP), LED, photodiode, Photo transistor, SCR. Rectifiers: Definition and types, circuit diagram and working principle of half wave rectifier, full wave rectifier, full wave bridge rectifier. Digital electronics: Symbols and truth table of logic gates, AND, OR, NOT, NAND, NOR, EX-OR, EX-NOR gates, introduction to 8085 microprocessor, introduction to PLC.	5

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