B. Pharm (Bachelor of Pharmacy)

SEMESTER – I

S. N.	Course no.	**Subject (Theory)**	Period			Evaluation scheme			Credit	Hours
			L	T	P	MSE	ESE	Sub Total		
1	PS 1101	Pharmaceutics – I	3	0	0	30	70	100	3	3
2	PS 1102	Pharmaceutical Analysis - I	3	0	0	30	70	100	3	3
3	PS 1103	Pharmaceutical Chemistry - I	3	0	0	30	70	100	3	3
4	PS 1104	Pharmacognosy - I	3	0	0	30	70	100	3	3
5	PS 1105	Communicative English	3	1	0	30	70	100	3	4
6	PS 1106	Remedial Mathematics	3	1	0	30	70	100	3	4
7	PS 1107	Remedial Biology	2	0	0	30	70	100	2	2
							Total	600	18/17	20/18

S. N.	Course no.	**Subject (Practical / Project)**	Period			Evaluation scheme			Credit	Hours
			L	T	P	CPA	ESE	Sub Total		
1	PS 1101P	Pharmaceutics – I	0	0	4	20	30	50	2	4
2	PS 1102P	Pharmaceutical Analysis - I	0	0	4	20	30	50	2	4
3	PS 1103P	Pharmaceutical Chemistry - I	0	0	4	20	30	50	2	4
4	PS 1104P	Pharmacognosy - I	0	0	4	20	30	50	2	4
5	PS 1107P	Remedial Biology	0	0	2	20	30	50	1	2
							Total	200/250	8/9	16/18

MSE (Internal Evaluation), ESE - End Semester Examination.

CPA (Internal Evaluation)

Total Credits (18+8 / 17+9) = 26 Total Marks 600+200/250=800/850 Total Hours (20+16 / 18+18) = 36

Candidates who did not pass Biology subject in entry qualification (+2 Sc. etc.) examination are required to take Remedial Biology (PS 1107 & PS 1107P), and those who did not pass Mathematics subject are required to take Remedial Mathematics (PS 1106). Candidates who passed both Biology and Mathematics subjects can take either Remedial Biology (T&P) or Remedial Mathematics.

B. Pharm (Bachelor of Pharmacy)

SEMESTER – II

S. N.	Course no.	**Subject (Theory)**	Period			Evaluation scheme			Credit	Hours
			L	T	P	MSE	ESE	Sub Total		
1	PS 1201	Pharmaceutics – II	3	0	0	30	70	100	3	3
2	PS 1202	Pharmaceutical Chemistry – II	3	0	0	30	70	100	3	3
3	PS 1203	Pharmaceutical Chemistry – III	3	0	0	30	70	100	3	3
4	PS 1204	APHE –I	3	0	0	30	70	100	3	3
5	PS 1205	Advanced mathematics	3	1	0	30	70	100	3	4
							Total	500	15	16
S. N.	Course no.	**Subject (Practical / Project)**	Period			Evaluation scheme			Credit	Hours
			L	T	P	CPA	ESE	Sub Total		
1	PS 1201P	Pharmaceutics – II	0	0	4	20	30	50	2	4
2	PS 1202P	Pharmaceutical Chemistry – II	0	0	4	20	30	50	2	4
3	PS 1203P	Pharmaceutical Chemistry – III	0	0	4	20	30	50	2	4
4	PS 1204P	APHE –I	0	0	4	20	30	50	2	4
							Total	200	8	16

MSE (Internal Evaluation)., ESE - End Semester Examination.

CPA (Internal Evaluation)

Total Credits: 15+8 = 23 Total Marks 500+200=700 Total Hours 16+16 = 32

B. Pharm (Bachelor of Pharmacy)

SEMESTER – III

S. N.	Course no.	**Subject (Theory)**	Period			Evaluation scheme			Credit	Hours
			L	T	P	MSE	ESE	Sub Total		
1	PS 1301	Pharmaceutics – III	3	0	0	30	70	100	3	3
2	PS 1302	Pharmaceutical Chemistry – IV	3	0	0	30	70	100	3	3
3	PS 1303	Pharmacognosy - II	3	0	0	30	70	100	3	3
4	PS 1304	Pharmaceutical Analysis - II	3	0	0	30	70	100	3	3
5	PS 1305	APHE -II	3	0	0	30	70	100	3	3
							Total	500	15	15
S. N.	Course no.	**Subject (Practical / Project)**	Period			Evaluation scheme			Credit	Hours
			L	T	P	CPA	ESE	Sub Total		
1	PS 1301P	Pharmaceutics – III	0	0	4	20	30	50	2	4
2	PS 1302P	Pharmaceutical Chemistry – IV	0	0	4	20	30	50	2	4
3	PS 1303P	Pharmacognosy - II	0	0	4	20	30	50	2	4
4	PS 1304P	Pharmaceutical Analysis - II	0	0	4	20	30	50	2	4
5	PS 1305P	APHE -II	0	0	4	20	30	50	2	4
							Total	250	10	20

MSE (Internal Evaluation)., ESE - End Semester Examination.

CPA (Internal Evaluation)

Total Credits: 15+10 = 25 Total Marks 500+250=750 Total Hours 15+20 = 35

B. Pharm (Bachelor of Pharmacy)

SEMESTER – IV

S. N.	Course no.	**Subject (Theory)**	Period			Evaluation scheme			Credit	Hours
			L	T	P	MSE	ESE	Sub Total		
1	PS 1401	Pharmaceutics – IV	3	0	0	30	70	100	3	3
2	PS 1402	Pharmaceutical Microbiology	3	0	0	30	70	100	3	3
3	PS 1403	Pharmacognosy - III	3	0	0	30	70	100	3	3
4	PS 1404	Pathophysiology of common diseases	3	0	0	30	70	100	3	3
5	PS 1405	Basic electronics and computer applications	3	0	0	30	70	100	3	3
6	PS1406	Pharmaceutical jurisprudence & ethics	3	0	0	30	70	100	3	3
							Total	600	18	18
S. N.	Course no.	**Subject (Practical / Project)**	Period			Evaluation scheme			Credit	Hours
			L	T	P	CPA	ESE	Sub Total		
1	PS 1401P	Pharmaceutics – IV	0	0	4	20	30	50	2	4
2	PS 1402P	Pharmaceutical Microbiology	0	0	4	20	30	50	2	4
3	PS 1403P	Pharmacognosy - III	0	0	4	20	30	50	2	4
4	PS 1405P	Basic electronics and computer applications	0	0	4	20	30	50	2	4
							Total	200	8	16

MSE (Internal Evaluation)., ESE - End Semester Examination.

CPA (Internal Evaluation)

Total Credits: 18+8 = 26 Total Marks 600+200=800 Total Hours 18+16 = 34

B. Pharm (Bachelor of Pharmacy)

SEMESTER – V

S. N.	Course no.	**Subject (Theory)**	Period			Evaluation scheme			Credit	Hours
			L	T	P	MSE	ESE	Sub Total		
1	PS 1501	Pharmaceutics – V	3	0	0	30	70	100	3	3
2	PS 1502	Pharmaceutical Chemistry – V	3	0	0	30	70	100	3	3
3	PS 1503	Pharmacology - I	3	0	0	30	70	100	3	3
4	PS 1504	Pharmacognosy - IV	3	0	0	30	70	100	3	3
5	PS 1505	Pharmaceutics – VI	3	0	0	30	70	100	3	3
							Total	500	15	15
S. N.	Course no.	**Subject (Practical / Project)**	Period			Evaluation scheme			Credit	Hours
			L	T	P	CPA	ESE	Sub Total		
1	PS 1501P	Pharmaceutics – V	0	0	4	20	30	50	2	4
2	PS 1502P	Pharmaceutical Chemistry – V	0	0	4	20	30	50	2	4
3	PS 1503P	Pharmacology - I	0	0	4	20	30	50	2	4
4	PS 1504P	Pharmacognosy - IV	0	0	4	20	30	50	2	4
5	PS 1505P	Pharmaceutics – VI	0	0	4	20	30	50	2	4
							Total	250	10	20

MSE (Internal Evaluation)., ESE - End Semester Examination.

CPA (Internal Evaluation)

Total Credits: 15+10 = 25 Total Marks 500+250=750 Total Hours 15+20 = 35

B. Pharm (Bachelor of Pharmacy)

SEMESTER – VI

S. N.	Course no.	**Subject (Theory)**	Period			Evaluation scheme			Credit	Hours
			L	T	P	MSE	ESE	Sub Total		
1	PS 1601	Pharmaceutics – VII	3	0	0	30	70	100	3	3
2	PS 1602	Pharmaceutical Chemistry – VI	3	0	0	30	70	100	3	3
3	PS 1603	Pharmacognosy - V	3	0	0	30	70	100	3	3
4	PS 1604	Pharmacology - II	3	0	0	30	70	100	3	3
5	PS 1605	Pharmaceutical Analysis - III	3	0	0	30	70	100	3	3
							Total	500	15	15
S. N.	Course no.	**Subject (Practical / Project)**	Period			Evaluation scheme			Credit	Hours
			L	T	P	CPA	ESE	Sub Total		
1	PS 1601P	Pharmaceutics – VII	0	0	4	20	30	50	2	4
2	PS 1602P	Pharmaceutical Chemistry – VI	0	0	4	20	30	50	2	4
3	PS 1603P	Pharmacognosy - V	0	0	4	20	30	50	2	4
4	PS 1604P	Pharmacology - II	0	0	4	20	30	50	2	4
5	PS 1605P	Pharmaceutical Analysis - III	0	0	4	20	30	50	2	4
							Total	250	10	20

MSE (Internal Evaluation), ESE - End Semester Examination.

CPA (Internal Evaluation)

Total Credits: 15+10 = 25 Total Marks 500+250=750 Total Hours 15+20 = 35

B. Pharm (Bachelor of Pharmacy)

SEMESTER – VII

S. N.	Course no.	**Subject (Theory)**	Period			Evaluation scheme			Credit	Hours
			L	T	P	MSE	ESE	Sub Total		
1	PS 1701	Pharmaceutics – VIII	3	0	0	30	70	100	3	3
2	PS 1702	Pharmacology – III	3	0	0	30	70	100	3	3
3	PS 1703	Pharmaceutical Chemistry – VII	3	0	0	30	70	100	3	3
4	PS 1704	Pharmaceutical Biotechnology	3	0	0	30	70	100	3	3
5	PS 1705	Pharmaceutical industrial management	3	0	0	30	70	100	3	3
6	PS 1706	Elective	3	0	0	30	70	100	3	3
							Total	600	18	18
S. N.	Course no.	**Subject (Practical / Project)**	Period			Evaluation scheme			Credit	Hours
			L	T	P	CPA	ESE	Sub Total		
1	PS 1701P	Pharmaceutics – VIII	0	0	4	20	30	50	2	4
2	PS 1702P	Pharmacology - III	0	0	4	20	30	50	2	4
3	PS 1703P	Pharmaceutical Chemistry – VII	0	0	4	20	30	50	2	4
4	PS 1706P	Elective	0	0	4	20	30	50	2	4
							Total	200	8	16

MSE (Internal Evaluation)., ESE - End Semester Examination.

CPA (Internal Evaluation)

Total Credits: 18+8 = 26 Total Marks 600+200=800 Total Hours 18+16 = 34

B. Pharm (Bachelor of Pharmacy)

SEMESTER – VIII

S. N.	Course no.	**Subject (Theory)**	Period			Evaluation scheme			Credit	Hours
			L	T	P	MSE	ESE	Sub Total		
1	PS 1801	Pharmaceutics – IX	3	0	0	30	70	100	3	3
2	PS 1802	Pharmaceutical Chemistry – VIII	3	0	0	30	70	100	3	3
3	PS 1803	Pharmacognosy - VI	3	0	0	30	70	100	3	3
4	PS 1804	Pharmacology - IV	3	0	0	30	70	100	3	3
							Total	400	12	12
S. N.	Course no.	**Subject (Practical / Project)**	Period			Evaluation scheme			Credit	Hours
			L	T	P	CPA	ESE	Sub Total		
1	PS 1801P	Pharmaceutics – IX	0	0	4	20	30	50	2	4
2	PS 1802P	Pharmaceutical Chemistry – VIII	0	0	4	20	30	50	2	4
3	PS 1803P	Pharmacognosy - VI	0	0	4	20	30	50	2	4
4	PS 1805P	Project Work & Viva-voce	0	0	12	40	60	100	10	12
							Total	250	16	24

MSE (Internal Evaluation), ESE - End Semester Examination.

CPA (Internal Evaluation)

Total Credits: 12+16 = 28 Total Marks 400+250=650 Total Hours 12+24 = 36

B. PHARM

SEMESTER - I

PS 1101 PHARMACEUTICS – I (Physical Pharmacy)
L-T-P : 3-0-0 Credit : 3

1. **Matter, Properties of Matter:** State of matter, change in the state of matter, latent heats and vapor pressure, sublimation-critical point, Eutectic mixtures, gases, aerosols-inhalers, relative humidity, liquid, complexes, liquid crystals, glassy state, solids-crystalline, amorphous and polymorphism.
2. **Micromeretic and Powder Rheology:** Particle size and distribution, average particle size, number and weight distribution, particle number, methods for determining particle volume, optical microscopy, Asieving, sedimentation, measurement, particle shape, specific surface, methods for determining surface area; permeability, adsorption, derived properties of powders, porosity, packing arrangement, densities, bulkiness & flow properties.
3. **Surface and Interfacial Phenomenon:** Liquid interface, surface and interfacial tensions, surface free energy, measurement of surface and interfacial tensions, Spreading coefficient, adsorption at liquid interfaces, surface active agents, HLB classification, solubilization, detergency, adsorption at solid interfaces, solid-gas and
Solid - liquid interfaces, complex films and electrical properties of interface.
4. **Viscosity and Rheology:** Newtonian systems, Law of flow, kinematic viscosity, effect of temperature, non-Newtonian systems, pseudoplastic, dilatant, plastic, thixotropy, thixotropy in formulation, determination of viscosity, capillary, falling ball, rotational viscometers.
5. **Dispersion Systems:** Colloidal Dispersions: Definition, types, properties of colloids, protective colloids, applications of colloids in pharmacy; Suspensions and Emulsions: Interfacial properties of suspended particles, settling in suspensions, theory of sedimentation, effect of Brownian movement" sedimentation of flocculated articles, sedimentation parameters, wetting of particles, controlled flocculation, flocculation in structured vehicles, rheological considerations; Emulsions-types, theories, physical stability.
6. **Complexation:** Classification of complexes, methods of preparation and analysis, applications.
7. Kinetics and Drug Stability: General considerations & concepts, half-life determination, Influence of temperature, light, solvent, catalytic species and other factors, Accelerated stability study, expiration dating.
8. **Buffers:** Buffer equations and buffer capacity in general, buffers in pharmaceutical systems, preparation, stability, buffered isotonic solutions, measurements of tonicity, calculations and methods of adjusting isotonicity.

PS 1101P PHARMACEUTICS – I (LAB)
L-T-P : 0-0-4 Credit : 2

1. Determination of latent heat, vapor pressure, critical point.
2. Studies on polymorphs, their identification and properties.
3. Determination of particle size, particle size distribution and surface area using various methods of particle size analysis.
4. Determination of derived properties of powders like density, porosity, compressibility, angle of repose etc.
5. Determination of surface/interfacial tension, HLB value and critical micellar concentration of surfactants.
6. Study of rheological properties of various types of systems using different Viscometers.
7. Studies of different types of colloids and their properties.
8. Preparation of various types of suspensions and determination of their sedimentation parameters.

9. Preparation and stability studies of emulsions.
10. Studies on different types of complexes and determination of their stability constants.
11. Determination of half-life, rate constant and order of reaction.
12. To study the influence of various factors on the rate of reaction.
13. Accelerated stability testing, shelf-life determination and expiration dating of pharmaceuticals.
14. Preparation of pharmaceutical buffers and determination of buffer capacity.
15. Experiments involving tonicity adjustments.

Recommended Books:

1. Martin's Physical Pharmaceutical Sciences by P. J. Sinko (Lippincott William and Wilkins, Baltimore).
2. Cooper and Gunn's Tutorial Pharmacy edited by S.J. Carter.
3. Bently's Textbook of Pharmaceutics edited by E.A. Rawlins.
4. Bahl & Tuli: "Essentials of Physical Chemistry," S. Chand & Co.
5. Gennaro et al., "Remington's The Science & Practice of Pharmacy" (Lippincott William and Wilkins, Baltimore).
6. Banker & Rhodes,. "Modern Pharmaceutics"
7. Aulton, "Pharmaceutics – The Science of Dosage Form Design"

PS 1102 PHARMACEUTICAL ANALYSIS - I
L-T-P : 3-0-0 Credit : 3

1. Significance of quantitative analysis in quality control, Different techniques of analysis, Preliminaries and definitions, Significant figures, Rules for retaining significant digits, Types of errors, Mean deviation, Standard deviation, Statistical treatment of small data sets, Selection of sample, Precision and accuracy. Fundamentals of volumetric analysis, methods of expressing concentration, primary and secondary standards.
2. **Acid Base Titrations:** Acid base concepts, Role of solvent, Relative strengths of acids and bases, Ionization, Law of mass action, Common-ion effect, Ionic product of water, pH, Hydrolysis of salts, Henderson-Hessel bach equation, Buffer solutions, Neutralization curves, Acid-base indicators. Theory of indicators, Choice of indicators, mixed indicators, Polyprotic system, Polyamine and amino acid systems, Amino acid titration, applications in assay of Hl04, NaOH, $CaC0_3$ etc. .
3. **Oxidation Reduction Titrations:** Concepts of oxidation and reduction, Redox reactions, Strengths and equivalent weights of oxidizing and reducing agents, Theory of redox titrations, Redox indicators, Cell representations, Measurement of electrode potential, Oxidation-reduction curves, Iodimetry and Iodometry, Titrations involving ceric sulphate, potassium iodate, potassium bromate, potassium permanganate; titanous chloride and Sodium 2, 6-dichlorophenol indophenol.
4. **Precipitation Titrations:** Precipitation reactions, Solubility products, Effect of acids, temperature and solvent upon the solubility of a precipitate. Argentometric titrations and titrations involving ammonium or potassium thiocyanate, mercuric nitrate, and barium sulphate, Indicators, Gay-Lussac method, Mohr's method, Volhard's method and Fajan's method.
5. **Gravimetric Analysis:** Precipitation techniques, Solubility products; The colloidal state, Supersaturation co-precipitation, Postprecipitation, Digestional washing of the precipitate, Filtration, Filter papers and crocibles, Ignition, Thermogravimetric curves, Specific examples like barium sulphate, aluminium as aluminium oxide, calcium as calcium oxalate and magnesium as magnesium pyrophosphate, Organic precipitants.

PS 1102P PHARMACEUTICAL ANALYSIS - I (LAB)
L-T-P : 0-0-4 Credit : 2

The students should be introduced to the main analytical tools through demonstrations. They should have a clear understanding of a typical analytical balance, the requirements of a good balance, weights, care and use of balance, methods of weighing and errors in weighing. The students should also be acquainted with

the general apparatus required in various analytical procedures.

1. Standardization of analytical weights and calibration of volumetric apparatus.
2. Acid Base Titrations : Preparation and standardization of acids and bases; some exercises related with determination of acids and bases separately or in mixture form, some official assay procedures e.g. boric acid should also be covered.
3. Oxidation Reduction Titrations: Preparation and standardization of some redox titrants e.g. potassium permanganate, potassium dichromate, iodine, sodium thiosulphate etc. Some exercises related to determination of oxidizing and reducing agents in the sample shall be covered. Exercises involving potassium iodate, potassium bromate, iodine solution, titanous chloride, sodium 2,6-dichlorophenol indophenol, and ceric ammonium sulphate.
4. Precipitation titrations: Preparation and standardization of titrants like silver nitrate and, ammonium thiocyanate, Titrations according to Mohr's, Volhard's and Fajan's methods.
5. Gravimetric Analysis: Preparation of gooch crucible for filtration and use of sintered glass crucible, Determination of water of hydration, some exercises related to gravimetric analysis should be covered.

Recommended Books:

1. Vogel's Text book of Quantitative Chemical Analysis (Person Education, Singapore).
2. Beckett & Stenlake: "Practical Pharmaceutical Chemistry," CBS Publishers & Distributors.
3. Garratt, "The Quantitative analysis of drugs".

PS 1103 PHARMACEUTICAL CHEMISTRY - I (Inorganic Pharmaceutical Chemistry)
L-T-P : 3-0-0 Credit : 3

An outline of methods of preparation, uses, sources of impurities, tests for purity and identity, including limit tests for iron, arsenic, lead, heavy metals, chloride, sulphate and special tests if any, of the following classes of inorganic pharmaceuticals included in Indian Pharmacopoeia.

1. Acids and Bases: Buffers, Water.
2. Gastrointestinal Agents: Acidifying agents, Antacids, Protectives and Adsorbents, Cathartics.
3. Major Intra-and Extra-cellular Electrolytes: Physiological ions. Electrolytes used for replacement therapy, acid-base balance and combination therapy.
4. Essential and Trace Elements: Transition elements and their compounds of pharmaceutical importance, Iron and haematinics, mineral supplements.
5. Cationic and anionic components of inorganic drugs useful for systemic effects.
6. Topical Agents: Protectives, Astringents and Anti-infectives.
7. Gases and Vapours: Oxygen, Anesthetics and Respiratory stimulants.
8. Dental Products: Dentifrice, Anti-caries agents.
9. Complexing and chelating agents used in therapy
10. Miscellaneous Agents: Sclerosing agents, expectorants, emetics, poisons and antidotes, sedatives etc. Pharmaceutical Aids Used in Pharmaceutical Industry. Anti-oxidants, preservatives, filter aids, adsorbents, diluents, excipients, suspending agents, colorants etc.
11. Inorganic Radio Pharmaceuticals: Nuclear radio pharmaceuticals, Reactions, Nomenclature, Methods of obtaining their standards and units of activity, measurement of activity, clinical applications and dosage, hazards and precautions.

PS 1103P PHARMACEUTICAL CHEMISTRY - I (LAB)
L-T-P : 0-0-4 Credit : 2

The background and systematic qualitative analysis of inorganic mixtures of up to four radicals. Six Mixtures to be analyzed, preferably by semimicro methods. At identification tests for pharmacopocial inorganic pharmaceuticals and qualitative tests for cations & anions should be covered.

Recommended Books:

1. Inorganic Medicinal and Pharmaceutical Chemistry by Block, Roche, Soine, Wilson
2. Bentley and Driver's Text Book of Pharmaceutical Chemistry.
3. Pharmaceutical Chemistry – Inorganic by G.R.Chatwal.

PS 1104 PHARMACOGNOSY - I
L-T-P : 3-0-0 Credit : 3

1. Definition, history, scope and development of Pharmacognosy
2. Sources of drugs: Biological, marine, mineral and plant tissue cultures as sources of drugs
3. Classification of drugs: Alphabetical, morphological, taxonomical, chemical and pharmacological classification of drugs.
4. Plant taxonomy: study of the following families with special reference to medicinally important plants - Apocynacae, Solanaceae, Rutacease, Umbelliferae, Leguminosae, Rubiaceae, Liliaceae, Graminae, Labiatae, Cruciferae, Papaveraceae.
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 and hybridization with reference to medicinal plants.
6. Quality control of crude drugs: Adulteration of crude drugs and their detection by organoleptic, microscopic, physical, chemical and biological methods and properties.
7. An introduction to active constituents of drugs: their isolation, classification and properties.
8. Systematic pharmacognostic study of following:
   a) Carbohydrates and derived products: agar, guar gum, acacia, Honey, Isabgol, pectin, Starch, sterculia and Tragacantyh.
   b) Lipids: Bees wax, Castor oil, Cocoa butter, Cod~liver oil, Hydnocarpus oil, Kokum butter, Lard, Linseed oil, Rice, Bran oil, Shark liver oil and Wool fat.

PS 1104P PHARMACOGNOSY – I (LAB)
L-T-P : 0-0-4 Credit : 2

1. Morphological characteristics of plant families mentioned in theory.
2. Microscopic measurements of cells and Cell contents: Starch grains, calcium oxalate crystals and phloem fibres.
3. Determination of leaf constants such as stomatal index, stomatal number, vein-islet number, vein-termination number and palisade ratio.
4. Identification of crude drugs belonging to carbohydrates and lipids.
5. Preparation of herbarium sheets.

Recommended Books:

1. Text Book of Pharmacognosy by Kokate C K, Purohit A P, Gokhale S B (Nirali Prakashan, Pune)
2. Trease G.E. and Evans W.C., Pharmacognosy (Balliene Tindall, Eastbourne)
3. Text Book of Pharmacognosy by T.E.Wallis.(CBS Publishers & Distributors, New Delhi)
4. Tyler V.E., Brady L.R. and Robbers J.E., Pharmacognosy (Len & Febiger, Philadelphia)

PS 1105 COMMUNICATIVE ENGLISH
L-T-P : 3-1-0 Credit : 3

1. Basic Grammar: Structural pattern, single word substitution: Editing tenses of Verbs.
2. Common errors, comparison, Syntax.
3. Antonyms, Homonyms, Comprehension based on topics of Science & Technology
4. Precise, Paragraph Writing, Technical description.

5. Expansion (worked & phrase)
6. Official Correspondence, Memorandum, Circular letter.
7. Applying for a job, Resume
8. Business Correspondence, Report Writing, E-mail.
9. Phonetics (Symbol and Transcription), Pronunciation.
10. Reading –developing Reading skill.
11. Group Discussion.

Recommended Books:

1. English grammar and Effective Business Communication by M.A. Pink & S.E. Thomas – S.Chand & Company Ltd.
2. English grammar by Dr. D .Thakur
3. Comprehensive English grammar by C.J.Joseph & EG Myall – Inter Univ. Press.
4. Technical English by Sharon j Garson and Steve M Garson.
5. Gartside's Model Business Letters by Shirley Taylor – Pitman Publishing.
6. Communication in English for Technical Student by Orient Longman.
7. Business Correspondence and Report Writing by R. C. Sharma and Krishna Mohan - Tata McGraw Hill.
9. A Student's Grammar of the English Language by Sidney Greendaum & Randolph Quirk (Pearson Education)

PS 1106 REMEDIAL MATHEMATICS

L-T-P : 3-1-0 **Credit : 3**

1. **Algebra:** Equations reducible to quadratics, simultaneous equations (linear and quadratic), Determinants, properties of solution of simultaneous equations by Cramer's rule, matrices, definition of special kinds of matrices, arithmetic operations on matrices, inverse of a matrix, solution of simultaneous equations by matrices, pharmaceutical applications of determinants and matrices. Evaluation of Enl, En2, and En3, mensuration and its pharmaceutical applications.
2. **Measures of Central Value:** Objectives and pre-requisites of an ideal, measure, mean, mode and median.
3. **Trigonometry:** Measurement of angle, T-ratios, addition, subtraction and transformation formulae, T-ratios of multiple, submultiple, allied and certain angles. Application of logarithms in pharmaceutical computations.
4. **Analytical Plans Geometry:** Certain co-ordinates, distance between two points, area of triangle, a locus of point, straight line, slope and intercept from, double - intercept form, normal (perpendicular form), slope-point and two point form, general equation of first degree.
5. **Calculus:**
   Differential: Limits and functions, definition of differential coefficient, differentiation of standard functions, including function of a function (Chain rule). Differentiation of implicit functions, logarithmic differentiation, parametric differentiation, successive differentiation.
   Integral: Integration as inverse of differentiation, indefinite integrals of standard forms, integration by parts, substitution and partial fractions, formal evaluation of definite integrals.

Recommended Books:

1. A Textbook of mathematics for XI-XII Students, NCERT Publications, vol. I-IV.
2. Sinha: "A Text Book of Algebra and Coordinate Geometry," Students Friends Publications.
3. Agarwal : "Senior Secondary School Mathematics," Bharti Bhawan Publications.
2. Boltons, Pharmaceutical Statistics. Practical and Clinical Applications, MeeceI Dekker, N Y.
3. Daniel W W, Biostatistics. A Foundation for Analysis in Health Sciences, John Wiley, NY.

Or

PS 1107 REMEDIAL BIOIOGY
L-T-P : 2-0-0 **Credit : 2**

1. Methods of classification of plants.
2. Plant cell, its structure and non-living inclusions; mitosis and meiosis; different types of plant tissues and their functions.
3. Morphology and histology of root, stem, bark, wood, leaf, flower, fruit and seed. Modification of root and stem.
4. General Survey of Animal Kingdom; Structure and life history of parasites as illustrated by amoeba, entamoeba, trypanosoma, plasmodium, taenia, ascaris, schistosoma, oxyuris, and ancylostoma.
5. General Structure and life history of insects like mosquito, housefly, mites and silkworm.
6. Cell & Tissue:
    - Structure of cell, its components and their functions.
    - Mechanism of transport through the cell membrane.

PS 1107P REMEDIAL BIOIOGY (LAB)
L-T-P : 0-0-2 **Credit : 1**

l. Morphology of plant parts indicated in theory.
2. Care, use and type of microscopes.
3. Gross identification of slides of structure and life cycle of lower plants animals mentioned in theory.
4. Morphology of plant parts indicated in theory.
5. Preparation, microscopic examination of stem, root and leaf of monocot and dicot plants.
6. Structure of human parasites and insects mentioned in theory with the help of Specimens.

Recommended Books:

1. Dutta: “Text Book of Botany”.
2. Maheshwari: “Text Book of Botany”.
3. Truemans: “Elementary Biology”.
4. Vidyarathi:“Text Book of Biology”.
5. Gupta: “Genetics”.

SEMESTER - II

PS 1201 PHARMACEUTICS - II (Unit Operations I, including Engg. Drawing)
L-T-P : 3-0-0 **Credit : 3**

1. Unit Operations: Introduction, basic laws.
2. Fluid Flow: Types of flow, Reynold's number, Viscosity, Concept of boundary layer, basic equations of fluid flow, valves, flow meters, manometers and measurement of flow and pressure.
3. Material Handling Systems:
    a. Liquid handling - Different types of pumps.
    b. Gas handling-Various types of fans, blowers and compressors.
    c. Solid handling-Bins, Bunkers, Conveyers, Air transport.
4. Filtration and Centrifugation: Theory of filtration, filter aids, filter media, industrial filters including filter press, rotary filter, edge filter etc. Factors affecting filtration, mathematical problems on filtration, optimum cleaning cycle in batch filters. Principles of centrifugation, industrial centrifugal filters and centrifugal sedimenters.
5. Crystallization: Characteristics of crystals like-purity, size, shape, geometry, habit, forms size and factors affecting them, Solubility curves and calculation of yields. Material and heat balances around

Swenson Walker Crystallizer. Supersaturation theory and its limitations, Nucleation mechanisms, crystal growth. Study of various types of Crystallizer, tanks, agitated batch, Swenson Walker, Single vacuum, ciralating magma and crystal Crystallizer, Caking of crystals and its prevention. Numerical problems on yields.

6. Dehumidification and Humidity Control: Basic concepts and definition, wet bulb and adiabatic saturation temperatures, Psychrometric chart and measurement of humidity, application of humidity measurement in pharmacy, equipments for dehumidification operations.
7. Refrigeration and Air Conditioning: Principal and applications of refrigeration and air conditioning.
8. Material of Construction: General study of composition, corrosion, resistance, Properties and applications of the materials of construction with special reference to stainless steel and glass.
9. Industrial Hazards and Safety Precautions: Mechanical, Chemical, Electrical, fire and dust hazards. Industrial dermatitis, Accident records etc.

PS 1201P PHARMACEUTICS - II (LAB)
L-T-P : 0-0-4 **Credit : 2**

1. Measurement of flow of fluids and their pressure, determination Reynold's number and calculation of Frictional losses.
2. Evaluation of filter media, determination of rate of filtration and study of factors affecting filtration.
3. Experiments to demonstrate applications of centrifugation.
4. Thermometers and Psychrometric charts.
5. Determination of humidity - use of Dry Bulb and Wet Bulb.
6. Elementary Knowledge of Engineering Drawing - Concept of orthographic and isometric views of elevation and third angle projection. Notation and abbreviation used in engineering drawing.
7. Basic Engineering Drawing Practice - Bolts, nuts, rivetted fronts, screws, worn screws as per specification.
8. Drawing of simple pharmaceutical machinery parts.

Recommended Books:

1. Cooper and Gunn's Tutorial Pharmacy Edited by S.J.Carter (CBS Publishers, Delhi)
2. Pharmaceutical Engineering by K.Sanbamurty (New Age International, New Delhi)
3. Chamical Engineering by Badger and Banchero (Mc Graw Hill, New Delhi)
4. Pharmaceutical Dosage forms by Aulton.(Churchill Livingstone, Edinburg)

PS 1202 PHARMACEUTICAL CHEMISTRY - II (Physical Chemistry)
L-T-P : 3-0-0 **Credit : 3**

1. **Behaviour of Gases**: Kinetic theory of gases, deviation from behaviours and explanation.
2. **The Liquid State**: Physical properties (surface tension, parachor, viscosity, refractive index, optical rotation, dipole moments and chemical constituents).
3. **Solutions**: Ideal and real solutions, solutions of gases in liquids, colligative properties, partition coefficient, conductance and its measurement, Debye Huckel theory.
4. **There dynamics**: First, second and third laws, Zeroth law, absolute temperature scale, thermochemical equations, phase equilibria and phase rule.
5. **Adsorption:** Freudlich and Gibbs adsorption, isotherms, Langmuir theory of adsorption.
6. **Photochemistry**: Consequences of light absorption, Jablenski diagram, Lambert-Beer Law, Quantum efficiency.
7. **Chemical Kincties**: Zero, first and second order reactions, complex reactions, theories of reaction kinetics, characteristics of homogeneous and heterogeneous catalysis, acid base and enzyme catalysis.
8. **Quantum Mechanics**: Postulates of quantum mechanics, operators in quantum mechanics, the Schrodinger wave equation.

PS 1202P PHARMACEUTICAL CHEMISTRY - II (LAB)
L-T-P : 0-0-4 **Credit : 2**

1. To determine molar mass by Rast method and cryoscopic method.
2 To determine refractive index of given liquids and find out the contribution of carbon, hydrogen and oxygen in molar refraction of a compourld.
3. To determine molar mass of volatile liquids by Victor-Meyer method.
4. To determine the specific rotation of sucrose at various concentrations and determine the intrinsic rotation.
5. To determine the heat of solution, heat of hydration and heat of neutralization.
6. To determine the cell constant, verify Ostwald dilution law and perform conductometric titration,.
7. To determine rate constant of simple reaction.

Recommended Books:
1. Bahl & Tuli: "Essentials of Physical Chemistry" S. Chand & Co.
2. Atkins & de Poule, "Atkins Physical Chemistry" Oxford University Press.

PS 1203 PHARMACEUTICAL CHEMISTRY - III (Organic Chemistry)
L-T-P : 3-0-0 **Credit : 3**

The subject of organic chemistry will be treated in its modem perspective keeping for the sake of convenience, the usual classification of organic compounds:

1. **Structure and Properties:** Atomic structure, Atomic orbitals, Molecular orbital theory, wave equation, Molecular orbitals, Bonding and Antibonding orbitals, Covalent bond, Hybrid orbitals, Intramolecular forces, Bond dissociation energy, Polarity of bonds, Polarity of molecules, structure and physical properties, Intermolecular forces, Acids and bases.
2. **Stereochemistry:** Isomerism and nomenclature and associated physicochemical properties, optical activity, stereoisomerism, specification of configuration, Reactions involving stereoisomers, chirality, chiral reagents conformations.
3. **Structure, Nomenclature, Preparation and Reactions of:** Alkanes, Alkenes, Alkynes, Cycloalkanes, Dienes, Benzene, Polynuclear aromatic compounds, Arenes, Alkyl halides, Alcohols, Ethers, Epoxides, Amines, Phenols, Aldehydes and ketones, Carboxylic acids, Functional derivatives of' carboxylic acids, Reactive intermediates - carbocations, carbanions, carbenes, nitrene and nitrenium ions.

PS 1203P PHARMACEUTICAL CHEMISTRY - III (LAB)
L-T-P : 0-0-4 **Credit : 2**

1. The student should be introduced to the various laboratory techniques through demonstrations involving synthesis of selected organic compounds (e.g. aspirin, p-bromoacetanilide, anthraquinone from anthracine, reduction of nitrobenzene etc)
2. Identification of organic compounds and their derivatisation.
3. Introduction to the use of stereomodels.

Recommended books:
1. Organic chemistry by Morrison and Boyd.(Prentice Hall of India, New Delhi)
2. Advanced organic chemistry by Bhal & Bhal (S.Chand, New Delhi)
3. Organic Chemistry Vol. 1 and II by I.L.Finar (Longman, Singapur)
4. Bently and Drivers text of Pharmaceutical chemistry by Oxford University, New Delhi

PS 1204 ANATOMY, PHYSIOLOGY & HEALTH EDUCATION (APHE) -I
L-T-P : 3-0-0 **Credit : 3**

1. Scope of anatomy and physiology and basic terminology used these subjects.
2. Structure of cell, its components and their functions.
3. **Elementary Tissues of the Human Body:** Epithelial, connective, muscular and nervous tissues, their sub-types and their characteristics.
4. **Osseous System:** Structure, composition and functions of skeleton Classification of joints, types of movements of joints, Disorders of joints.
5. **Skeletal Muscles:** Gross anatomy; physiology of muscle contraction, physiological properties of skeletal muscles and their disorders.
6. **Haemopoietic System**: Composition and functions of blood and its elements, their disorders, blood groups and their significance, mechanism of coagulation, disorders of platelets and coagulation.
7. **Lymph and Lymphatic System**: Composition, formulation and circulation of lymph; disorders of lymph and lymphatic system. Basic physiology and functions of spleen.
8. **Cardiovascular System**: Basic anatomy of the heart, Physiology of heart, blood vessels and circulation. Basic understanding of Cardiac cycle, heart sounds and understanding of Cardiac cycle, heart sounds and electrocardiogram. Blood pressure and its regulation. Brief outline of cardiovascular disorder like hypertension, hypotension, arteriosclerosis, angina, myocardial infarction, congestive heart failure and cardiac arrhythmias.

PS 1204P APHE –I (LAB)
L-T-P : 0-0-4 **Credit : 2**

1. Study of human skeleton.
2. Study of different systems with the help of charts and models.
3. Microscopic study of different tissues.
4. Estimation of haemoglobin in blood. Determination of bleeding time, clotting time, R.B.C. Count, Total leucocyte count, D.L.C. and E.S.R.
5 Recording of body temperature, pulse rate and blood pressure, basic understanding of Electrocardiogram-PQRST waves and their significance.

Recommended books:

1. Anatomy and Physiology in Health and Illness by Ross and Willson (Churchill living stone)
2. Concise Medical Physiology by S.K.Choudhury (New central book agency, Calcutta)
3. Guyton A C, Hall JE., Text book of Medical Physiology, W.B.Sandnders Company
4. Human Physiology, C C Chatterjee, Medical allied agency, Calcutta
5. Tortora G.J., S.R.Grabowski & Anagnodokos N.P., Principles of Anatomy & Physiology

PS 1205 ADVANCED MATHEMATICS
L-T-P : 3-1-0 **Credit : 3**

1. **Differential equations:** Revision of integral calculus, definition and formation of differential equations, equations of first order and first degree, variable separable, homogeneous and linear differential equations and equations reducible to such types, linear differential equations of order greater than one with constant coefficients, complementary function and particular integral, simultaneous linear differential equations, pharmaceutical applications.
2. **Laplace transforms:** Definition, transforms of elementary functions, properties of linearity and shifting, inverse laplace transforms, transforms of derivatives, solution of ordinary and simultaneous differential equations.
3. **Biometrics:** Significant digits bend rounding of numbers, data collection, random and non-random sampling methods, sample size, data organization, diagrammatic representation of data, bar, pie, 2-D and 3-D diagrams, measures of central tendency, measures of dispersion, Standard Deviation and standard error of means, coefficient of variation, confidence (fiducial) limits, probability and events, Bayes' theorem, probability theorems, probability distributions, elements of binomial and Poisson distribution,

normal Histribution curve & properties, kurtosis and skewness, correlation and regression analysis, method of least squares, statistical inference, Student's and paired t-test, F-test and elements of ANOVA, applications of statistical concepts in Pharmaceutical Sciences.

Recommended Books:

1. Daniel W W, Biostatistics. A Foundation for Analysis in Health Sciences, John Wiley, NY.
2. Grewal B S, Higher Engineering Mathematics, Khanna Publishers, New Delhi.
3. Gupta S P, Statistical Methods, Sultan Chand & Co., New Delhi.
4. Schaum, Differential Equations, McGraw- Hill Singapore.

SEMESTER – III

PS 1301 PHARMACEUTICS – III (Unit Operations II)

L-T-P : 3-0-0 **Credit : 3**

1. **Stoichiometry:** Unit processes material and energy balances, molecular units, mole fraction, tie substance, gas laws, mole volume, primary and secondary quantities, equilibrium state, rate process, steady and unsteady states, dimensionless equations, dimensionless formulae, dimensionless groups, different types of graphic representation, mathematical problems.
2. **Heat Transfer:** Source of heat, heat transfer, steam and electricity as heating media, determination of requirement of amount of steam/electrical energy, steam pressure, Boiler capacity, Mathematical problems on heat transfer.
3. **Evaporation:** Basic concept of phase equilibria, factor affecting evaporation, evaporators, film evaporators, single effect and multiple effect evaporators, Mathematical problems on evaporation.
4. **Distillation:** Rault's law, phase diagrams, volatility; simple steam and flash distillations, principles of rectification, Mc. Cabe Thiele method for calculations of number of theoretical plates, Azeotropic and extractive distillation. Mathematical problems on distillation.
5. **Drying:** Moisture content and mechanism of drying, rate of drying and time of drying calculations; classification and types of dryers, dryers used in pharmaceutical industries and special drying methods. Mathematical problems on drying.
6. **Size Reduction and Size Separation:** Definition, objectives of size reduction, factors affecting size reduction, laws governing energy and power requirements of a mills including ball mill, hammer mill, fluid energy mill etc.
7. **Mixing:** Theory of mixing, solid-solid, solid-liquid and liquid-liquid mixing equipments.
8. **Automated Process Control Systems:** Process variables, temperature, pressure, flow, level and vacuum and their measurements. Elements of automatic process control and introduction to automatic process control systems. Elements of computer aided manufacturing (CAM).
9. Reactors and fundamentals of reactors design for chemical reactions.

PS 1301P PHARMACEUTICS – III (LAB)

L-T-P : 0-0-4 **Credit : 2**

1. Determination of overall heat transfer coefficient.
2. Determination of rate of evaporation.
3. Experiments based on steam, extractive and azeotropic distillations.
4. Determination of rare of drying, free moisture content and bound moisture content.
5. Experiments to illustrate the influence of various parameters on the rate of drying.
6. Experiments to illustrate principles of size reduction, Laws governing energy and power requirements of size Reduction.
7. Experiments to illustrate solid-solid mixing, determination of mixing efficiency using different types of mixers.

Recommended Books:

1. Cooper and Gunn's Tutorial Pharmacy Edited by S.J.Carter (CBS Publishers, Delhi)
2. Pharmaceutical Engineering by K.Sanbamurty (New Age International, New Delhi)
3. Chamical Engineering by Badger and Banchero (Mc Graw Hill, New Delhi)
4. Pharmaceutical Dosage forms by Aulton.(Churchill Livingstone, Edinburg)
5. Gennaro, "Remington's The Science & Practice of Pharmacy" (Lippincott William and Wilkins).

PS 1302 PHARMACEUTICAL CHEMISTRY - IV (Organic Chemistry - II)
L-T-P : 3-0-0 Credit : 3

Nucleophillic aromatic substitutions; α β unsaturated carbonyl compounds; Conservation of orbital symmetry and rules., Electrocyclic, Cycloaddition and sigmatropic reactions; Neighbouring group effects; Catalysis by transition metal complexes, Stereoselective and sterospecific reactions; New organic reagents used in drug synthesis.

Heterocyclic Compounds: Chemistry, preparations and properties of some important heterocyclis containing 3, 4,5,6 & 7 atoms with one or two heteroatoms like 0, N, S.

Chemistry of Lipids, Carbohydrates, Proteins and Nucleic acids.

PS 1302P PHARMACEUTICAL CHEMISTRY - IV (LAB)
L-T-P : 0-0-4 Credit : 2

At least five exercises in synthesis involving various heterocyclic ring systems. An exercise involving stereo selective synthesis of a compound. Resolution of racemic D,L alanine or any other example.

Workshop on molecular modeling of primary, secondary and tertiary structures of proteins, molecular modelling on double helical structure of nucleic acid showing hydrogen bonding.

Recommended Books:

1. Organic Chemistry by R.T. Morrison and R.N.Boyd.(Prentice Hall of India, New Delhi)
2. Advanced Organic Chemistry by B.S.Bahl and Arun Bahl.(S.Chand, New Delhi)
3. Bentley and Driver's Text Book of Pharmaceutical Chemistry. (Oxford University Press, New Delhi)
4. Organic Chemistry – Reactions and Reagents by O. P.Agarwal.
5. Organic Chemistry by I.L. Finar Vol. I & Vol. II.(Longman, Singapore)

PS 1303 PHARMACOGNOSY - II
L-T-P : 3-0-0 Credit : 3

1. **Resins:** Study of Drugs Containing Resins and Resin Combination like Colophony, podophyllum, jalap, cannabis, capsicum, myrrh, asafoetida, balsam of tolu, balsam of peru, benzoin, turmeric, ginger.
2. **Tannis:** Study of tannins and tannin containing drugs like Gambir, black catechu, gall and myrobalan.
3. **Volatile Oils:** General methods of obtaining volatile oils from plants, Study of volatile oils of Mentha, Coriander, Cinnamon, Cassia, Lemon peel, Orange peel, Lemon grass, Citronella, Caraway, Dill, Spearmint, Clove, Fennel, Nutmeg, Eucalyptus, Chenopodium, Cardamom, Valerian, Musk, Palmarosa, Gaultheria, Sandal wood.
4. **Phytochemical Screening:**
   a) Preparation of extracts.
   b) Screening of alkaloids, saponins, cardenolides and bufadienolides, flavonoids and leucoanthocyanidins, tannins and polyphenols, anthraquinones, cynogenetic glycosides, amino acids in plant extracts.

5. **Fibres:** Study of fibres used in pharmacy such as cotton, silk, wool, nylon, glass-wool, polyester and asbestos.
6. **Pharmaceutical aids:** Study of pharmaceutical aids like talc, diatomite, kaolin, bentonite, gelatin and natural colors.

PS 1303P PHARMACOGNOSY - II (LAB)
L-T-P : 0-0-4 **Credit : 2**

1. Identification of crude drugs mentioned in theory.
2. Study of fibres and pharmaceutical aids.
3. Microscopic studies of seven-selected crude drugs and their powders mentioned under the category of volatile oils in theory and their chemical tests,
4. General chemical tests for alkaloids, glycosides, steroids, flavonoids and tannins.

Recommended Books:
1. Text Book of Pharmacognosy by Kokate C K, Purohit A P, Gokhale S B (Nirali Prakashan, Pune)
2. Trease G.E. and Evans W.C., Pharmacognosy (Balliene Tindall, Eastbourne)
3. Text Book of Pharmacognosy by T.E.Wallis.(CBS Publishers & Distributors, New Delhi)
4. Tyler V.E., Brady L.R. and Robbers J.E., Pharmacognosy (Len & Febiger, Philadelphia)

PS 1304 PHARMACEUTICAL ANALYSIS - II
L-T-P : 3-0-0 **Credit : 3**

Theoretical considerations and application in drug analysis and quality control of the following analytical techniques.
1. **Non-aqueous titrations**
2. **Complexometric titrations**
3. **Miscellaneous Methods of Analysis:** Diazotisation titrations, Kjeldahl method of nitrogen estimation, Karl-Fischer titration, Oxygen flask combustion, gasometry.
4. **Extraction procedures including separation of drugs from excipients**
5. **Chromatography:** The following techniques will be discussed with relevant examples of Pharmacopoeial products. TLC, HPLC, GLC, HPTLC, Paper Chromatography and Column Chromatography.
6. **Potentiometry**
7. **Conductometry**
8. **Coulometry**
9. **Polarography**
10. **Amperometry**

PS 1304P PHARMACEUTICAL ANALYSIS - II (LAB)
L-T-P : 0-0-4 **Credit : 2**

1. **Nonaqueous Titrations:** Preparation and standardization of perchloric acid and sodium / potassium / lithium methoxides solutions; Estimations of some pharmacopoeial products.
2. **Complexometric Titrations:** Preparations and standardization of EDT A solution, some exercises related to pharmacopoeial assays by complexometric titrations.
3. **Miscellaneous Determinations:** Exercises involving diazotisation, Kjeldahl, Karl- Fischer, Oxygen flask combustion and gasometry methods. Determination of alcohol content in liquid galenicals, procedure (BPC) shall be covered.
4. Experiments involving separation of drugs from excipients.
5. Chromatographic analysis of some pharmaceutical products.
6. Exercises based on acid base titration in aqueous and nonaqueous media, oxidation-reduction titrations

using potentiometric technique, Determination of acid-base disassociation constants and plotting of titration curves using pH meter.
7. Exercises involving polarimetry.
8. Exercises involving conductometric and polarographic techniques.

Recommended Books:
1. Vogel's Text Book of Quantitative Chemical Analysis.
2. Practical Pharmaceutical Analysis by Beckette and Stenlake Vol. I & II.
3. Indian Pharmacopocia Vol. I & II
4. Instrumental methods chemical analysis by B.K. Sharma
5. Bently and Driver's Text Book of Pharmaceutical Chemistry.

PS 1305 ANATOMY, PHYSIOLOGY AND HEALTH EDUCATION (APHE -II)
L-T-P : 3-0-0 Credit : 3

1. **Digestive System:** Gross anatomy of the gastro-intestinal tract, functions of its different parts including those of liver, pancreas and gall bladder, various gastrointestinal secretions and their role in the absorption and digestion of food. Disorders of digestive system.
2. **Respiratory System:** Anatomy of respiratory organs & its functions, respiration, mechanism and regulation of respiration, respiratory volumes and vital capacity.
3. **Central Nervous System:** Functions of different parts of brain and spinal cord. Neurohumoral transmission in the central nervous system, reflex action electroencephalogram, specialized functions of the brain, Cranial nerves and their functions.
4. **Autonomic Nervous System:** Physiology and functions of the autonomic nervous system. Mechanism of neurohumoral transmission in the A.N.S.
5. **Urinary System:** Various parts, structures and functions of the kidney and urinary tract. Physiology of urine formation and acid-base balance. Diseases of the urinary system.
6. **Reproductive System:** Male and female reproductive systems and their hormones, physiology of menstruation, coitus and fertilization. Sex differentiation, spermatogenesis & oogenesis. Pregnancy its maintenance and parturition.
7. **Endocrine System:** Basic anatomy and physiology of Pituitary, Thyroid, Parathyroid. Adrenals, Pancreas, Testes and ovary, their hormones and functions.
8. **Sense Organs:** Basic anatomy and physiology of the eye (vision), ear (hearing), taste buds, nose (smell) and skin (superficial receptors).
9. a. **Concepts of health and disease:** Disease causing agents and prevention of disease.
   b. **Classification of food requirements:** Balanced diet, nutritional deficiency disorders, their treatment and prevention, specifications for drinking water.
   c. **Demography and family planning:** Medical termination of pregnancy.
   d. **Communicable diseases:** Brief outline, their causative agents, modes of transmission and prevention (Chicken pox, measles, influenza, diphtheria, whooping cough, tuberculosis, poliomyelitis, helminthiasis, malaria, filariasis, rabies, trachoma, tetanus, leprosy, syphilis, gonorrhoea, and AIDS).
   e. **First Aid:** Emergency treatment of shock, snake bites, burns, poisoning, fractures and resuscitation methods.

PS 1305P APHE –II (LAB)
L-T-P : 0-0-4 Credit : 3

1. Study of different systems with the help of charts and models.
2. Microscopic studies of different tissues.
3. Simple experiments involved in the analysis of normal and abnormal urine: Collection of specimen, appearance, determination of pH, Sugars, proteins, urea and creatinine.

4. Physiological experiments on nerve-muscle preparations.
5. Determination of vital capacity, experiments on spirometry.

Recommended books:

1. Anatomy and Physiology in Health and Illness by Ross and Willson (Churchill living stone)
2. Concise Medical Physiology by S.K.Choudhury (New central book agency, Calcutta)
3. Guyton A C, Hall JE., Text book of Medical Physiology, W.B.Sandnders Company
4. Human Physiology, C C Chatterjee, Medical allied agency, Calcutta
5. Tortora G.J., S.R.Grabowski & Anagnodokos N.P., Principles of Anatomy & Physiology

SEMESTER - IV

PS 1401 PHARMACEUTICS - IV (Dispensing and Community Pharmacy)

L-T-P : 3-0-0 **Credit : 3**

1. Definition and Scope
2. **Prescription:** Handling of prescription, source of errors in prescription, care required in dispensing procedures including labeling of dispensed products.
3. General dispensing procedures including labeling of dispensed products.
4. **Pharmaceutical calculations:** Posology, calculation of doses for infants, adults and elderly patients; Enlarging and reducing recipes percentage solutions, allegation, alcohol dilution, proof spirit, isotonic solutions, displacement value etc.
5. **Principles involved and procedures adopted in dispensing of:** Typical prescriptions like mixtures, solutions, emulsions, creams, ointments, powders, capsules, pastes, jellies, suppositories, ophthalmic, pastilles, lozenges, pills, lotions, liniments, inhalations, paints sprays tablet triturates, etc.
6. **Incompatibilities:** Physical and chemical incompatibilities, inorganic incompatibilities including incompatibilities of metals and their salts, non-metals, acids, alkalis, organic incompatibilities. Purine bases, alkaloids, pyrazolone derivatives, amino acids, quaternary ammonium compounds, carbohydrates, glycosides, anesthetics, dyes, surface active agents, correction of incompatibilities. Therapeutic incompatibilities.
7. **Community Pharmacy:** Organization and structure of retail and whole sale drug store-types of drug store and design, legal requirements for establishment, maintenance and drug store-dispensing of proprietary products, maintenance of records of retail and wholesale, patient counseling, role of pharmacist in community health care and education.

PS 1401P PHARMACEUTICS - IV (LAB)

L-T-P : 0-0-4 **Credit : 2**

1. Dispensing of prescriptions falling under the categories: Mixtures, solutions, emulsions. Creams, ointments, powders, suppositories, opthalmics, capsules, pastes, jellies, pastille, lozenges, pills, tablet triturates, lotions, liniments, inhalations, paints, etc.
2. Identification of various types of incompatibilities in prescription, correction thereof and dispensing of such prescriptions.
3. Dispensing procedures involving pharmaceuticals calculations, pricing of prescriptions and dosage calculations for pediatric and geriatric patients.
4. Dispensing of prescriptions involving adjustment of tonicity.
5. Categorization and storage of pharmaceutical products based on legal requirements of labeling and storage.
6. Project report on visit to the nearby community for counseling on the rational use of drugs and aspects of health care.

Recommended books:

1. Cooper & Gunn's Dispensing for Pharmaceutical students CBS Publishers, New Delhi
2. Dispensing Pharmacy by R.M.Mehta (Vallabh Prakashan, Delhi)
3. Remington's "The Science & Practice of Pharmacy" (Lippincott William and Wilkins)

PS 1402 PHARMACEUTICAL MICROBIOLOGY
L-T-P : 3-0-0 Credit : 3

1. Introduction to the scope of microbiology.
2. Structure of bacterial cell.
3. Classification of microbes and their taxonomy. Actinomycetes, bacteria, rickettsiae, spirochetes and viruses.
4. Identification of Microbes: Stains and types of staining techniques, electron microscopy.
5. Nutrition, cultivation, isolation of bacteria, actinomycetes, fungi, viruses, etc.
6. Microbial genetics and variation.
7. Control of microbes by physical and chemical methods.
   a. Disinfection, factors influencing disinfectants, dynamics of disinfection, disinfectants and antiseptics and their evaluation.
   b. Sterilization, different methods, validation of sterilization methods & equipments.
8. Sterility testing of all pharmaceutical products.
9. Immunity, primary and secondary, defensive mechanisms of body, microbial resistance, interferon.
10. Microbial assays of antibiotics, vitamins & amino acids.

PS 1402P PHARMACEUTICAL MICROBIOLOGY (LAB)
L-T-P : 0-0-4 Credit : 2

Experiments devised to prepare various types of culture media, sub culturing of common aerobic and anaerobic bacteria, fungus and yeast, various staining methods, various methods of isolation and identification of microbes, sterilization techniques and their validation, evaluation of antiseptics and disinfectants, testing the sterility of pharmaceutical products as per I.P. requirements, microbial assay of antibiotics and vitamins, etc.

Recommended books:

1. Microbiology of Pelczar and Kreig.
2. Text Book of Microbiology by Anantanarayana and Panicker.
3. Dispensing for pharmaceutical students by Cooper and Gunn.
4. Bently's Text Book of Pharmaceutics
5. Tutorial Pharmacy by Cooper and Gunn
6. Indian Pharmacopoeia
7. Shah and Shah (Pharmaceutical Microbiology)

PS 1403 PHARMACOGNOSY - III
L-T-P : 3-0-0 Credit : 3

1. Study of the biological sources, cultivation, collection, commercial varieties, chemical constituents, substitutes, adulterants, uses, diagnostic macroscopic and microscopic features and specific chemical tests of following groups of drugs containing glycosides.

Saponins : Liquorice, ginseng, dioscorea, sarsaparilla, and senega.
Cardioactive sterols: Digitalis, squill, strophanthus and thevetia.
Anthraquinone cathartics: Aloe, senna, rhubarb and cascara.
Others: Psoralea, Ammi majus, Ammi visnaga, gentian, saffron, chirata, quassia.

2. 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: Amla, Kantkari, Satavari, Tylophora, Bhilawa, Kalijiri, Bach, Rasna, Punamava, Chitrack, Apamarg, Gokhru, Shankhapushpi, Brahmi, Adusa, Atjuna, Ashoka, Methi, Lahsun, Palash, Guggal, Gymnema, Shilajit, Nagarmotha and Neem.
3. The holistic concept of drug administration in traditional systems of medicine. Introduction to ayurvedic preparations like Arishtas, Asvas, Gutikas, Tailas, Chumas, Lehyas and Bhasmas.

PS 1403P PHARMACOGNOSY - III (LAB)
L-T-P : 0-0-4 **Credit : 2**

1. Identification of crude drugs listed in theory.
2. Microscopic study of some important glycoside containing crude drugs as outlined above. Study of powdered drugs.
3. Standardization of some traditional drug formulations.

Recommended Books:
1. Text Book of Pharmacognosy by Kokate C K, Purohit A P, Gokhale S B (Nirali Prakashan, Pune)
2. Trease G.E. and Evans W.C., Pharmacognosy (Balliene Tindall, Eastbourne)
3. Text Book of Pharmacognosy by T.E.Wallis.(CBS Publishers & Distributors, New Delhi)
4. Tyler V.E., Brady L.R. and Robbers J.E., Pharmacognosy (Len & Febiger, Philadelphia)

PS 1404 PATHOPHYSIOLOGY OF COMMON DISEASES
L-T-P : 3-0-0 **Credit : 3**

1. Basic Principles of Cell Injury and Adaptation: Causes of Cellular injury, pathogenesis, morphology of cell injury. Intercellular alterations in lipids, proteins and carbohydrates, Cellular adaptation, atrophy, hypertrophy.
2. Basic Mechanisms involved in the process of inflammation and repair: Alterations in vascular permeability and blood flow, migration of WBC, acute and chronic inflammation, mediators of inflammation, brief outline of the process of repair.
3. Pathophysiology of Common Diseases: Rheumatoid arthritis, gout, epilepsy, psychosis, depression, mania, hypertension, angina, congestive heart failure, atherosclerosis, myocardial infarction, diabetes, peptic ulcer, asthma, ulcerative colitis, hepatic disorders, acute and chronic renal failure, tuberculosis, urinary tract infections, sexually transmitted diseases, anemia and common types of neoplasm. Wherever applicable the molecular basis should be discussed.

Recommended Books:
1. Pathologic basis of diseases by Robbins S.L. (Harcourt India, New Delhi).
2. Pathology Quick Review and MCQs based on Harsh Mohan's Text Book of Pathology (Jaypee brothers medical publishers, New Delhi)

PS 1405 BASIC ELECTRONICS AND COMPUTER APPLICATIONS
L-T-P : 3-0-0 **Credit : 3**

1. Basic Electronics: Semiconductors, p-n function diode, LED, photodiode and its uses. Rectifiers (half wave, full wave / with filters), transistors configurations, transistor amplifiers. Introduction to Integrated circuits, photo cells and photomultiplier tubes.
2. **Computers:**
2.1 Introduction to Computers: History of Computer development and respective generation: Abacus, Napier's-Bones, Slide rule, Pascal's Calculator. Need to use computers, applications in pharmacy and in general.

Computer Classification: Mainframe, Mini and Micro Computers, comparison of Analog & Digital Computers, Hardware and Software. Calculator and Computer.

2.2. Operating Systems: Introduction to types of operating systems, UNIX, MS-DOS, etc. RAM, ROM, Virtual Memory etc.

2.3. Type of Languages: Conventional languages; their advantages, limitations; C, Pascal, FORTRAN, Programming of these languages.

2.4. Introduction to Computer Networks: Architecture of seven layers of communications.

2.5. Introduction to Data Structure: Like Queues, list, trees, Binary trees algorithms, Flow chart, Structured Systems, Analysis and development, Ingress-SQL, Gateways etc. Statistics, methodologies. Basic Language: Constants and Variables: Character set, constants, variables, Naming the variables getting data into memory, LET, INPUT, READ. DATA, Print Statement. Expressions: Arithmetic expression, Hierarchy of operations, Rules of Arithmetic, Evaluation of expressions, Relational expressions, Logical operations, Library functions. Printer Control: Comma and semicolon control, the TAB function, PRINT, LPRINT. Functions and Subroutines: User defined functions, subroutines, subscripted variables.

2.6. Computer Graphics:

2.7. Computer applications in pharmaceutical and clinical studies.

PS 1405P BASIC ELECTRONICS AND COMPUTER APPLICATIONS (LAB)
L-T-P : 0-0-2 **Credit : 2**

Exercises based on the following are to be dealt:

1. Computer operating systems like Unix, MS DOS, etc.
2. Simple program in BASIC
3. Study of soft-ware packages like WORD-STAR, LOTUS-123 etc.

Recommended Books:

1. Grogona P, Programming in Pascal, Adeison Wesley, Reading, M A. Hunt N and Shelley J. Computers and Commonsense, Prentice _ Hall of India, New Delhi.
2. Jensen K and Wirth N., Pascal User Mannual and Report, Narosa Publishing House, New Delhi.
3. Popst and Perrum "Computer Aided Drug Design", Academic Press, New York.
4. Ramanujan V, Computer Prograrnming in Pascal, Prentice- Hall of India, New Delhi, I983.
5. Wirth N, Systematic Programming an Introduction, Prentice Hall Englewood Cliff's New Jersey.

PS 1406 PHARMACEUTICAL JURISPRUDENCE & ETHICS
L-T-P : 3-0-0 **Credit : 3**

1. Introduction
   a. Pharmaceutical Legislations - A brief review.
   b. Drugs & Pharmaceutical Industry - A brief review.
   c. Pharmaceutical Education - A briefreview.

2. An elaborate study of the **following**
   a. Pharmaceutical Ethics
   b. Pharmacy Act 1948.
   c. Drugs and Cosmetics Act 1940 and Rules 1945.
   d. Medicinal & Toilet Preparations (Excise Duties) Act 1955.
   e. Narcotic Drugs & Psychotropic Substances Act 1985 & Rules.
   f. Drugs Price Control Order.

3. A brief study of the following with special reference to the main provisions.
   a. Poisons Act 1919
   b. Drugs and Magic Remedies (Objectionable Advertisements) Act 1954
   c. Medical Termination of Pregnancy Act 1970 & Rules 1975.
   d. Prevention of Cruelty to Animals Act 1960.

e. States Shops & Establishments Act & Rules.
f. Insecticides Act 1968.
g. AICTE Act 1987.
h. Factories Act 1948.
i. Minimum Wages Act 1948. k Patents Act 1970.

4. A brief study of the various Prescription/Non-prescription Products, Medical/Surgical accessories, Diagnostic aids, appliances available in the market.

(Note: The teaching of all the about Acts should cover the latest amendments).

Recommended Books:

1. A Textbook of Forensic Pharmacy by B.M.Mithal
2. A Textbook of Forensic Pharmacy by N.K.Jain
3. Drugs and Cosmetics Act and Rules published by Government of India
4. Pharmacy Act, Published by Government of India
5. Law of Drugs
6. Drug Cases published by International Law Book Co. Delhi (Reference)

SEMESTER - V

PS 1501 PHARMACEUTICS – V (Pharmaceutical Technology - I)
L-T-P : 3-0-0 **Credit : 3**

1. **Liquid Dosages Forms**: Introduction, types of additives used in formulations, Vehicles, stabilizers, preservatives, suspending agents, emulsifying agents, solubilizer, colors, flavours and others, manufacturing packaging and evaluation of clear liquids, suspensions and emulsions official in pharmacopoeia.
2. **Semisolid Dosage Forms**: Definitions, types, mechanisms of drug penetration, factors influencing penetration, semisolid bases and their selection. General formulation of semisolids, clear gels manufacturing procedure, evaluation and packaging.
3. **Suppositories**: Ideal requirements, bases, manufacturing procedure, packaging and evaluation.
4. **Extraction and Galenical Products:** Principle and method of extraction, preparation of infusion, tinctures, dry and soft liquid extracts.
5. **Blood Products and Plasma Substitutes:** Collection, processing and storage of whole human blood, concentrated human RBCs, dried human plasma, human fibrinogen, human thrombin, human normal immunoglobulin, human fibrin, foam plasma substitutes, -ideal requirements, PVP, dextran etc. for control of blood pressure as per I.P.
6. **Pharmaceutical Aerosols:** Definition, propellants, general formulation, manufacturing and packaging methods, pharmaceutical applications.
7. **Ophthalmic Preparations:** Requirements, formulation, methods of preparation, containers, evaluation.
8. **Cosmeticology and Cosmetic Preparations:** Fundamentals of cosmetic science, structure and functions of skin and hair. Formulation, preparation and packaging of cosmetics for skin, hair, dentifrice and manicure preparations like nail polish, Lipsticks, eye lashes, baby care products etc.

PS 1501P PHARMACEUTICS – V (LAB)
L-T-P : 0-0-4 **Credit : 2**

1. Preparation, evaluation and packaging of liquid orals like solutions, suspensions and emulsions, ointments, suppositories, aerosols, eye drops, eye ointments etc.
2. Preparation of pharmacopoeial extracts and galenical products utilizing various methods of Extraction.
3. Collection, processing, storage and fractionation of blood.
4. Formulation of various types of cosmetics for skin, hair, dentifrices and manicure preparations.

Recommended Books:

1. Bently's Textbook of pharmaceutics edited by E.A. Rawlins (All India Traveller Book Seller, New Delhi)
2. The Theory and Practice of Industrial Pharmacy by Lachmann, Libermann and Kanig (Varghese Pub. House, Bombay)
3. Pharmaceutical Dosage Forms and Drug Delivery Systems by Ansel, Allen and Popovich (B.I.Waverly Pvt. Ltd., New Delhi)
4. REMINGTON : The Science and Practice of Pharmacy, (Lippincott Williams & Wilkins, Baltimore)
5. Pharmaceutics : The Science of Dosage Form Design by Aulton (Churchill Livingstone, Edinburgh)

PS 1502 PHARMACEUTICAL CHEMISTRY -V (Biochemistry)
L-T-P : 3-0-0 Credit : 3

1. Biochemical organization of the cell and transport processes across cell membrane.
2. The concept of free energy, determination of change in free energy - from equilibrium constant and reduction potential, bioenergetics, production of ATP and its biological significance.
3. Enzymes: Nomenclature, enzyme kinetics and its mechanism of action, mechanism of inhibition, enzymes and iso-enzymes in clinical diagnosis.
4. Co-enzymes: Vitamins as co-enzymes and their significance. Metals as co-enzymes and their significance.
5. Carbohydrate Metabolism: Conversion of polysaccharide to glucose-I-phosphate, Glycolysis and fermentation and their regulation, Gluconeogenesis and glycogenolysis, Metabolism of galactose and galactosemia, Role of sugar nucleotides in biosynthesis, and Pentosephosphate pathway.
6. The Citric Acid Cycle: Significance, reactions and energetic of the cycle, Amphibolic role of the cycle, and Glyoxalic acid cycle.
7. Lipids Metabolism: Oxidation of fatty acids, oxidation & energetic, a-oxidation, Biosynthesis of ketone bodies and their utilization. Biosynthesis of saturated and unsaturated fatty acids, Control of lipid metabolism, Essential fatty acids & eicosanoids (prostaglandins, thromboxanes and leukotrienes), phospholipids, and sphingolipids.
8. Biological Oxidation: Redox-potential, enzymes and co-enzymes involved in oxidation reduction & its control, The respiratory chain, its role in energy capture and its control, Energetics of oxidative phosphorylation, Inhibitors of respiratory chain and oxidative phosphoryla Mechanism of oxidative phosphorylation.
9. Nitrogen & Sulphur Cycle: Nitrogen fixation. ammonia assimilation, nitrification and nitrate assimilation, Sulphate activation. sulphate reduction. Incorporation of sulphur in organic compounds. Release of sulphur from organic compounds.
10. Metabolism of Ammonia and Nitrogen Containing Monomers: Nitrogen balance. Biosynthesis of amino acids. Catabolism of amino acids. Conversion of amino acids to specialized products, Assimilation of ammonia. Urea. cycle, metabolic disorders of urea cycle. Metabolism of sulphur containing amino acids. Porphyrin biosynthesis. formation of bile pigments. hyperbilirubinemia. Purine biosynthesis. Purine nucleotide interconversion. Pyrimidine biosynthesis. and Formation of deoxyribounucleotides.
11. Biosynthesis of Nucleic Acids: Brief introduction of genetic organization of the mammalian genome, alteration and rearrangements of genetic material, Biosynthesis of DNA and its replication. Mutation: Physical & chemical mutagenesis / carcinogenesis. DNA repair mechanism. Biosynthesis of RNA.
12. Genetic Code and Protein Synthesis: Genetic code. Components of protein synthesis and Inhibition of protein synthesis. Brief account of genetic engineering and polymerase chain reactions.
13. Regulation of gene expression.

PS 1502P PHARMACEUTICAL CHEMISTRY -V (LAB)
L-T-P : 0-0-4 **Credit : 2**

1. Preparation of standard buffers (citrate, phosphate and carbonate) and measurement of pH.
2. Titration curve for amino acids.
3. Separation of amino acids by two dimensional paper chromatography and gel electrophoresis.
4. The separation of lipids by TLC.
5. Separation of serum proteins by electrophoresis on cellulose acetate.
6. Quantitative estimation of amino acids.
7. Quantitative estimation of proteins.
8. The identification of c-terminal amino acids of a protein.
9 The determination of glucose by means of the enzyme glucose oxidase.
10. The isolation and assay of glycogen from the liver and skeletal muscle of rats.
11 Enzymatic hydrolysis of glycogen by. alpha- and beta-amylases.
12. The isolation and determination of RNA and DNA.
13. Effect of temperature on the activity of alpha - amylase.
14. Estimation of SGOT, SGPT, ALP and BRN in the serum.

Recommended Books:
1. Harper's Biochemistry R.K.Murray and Others (Prentice Hall of India, New Delhi)
2. Text Book of Biochemistry by West & Todd (Oxford & IBH Pub., Co., New Delhi)
3. Fundamentals of Biochemistry by Dr.A.C.Deb (New Central Book Agency, Calcutta)
4. Text Book of Biochemistry by Dr.A.V.S.S.Rama Rao (UBS Publishers & Distributors, New Delhi)
5. Text Book of Biochemistry by Dr. U. Satyanarayana

PS 1503 PHARMACOLOGY - I
L-T-P : 3-0-0 **Credit : 3**

1. **General Pharmacology:** Introduction to Pharmacology, Sources of drugs, Dosage forms and routes of administration, mechanism of action, Combined effect of drugs, Factors modifying drug action, tolerance and dependence, Pharmacogenetics, Absorption, Distribution, Metabolism and Excretion of drugs, Principles of Basic and Clinical pharmacokinetics, Adverse Drug Reactions and treatment of poisoning, ADME drug interactions, Bioassay of Drugs and Biological Standardization, Discovery and development of new drugs.
2. Pharmacology of Peripheral Nervous System:
    a. Neurohumoral transmission (autonomic and Somatic)
    b. Parasympathomimetics, Parasympatholytics, Sympathomimetics, Adrenergic Receptor and neuron blockingagents, Ganglionic, stimulants and blocking agents.
    c. Neuromuscular blocking Agents.
    d. Local anesthetic Agents.
3. Pharmacology of Central Nervous System:
    a. Neurohumoral transmission in the C.N.S.
    b. General Anesthetics.
    c. Alcohols and disulfiram.
    d. Sedatives, hypnotics, Anti-anxiety agents and centrally acting muscle relaxants.
    e. Psychopharmacological agents (anti-psychotics) antidepressants anti maniacs and hallucinogens.
    f. Anti-epileptics drugs.
    g. Anti-Parkinsonian Drugs.
    h. Analgesics, Antipyretics, Anti-inflammatory and Anti-gout drugs.
    i. Narcotic analgesics and antagonists.
    j. C.N .S. stimulants.
    k. Drug Addiction and Drug Abuse.

PS 1503P PHARMACOLOGY – I (LAB)
L-T-P : 0-0-4 **Credit : 2**

1. Introduction to Experimental Pharmacology: Preparation of different solutions for experiments. Drug dilutions, use of molar and w/v solutions in experimental pharmacology. Common laboratory animals and anesthetics used in animal studies. Commonly used instruments in experimental pharmacology. Some common and standard techniques. Bleeding and intravenous injection, intragastric administration. Procedures for rendering animals unconscious-stunning of rodents, pithing of frogs, chemical euthanasia.
2. Experiments on intact preparations: Study of different routes of administration of drugs in mice/rats. To study the effect of hepatic microsomal enzyme inhibitors and induction on the phentobarbitone sleeping time in mice.
3. Experiments on Central Nervous system: Recording of spontaneous motor activity, stereotypy, analgesia, anticonvulsant activity, anti-inflammatory activity, and muscle relaxant activity of drugs using simple experiments.
4. Effects of autonomic drugs on rabbit's eye.
5. Effects of various agonists and antagonists and their characterization using isolated preparations like frog's rectus abdominis muscle and isolated ileum preparations of rat, guinea pig and rabbit.

Recommended Books:
1. Essentials of Medical Pharmacology by K.D.Tripathy
2. Pharmacology and pharmacotherapeutics by Satoshkar and Bhandarkar
3. Pharmacology by Prasun K Das, S.K.Bhattacharya and P.Sen.
4. Text book of Pharmacology by S.D. Sethi
5. The Pharmacological basis of Therapeutics by Goodman and Gilman
6. Pharmacology by Rang, Dale and Ritter.
7. Basic and Clinical Pharmacology by B.G.Katzung.

PS 1504 PHARMACOGNOSY - IV
L-T-P : 3-0-0 **Credit : 3**

1. Systematic study of source, cultivation, collection, processing, commercial varieties, chemical constituents, substitutes, adulterants, uses, diagnostic macroscopic and microscopic features and specific chemical tests of following alkaloid containing drugs:
   a) Pyridine - piperidine: Tobacco, areca and lobelia.
   b) Tropane: Belladonna, hyoscyamus, datura, duboisia, coca and withania
   c) Quinoline and isoquinoline : Cinchona, ipecac, opium.
   d) Indole : Ergot, rauwolfia, catharanthus, nux-vomica and physostigma
   e) Imidazole: Pilocarpus
   f) Steroidal: Veratrum and kurchi
   g) Alkaloidal amine: Ephedra and colchicum.
   h) Glycoalkaloid: Solanum.
   i) Purines: Coffee, tea and cola.
2. Role of medicinal and aromatic plants in national economy.
3. Biological sources, preparation, identification tests and uses of the following enzymes: Diastase, papain, pepsin, trypsin, pancreatin.
4. General techniques of biosynthetic studies and basic metabolic pathways. Brief introduction to biogenesis of secondary metabolites of pharmaceutical importance.
5. Plant bitters and sweeteners.
6. Introduction, classification and study of different chromatographic methods and their applications in evaluation of herbal drugs.

PS 1504P PHARMACOGNOSY - IV (LAB)
L-T-P : 0-0-4 **Credit : 2**

i) Identification of crude drugs listed above.
ii) Microscopic study of characters of eight - selected drugs given in theory in entire and powdered form.
iii) Chemical evaluation of powdered drugs and enzymes.
iv) Chromatographic studies of some herbal constituents.

Recommended Books:
1. Text Book of Pharmacognosy by Kokate C K, Purohit A P, Gokhale S B (Nirali Prakashan, Pune)
2. Trease G.E. and Evans W.C., Pharmacognosy (Balliene Tindall, Eastbourne)
3. Text Book of Pharmacognosy by T.E.Wallis.(CBS Publishers & Distributors, New Delhi)
4. Tyler V.E., Brady L.R. and Robbers J.E., Pharmacognosy (Len & Febiger, Philadelphia)

PS 1505 PHARMACEUTICS - VI (Hospital Pharmacy)
L-T-P : 3-0-0 **Credit : 3**

1. Organization and Structure: Organization of a hospital and hospital pharmacy, Responsibilities of a hospital pharmacist, Pharmacy and therapeutic committee, Budget preparation and Implementation.
2. Hospital Formulary: Contents, preparation and revision of hospital formulary.
3. Drug Store Management and Inventory Control:
   (a) Organization of drug store, Types of materials stocked, storage conditions.
   (b) Purchase and Inventory Control principles, purchase procedures, Purchase order, Procurement and stocking.
4. Drug distribution Systems in Hospitals:
   (a) Out-patient dispensing, methods adopted.
   (b) Dispensing of drugs to in-patients. Types of drug distribution systems. Charging policy, labeling.
   (c) Dispensing of drugs to ambulatory patients.
   (d) Dispensing of controlled drugs.
5. Central Sterile Supply Unit and their Management: Types of materials for sterilization, packing of materials prior to sterilization, sterilization equipments, Supply of sterile materials.
6. Manufacture of Sterile and Nonsterile Products: Policy making of manufacturable items, demand and costing, personnel requirements, manufacturing practice, Master formula Card, production control, manufacturing records.
7. Drug Information Services: Sources of Information on drugs, disease, treatment schedules, procurement of information, Computerized services (e.g., MEDLINE), Retrieval of information, Medication error.
8. Records and Reports: Prescription filling, drug profile, patient medication profile, cases on drug interaction and adverse reactions, idiosyncratic cases etc.
9. Nuclear Pharmacy: Introduction to Radio- pharmaceuticals, radio-active half-life, Units of radio-activity Production of radio-pharmaceuticals, methods of isotopic tagging, preparation of radio-isotopes in laboratory using radiation dosimeters, radio-isotope generators, Permissible radiation dose level, Radiation hazards and their prevention, specifications for radio-active laboratory.

PS 1505 PHARMACEUTICS - VI (LAB)
L-T-P : 0-0-4 **Credit : 2**

1. Experiments based on sterilization of various types of materials used in Hospitals.
2. Practical's designed on the use of computers in Drug Information Centre, prescription filling, documentation of information on drug interaction.
3. Experiments to illustrate handling of radio pharmaceutical products, measurement of radioactivity.

Recommended Books:

1. Hospital Pharmacy-Hassan WE, Lec and Febiger Publication.
2. Text book of Hospital Pharmacy-Allowood MC and Blackwell,
3. Remington: The Science & Practice of Pharmacy, Lippincott Williams & Wilkins.
4. Collet & Aulton, Eds. : "Pharmaceutical Practice," ELBS
5. Owunwanne, Patel, and Sadek : "The Hand Book of Radiopharmaceuticals,"Chapman & Hall.
6. Shroff : "Professional Pharmacy," 1st ed., Part I (Ethics) & Part III (Hospital Pharmacy), Five Star Enterprises.
7. Aulton, Ed. : "Pharmaceutics – The Science of Dosage Form Design," ELBS,
8. Text Book of Hospital Pharmacy," Blackwell Scientific Publications.
9. Merchant & Qadry : "Text Book of Hospital Pharmacy," Shah Prakashan.
10. Chittion & Witcofski : "Nuclear Pharmacy," Lea & Febiger.Aiiwodd & Fell :

SEMESTER - VI

PS 1601 PHARMACEUTICS - VII (Biopharmaceutics & Pharmacokinetics)

L-T-P : 3-0-0 **Credit : 3**

1. Introduction to Biopharmaceutics and Pharmacokinetics and their role in formulation development and clinical setting.

2. Biopharmaceutics:

a) Passage of drugs across biological barrier (passive diffusion, active transport, facilitated diffusion and pinocytosis).
b) Factors influencing absorption - Physicochemical, physiological and pharmaceutical.
c) Drug distribution in the body, plasma protein binding.

3. Phamacokinetics :

a) Significance of plasma drug concentration measurement.
b) Compartment model-Definition and Scope.
c) Pharmacokinetics of drug absorption - Zero order and first order absorption rate constant using Wagner - Nelson and Loo- Reigelman method.
d) Volume of distribution and distribution coefficient.
e) Compartment kinetics - One compartment and two compartment models.
f) Determination of pharmacokinetic parameters from plasma and urine data after drug administration by intravascular and oral route.
g) Curve fitting (method of Residuals), regression procedures.
h) Clearance concept, Mechanism of renal clearance, clearance ratio, determination of renal clearance.
i) Extraction ratio, hepatic clearance, biliary excretion, Extrahepatic circulation.
j) Non-linear pharmacokinetics with special reference to one compartment model after intravenous drug administration, Michaeles Menten Equation, detection of non-linearity (Saturation mechanism).

4. Clinical Pharmacokinetics:

a) Definition and scope.
b) Dosage adjustment in patients with and without renal and hepatic failure.
c) Design of single dose bio-equivalence study and relevant statistics.
d) Pharmacokinetic drug interactions and their significance in combination therapy.

5. Bioavailability and bioequivalence:

a) Measures of bioavailability, C_{max}, t_{max}, and Area under the curve (AUC).
b) Design of single dose bioequivalence study and relevant statistics.
c) Review of regulatory requirements for conduction of bioequivalent studies.

PS 1601P PHARMACEUTICS - VII (LAB)

L-T-P : 0-0-4 **Credit : 2**

1. Experiments designed for the estimation of various pharmacokinetic parameters with given data.
2. Analysis of biological specifications for drug content and estimation of the pharmacokinetic parameters.
3. In vitro evaluation of different dosage forms for drug release.
4. Absorption studies - in- vitro and in -situ.
5. Statistical treatment of pharmaceutical data.

Recommended Books:

1. Biopharmaceutics and Pharmacokinetics by D.M. Brahmankar and Sunil B. Jaiswal
2. Fundamentals of Biopharmaceutics and Pharmacokinetics by V. Venkateswarulu
3. Biopharmaceutics and Clinical Pharmacokinetics by Notari
4. Biopharmaceutics and Clinical Pharmacokinetics by Gibaldi
5. Applied Biopharmaceutics and Pharmacokinetics by Shargel and Yu

PS 1602 PHARMACEUTICAL CHEMISTRY – VI (Medicinal Chemistry - I)
L-T-P : 3-0-0 Credit : 3

1. Basic Principles of Medicinal Chemistry: Physico-chemical aspects (Optical, geometric and bioisosterism) of drug molecules and bilological action, Drugreceptor interaction including transduction mechanisms.
2. Principles of Drug Design (Theoretic~fll Aspects) : Traditional analog (QSAR) and mechanism based approaches (Introduction 00' graph theory, applications of quantum mechanics, Computer Aided Drug Desigming (CADD) androolecular modeling.
3. Synthetic procedures of selected drugs, mode of action, uses, structure activity relationship including physicochemical properties of the following classes of drugs:

   A. Drugs acting at Synaptic and neuro-effector junction sites:

   i. Cholinergics and Anticholinesterases
   ii. Adrenergic .drugs
   iii. Antispasmodic and anti ulcer drugs
   iv. Neuromuscular blocking agents.

   B. Autocoids

   i. Antihistamines
   ii. Eicosanoids
   iii. Analgesic-antipyretics, anti-inflammatory (non-steroidal) agents.

   C. Drugs affecting uterine motility

   Oxytocics (including oxytocin, ergot alkaloids and prostaglandins' Biochemical approaches in drug designing wherever applicable should be discussed.

PS 1602P PHARMACEUTICAL CHEMISTRY – V (LAB)
L-T-P : 0-0-4 Credit : 2

1. Exercises based on QSAR: Hansch & Free-Wilson methods.
2. Synthesis of selected drugs from the course content.
3. Spectral analysis of the drugs synthesized.
4. Establishing the pharmacopoeial standards of the drugs synthesized.
5. Determination of partition coefficient, dissociation constant and molar refractivity of compounds for QSAR analysis.

Recommended Books:

1. Wilson and Grisvold’s Text Book of Organic Medicinal and Pharmaceutical Chemistry.
2. Principles of Medicinal Chemistry by William O.Foye.
3. A Text Book of Medicinal Chemistry by S.N.Pandeya.

4. Medicinal Chemistry by Ashutoshkar.
5. Bentley's and Driver's Text Book of Pharmaceutical Chemistry.

PS 1603 PHARMACOGNOSY - V (Chemistry of Natural Products)
L-T-P : 3-0-0 Credit : 3

1. Chemical and spectral approaches to simple molecules of natural origin
2. Concept of stereoisomerism taking examples of natural products.
3. Chemistry, biogenesis and pharmacological activity of medicinally important monoterpenes, sesquiterpenes, diterpenes, and triterpenoids.
4. Carotenoids: α-carotenoids, β-carotenes, vitamin A, Xanthophylls of medicinal importance.
5. Glycosides : Chemistry and biosynthesis of digitoxin, digoxin, hecogenin, sennosides, diosgenin and sarasapogenin.
6. Alkaloids: Chemistry, biogenesis and pharmacological activity of atropine and related compounds; quinine, reserpine, morphine, papaverine, ephedrine, ergot and vinca alkaloids.
7. Chemistry and biogenesis of medicinally important lignans and quassanoids, flavonoids.
8. Chemistry and therapeutic activity of penicillin, streptomycin and tetracyclines.

PS 1603P PHARMACOGNOSY - V (LAB)
L-T-P : 0-0-4 Credit : 2

i) Laboratory experiments on isolation, separation, purification of various groups of chemical constituents of pharmaceutical significance.
ii) Exercises on paper and thin layer chromatographic evaluations of herbal drug constituents.

Recommended Books:
1. Text Book of Pharmacognosy by Kokate C K, Purohit A P, Gokhale S B (Nirali Prakashan, Pune)
2. Trease G.E. and Evans W.C., Pharmacognosy (Balliene Tindall, Eastbourne)
3. Text Book of Pharmacognosy by T.E.Wallis.(CBS Publishers & Distributors, New Delhi)
4. Tyler V.E., Brady L.R. and Robbers J.E., Pharmacognosy (Len & Febiger, Philadelphia)

PS 1604 PHARMACOLOGY - II
L-T-P : 3-0-0 Credit : 3

1. **Pharmacology of Cardiovascular System:**
   a) Digitalis and cardiac glycosides.
   b) Antihypertensive drugs.
   c) Antianginal and Vasodilator drugs, including calcium channel blockers and beta adrenergic antagonists.
   d) Antiarrhythmic drugs.
   e) Antihyperlipedemic drugs.
   f) Drugs used in the therapy of shock.
2 **Drugs Acting on the Hemopoietic System:**
   a) Hematinics.
   b) Anticoagulants, Vitamin K and hemostatic agents.
   c) Fibrinolytic and anti-platelet drugs.
   d) Blood and plasma volume expanders.
3. **Drugs acting on urinary system:**
   a) Fluid and electrolyte balance
   b) Diuretics
4. **Autocoids :**
   a) Histamine, 5-HT and their antagonists.

b) Prostaglandins, thromboxanes and leukotrienes.
c) Pentagastrin, Cholecystokinin, Angiotensin, Bradykinin and Substance P.

5. **Drugs Acting on the Respiratory System:**
   a) Anti-asthmatic drugs including bronchodilators.
   b) Anti-tussives and expectorants.
   c) Respiratory stimulants.

PS 1604P PHARMACOLOGY – II (LAB)
L-T-P : 0-0-4 **Credit : 2**

1. Experiments on Isolated Preparations:
   a) To record the concentration response curve (CRC) of acetylcholine using rectus abdominis muscle preparation of frog.
   b) To study the effects of physostigmine and d-tubocurarine on the CRC of acetylcholine using rectus abdominis muscle preparation of frog.
   c) To record the CRC of 5-HT on rat fundus preparation.
   d) To record the CRC of histamine on guinea pig ileum preparation.
   e) To record the CRC of nor-aderenaline on rat anococcygeus muscle preparation.
   f) To record the CRC of oxytocin using rat uterus preparation.

2. **Pharmacology of Cardiovascular System:**
   a) To study the ionotropic and chronotropic effects of drugs on isolated frog heart.
   b) To study the effects of drugs on normal and hypodynamic frog heart.

3. **Blood Pressure of anaesthetized Dog/Cat/Rat:**
   To demonstrate the effects of various drugs on the B.P. and respiration including the Vasomotor Reversal of Dale and nicotinic action of acetylcholine.

Recommended Books:
1. Essentials of Medical Pharmacology by K.D.Tripathy
2. Pharmacology and pharmacotherapeutics by Satoshkar and Bhandarkar
3. Pharmacology by Prasun K Das, S.K.Bhattacharya and P.Sen.
4. Text book of Pharmacology by S.D. Sethi
5. The Pharmacological basis of Therapeutics by Goodman and Gilman
6. Pharmacology by Rang, Dale and Ritter.
7. Basic and Clinical Pharmacology by B.G.Katzung.

PS 1605 PHARMACEUTICAL ANALYSIS - III
L-T-P : 3-0-0 **Credit : 3**

A. **Quality assurance:**
   1. GLP, ISO 9000, TQM, Quality Review and Quality Documentation.
   2. Regulatory control, regulatory drug analysis, interpretation of analytical data.
   3. Validation, quality audit: quality of equipment, validation of equipment, validation of analytical procedures.

B. The theoretical aspects, basic instrumentation, elements of interpretation of spectra, and applications of the following analytical techniques should be discussed:
   1. Ultraviolet and visible spectrophotometry
   2. Fluorimetry.
   3. Infrared spectrophotometry.
   4. Nuclear Magnetic Resonance spectroscopy including 13c NMR.
   5. Mass Spectrometry.
   6. Flame Photometry.
   7. Emission Spectroscopy.

8. Atomic Absorption Spectroscopy.
9. X -ray Diffraction. 10. Radio immunoassay.

PS 1605P PHARMACEUTICAL ANALYSIS – III (LAB)
L-T-P : 0-0-4 **Credit : 2**

1. Quantitative estimation of at least ten formulations containing single drug or more than one drug, using instrumental techniques.
2. Estimation of Na+, K+, Ca++ ions using flame photometry.
3. IR of samples with different functional groups (-COOH, -COOR, - CONHR, - NH2, -NHR, -OH, etc.).
4. Workshop to interpret the structure of simple organic compounds using UV, IR, NMR and MS.

Recommended Books:

1. Vogel's Text Book of Quantitative Chemical Analysis
2. 2. Instrumental methods of Chemical Analysis by B.K. Sharma
3. 3. Instrumental methods of Analysis by Willard Den & Merrit
4. 4. Practical Pharmaceutical Chemistry by Beckette and Sten Lake Vol. 2
5. 5. Text Book of Pharmaceutical Analysis by Conner

SEMESTER - VII

PS 1701 PHARMACEUTICS - VIII (Pharmaceutical Technology II)
L-T-P : 3-0-0 **Credit : 3**

1. **Capsules:** Advantages and disadvantages of capsule dosage form, material for production of hard gelatin capsules, size of capsules, method of capsule filling, soft gelatin, capsule shell and capsule content, importance of base absorption and minimum/gm factors in soft capsules, quality control, stability testing and storage of capsule dosage forms.
2. **Micro-encapsulation:** Types of microcapsules, importance of microencapsulation in pharmacy, microencapsulation by phase separation, coacervation, multi orifice, spray drying, spray congealing, polymerization complex emulsion, air suspension technique, coating pan and other techniques, evaluation of micro capsules.
3. **Tablets:**
   a) Formulation of different types of tablets, granulation, technology on large-scale by various techniques, physics of tablets making, different types of tablet compression machinery and the equipments employed, evaluation of tablets.
   b) Coating of Tablets: Types of coating, film forming materials, formulation of coating solution, equipments for coating, coating process, evaluation of coated tablets.
   c) Stability kinetics and quality assurance.
4. **Parenteral Products:**
   a) Preformulation factors, routes of administration, water for injection, pyrogenicity, non aqueous vehicles, isotonicity and methods of its adjustment.
   b) Formulation details, containers and closures and selection.
   c) Prefilling treatment, washing of containers and closures, preparation of solution and suspensions, filling and closing of ampoules, vials, infusion fluids, lyophillization & preparation of sterile powders, equipment for large scale manufacture and evaluation of parenteral products.
   d) Aseptic Techniques-source of contamination and methods of prevention, Design of aseptic area, Laminar flow bench services and maintenance.
   e) Sterility testing of pharmaceuticals.
5. **Surgical products:** Definition, primary wound dressing, absorbents, surgical cotton, surgical gauzes etc. Bandages, adhesive tape, protective cellulosic hemostastics, official dressings, absorbable and

nonabsorbable sutures, ligatures and catguts. Medical prosthetics and organ replacement materials.

6. **Packaging of Pharmaceutical Products:** Packaging components, types, specifications and methods of evaluation, stability aspects of packaging. Packaging equipments, factors influencing choice of containers, legal and other official requirements for containers, package testing.

PS 1701P PHARMACEUTICS - VIII (LAB)
L-T-P : 0-0-4 **Credit : 2**

1. Experiments to illustrate preparation, stabilization, physical & biological evaluation of pharmaceutical products like powders, capsules, tablets, parenterals, micro capsules, surgical dressing etc.
2. Evaluation of materials used in pharmaceutical packaging.

Recommended Books:

1. Bently's Textbook of pharmaceutics by E.A. Rawlins (All India Traveller Book Seller, New Delhi)
2. The Theory and Practice of Industrial Pharmacy by Lachmann, Libermann and Kanig (Varghese Pub. House, Bombay)
3. Pharmaceutical Dosage Forms and Drug Delivery Systems by Ansel, Allen and Popovich (B.I.Waverly Pvt. Ltd., New Delhi)
4. REMINGTON : The Science and Practice of Pharmacy, (Lippincott Williams & Wilkins, Baltimore)
5. Pharmaceutics : The Science of Dosage Form Design by Aulton (Churchill Livingstone, Edinburgh)

PS 1702 PHARMACOLOGY - III
L-T-P : 3-0-0 **Credit : 3**

1. Drugs Acting on the Gastrointestinal Tract:
- a) Antacids, Anti Secretory and Anti-ulcer drugs.
- b) Laxatives and anti diarrhoeal drugs.
- c) Appetite Stimulants and Suppressants.
- d) Emetics and anti-emetics.
- e) Miscellaneous-Carminatives, demulcents, protectives, adsorbents, astringents, digestants, enzymes and mucolytics.

2. Pharmacology of Endocrine System:
- a) Hypothalamic and pituitary hormones.
- b) Thyroid hormones and anti thyroid drugs, parathormone, calcitonin and Vitamin D.
- c) Insulin, oral hypoglycaemic agents & glucagon.
- d) ACTH and corticosteroids.
- e) Androgens and anabolic steroids.
- f) Estrogens, progesterone and oral contraceptives.
- g) Drugs acting on the uterus.

3. Chemotherapy:
- a) General Principles of Chemotherapy.
- b) Sulfonamides and cotrimoxazole.
- c) Antibiotics-Penicillins, Cephalosporins, Chloramphenicol Erythromycin, Quinolones and Miscellaneous Antibiotics.
- d) Chemotherapy of tuberculosis, leprosy, fungal diseases, viral diseases, urinary tract infections and sexually transmitted diseases.
- e) Chemotherapy of malignancy and Immunosuppressive Agents.

4. Principles of Toxicology:
- a) Definition of poison, general principles of treatment of poisoning with particular reference to barbiturates, opioids, organophosphorous and atropine poisoning.
- b) Heavy metals and heavy metal antagonists.

PS 1702P PHARMACOLOGY - III (LAB)
L-T-P : 0-0-4 **Credit : 2**

1. Experiments on Isolated Preparations:
   a) To calculate the pA2 value of atropine using acetylcholine as an agonist on rat ileum preparation.
   b) To calculate the pA2 value of mepyramine or chlorpheniramine using histamine as agonist on guinea pig ileum.
   c) To estimate the strength of the test sample of agonist/drug (e.g. Acetylcholine, Histamine, 5 -HT, Oxytocin, etc) using a suitable isolated muscle preparation employing Matching bioassay, Bracketing assay, Three point assay and Four point bioassay.
2. Pharmacology of the Gastrointestinal Tract: To study the Anti- secretary and anti-ulcer activity using pylorus.
3. Clinical pharmacology: To determine the effects of certain clinically useful drugs on human volunteers like:
   (a) Antihistaminics
   (b) Anti-anxiety and sedative drugs
   (c) Analgesics
   (d) Beta blockers.

Recommended Books:
1. Essentials of Medical Pharmacology by K.D.Tripathy
2. Pharmacology and pharmacotherapeutics by Satoshkar and Bhandarkar
3. Pharmacology by Prasun K Das, S.K.Bhattacharya and P.Sen.
4. Text book of Pharmacology by S.D. Sethi
5. The Pharmacological basis of Therapeutics by Goodman and Gilman
6. Pharmacology by Rang, Dale and Ritter.
7. Basic and Clinical Pharmacology by B.G.Katzung.

PS 1703 PHARMACEUTICAL CHEMISTRY - VII (Medicinal Chemistry - II)
L-T-P : 3-0-0 **Credit : 3**

Synthetic procedures of selected drugs, mode of action, uses, structure activity relationship including Physico-Chemical properties of the following classes of drugs.

1. **Steroids and related drugs**: Steroidal nomenclature and stereochemistry, androgens and anabolic agents, estrogens, and progestational agents, adrenocorticoids.
2. **Drugs acting on the Central Nervous System:** General Anesthetics, Local Anesthetics, Hypnotics and Sedatives, Opioid analgesics, antitussives, anti convulsants, Antiparkinsonism drugs, CNS stimulants, Psychopharmacological agents (neuroleptics, antidepressants, anxiolytics).
3. Diuretics, Cardiovascular drugs, Anticoagulant and Antiplatelet drugs.

Biochemical approaches in drug designing wherever applicable should be discussed.

PS 1703P PHARMACEUTICAL CHEMISTRY - VII (LAB)
L-T-P : 0-0-4 **Credit : 2**

1. Workshop on stereomodel use of some selected drugs.
2. Synthesis of selected drugs from the course content involving two or more steps and their spectral analysis.
3. Establishing the Pharmacopoeial standards of the drugs synthesized.

Recommended Books:
1. Wilson and Grisvold's Text Book of Organic Medicinal and Pharmaceutical Chemistry.
2. Principles of Medicinal Chemistry by William O.Foye.

3. A Text Book of Medicinal Chemistry by S.N.Pandeya.
4. Medicinal Chemistry by Ashutoshkar.
5. Bentley's and Driver's Text Book of Pharmaceutical Chemistry.

PS 1704 PHARMACEUTICAL BIOTECHNOLOGY
L-T-P : 3-0-0 Credit : 3

1. **Immunology and Immunological Preparations**: Principles, antigens and haptens, immune system, cellular humorai immunity, immunological tolerance, antigen-antibody reactions and their applications. Hypersensitivity, Active and passive immunization, Vaccines- their preparation, standardization and storage.
2. **Genetic Recombination**: Transformation, conjugation, transduction, protoplast fusion and gene cloning and their applications. Development of hybridoma for monoclonal antibodies. Study of drugs produced by biotechnology such as Activase, Humulin, Humatrope, HB etc.
3. **Antibiotics:** Historical development of antibiotics. Antimicrobial spectrum and methods used for their standardization. Screening of soil for organisms producing antibiotics, fermenter, its design, control of different parameters. Isolation of mutants, factors influencing rate of mutation. Design of fermentation process. Isolation of fermentation products with special reference to penicillins, streptomycins tetracyclines and vitamin B12.
4. **Microbial Transformation:** Introduction, types of reactions mediated by microorganisms, design of biotransformation processes, selection of organisms, biotransformation process and its improvements with special reference to steroids.
5. **Enzyme immobilization:** Techniqes of immobilization, factors affecting enzyme kinetics. Study of enzymes such as hyaluronidase, penicillinase, streptokinase and streptodornase, amylases and proteases etc. Immobilization of bacteria and plant cells.

Recommended Books:
1. Industrial Microbiology by Casida.
2. Industrial Microbiology by A.H. Patel.
3. Industrial microbiology by Prescott and Dunn.
4. Pharmaceutical Biotechnology by Vyas and Dixit.
5. Molecularbiology and Genetic Engineering by A.M.Narayanan, A.M.Selvaraj, A.Mani
6. Text Book of Microbiology by Anantanarayana and Panicker.
7. Concepts in Biotechnology by Balasubramanium.
8. Molecular Biotechnology by Glick.
9. Molecular Biotechnology by Gingold.

PS 1705 PHARMACEUTICAL INDUSTRIAL MANAGEMENT
L-T-P : 3-0-0 Credit : 3

1. **Concept of Management:** Administrative Management (Planning, Organizing, Staffing, Directing and Controlling), Entrepreneurship development, Operative Management (Personnel, Materials, Production, Financial, Marketing, Time/space, Margin/Morale). Principles of Management (Co-ordination, Communication, Motivation, Decision-making, leadership, Innovation, Creativity, Delegation of Authority / Responsibility, Record Keeping). Identification of key points to give maximum thrust for development and perfection.
2. **Accountancy:** Principles of Accountancy, Ledger posting and book entries, preparation of trial balance, columns of a cash book, Bank reconciliation statement, rectification of errors, Profits and loss account, balance sheet, purchase, keeping and pricing of stocks, treatment of cheques, bills of exchange, promissory notes and hundies, documentary bills.
3. **Economics:** Principles of economics with special reference to the laws of demand and supply, demand schedule, demand curves, labor welfare, general principles of insurance and inland and foreign trade, procedure of exporting and importing goods.

4. **Pharmaceutical Marketing:** Functions, buying, selling, transportation, storage, finance, feedback, information, channels of distribution, wholesale, retail, departmental store, multiple shop and mail order business.
5. **Salesmanship:** Principles of sales promotion, advertising, ethics of sales, merchandising, literature, detailing. Recruitment, training, evaluation, compensation to the pharmacist.
6. **Market Research:**
(a) Measuring & Forecasting Market Demands-Major concept in demand measurement, Estimating current demand, Geodemographic analysis, Estimating industry sales, Market share & Future demand.
(b) Market Segmentation & Market Targeting.
7. **Materials Management:** A brief exposure or basic principles of materials management-major areas, scope, purchase, stores, inventory control and evaluation of materials management.
8. **Production Management:** A brief exposure of the different aspects of Production Management-Visible and Invisible inputs, Methodology of Activities, Performance Evaluation Technique, Process-Flow, Process Knowhow, Maintenance Management.

Recommended Books:

1. M. J. Etazel , B. J. Walker and W. J. Stanton, Marketing, Tata McGraw Hill, 13th Edition, 2004.
2. R. Saxena, "Marketing Management" Tata McGraw Hill, second Edition, 2003.

PS 1706 Elective Theory
L-T-P : 3-0-0 **Credit: 3**

PS 1706P Elective Practical
L-T-P : 0-0-4 **Credit: 2**

SEMESTER - VIII

PS 1801 PHARMACEUTICS - IX (Dosage Form Design)
L-T-P : 3-0-0 **Credit : 3**

1. **Preformulation studies:**
   a) Study of physical properties of drug like physical form, particle size, shape, density, wetting dielectric constant. Solubility, dissolution and organoleptic property and their effect on formulation, stability and bioavailability.
   b) Study of chemical properties of drugs like hydrolysis, oxidation, reduction, racemization, polymerization etc., and their influence on formulation and stability of products.
   c) Study of pro-drugs in solving problems related to stability, bioavailability and elegancy of formulations.
2. Design, development and process validation methods for pharmaceutical operations involved in the production of pharmaceutical products with special reference to tablets, suspensions.
3. Stabilization and stability testing protocol for various pharmaceutical products.
4. **Performance evaluation methods**
   a) In-vitro dissolution studies for solid dosage forms methods, interpretation of dissolution data.
   b) Bioavailability studies and bioavailability testing protocol and procedures.
   c) In-vivo methods of evaluation and statistical treatment.
   d) GMP and quality assurance, Quality audit.
   e) Design, development, production and evaluation of controlled released formulations.

PS 1801P PHARMACEUTICS - IX (LAB)
L-T-P : 0-0-4 **Credit : 2**

1. Preformulation studies including drug-excipient compatibility studies, effect of stabilizers, preservatives etc. in dosage form design.
2. Experiments demonstrating improvement in bioavailability through prodrug concept.
3. Stability evaluation of various dosage forms and their expiration dating.
4. Dissolution testing and data evaluation for oral solid dosage forms.
6. In -vivo bioavailability evaluation from plasma drug concentration and urinary excretion curves.
7. Design, development and evaluation of controlled release formulations.

Recommended Books:

1. Bently's Textbook of pharmaceutics edited by E.A. Rawlins (All India Traveller Book Seller, New Delhi)
2. The Theory and Practice of Industrial Pharmacy by Lachmann, Libermann and Kanig (Varghese Pub. House, Bombay)
3. Pharmaceutical Dosage Forms and Drug Delivery Systems by Ansel, Allen and Popovich (B.I.Waverly Pvt. Ltd., New Delhi)
4. REMINGTON : The Science and Practice of Pharmacy, (Lippincott Williams & Wilkins, Baltimore)
5. Pharmaceutics : The Science of Dosage Form Design by Aulton (Churchill Livingstone, Edinburgh)

PS 1802 PHARMACEUTICAL CHEMISTRY – VIII (Medicinal Chemistry III)
L-T-P : 3-0-0 Credit : 3

1. Drug metabolism and Concepts of Prodrugs.

2 Synthetic procedures of selected drugs, mode of action, uses, structure activity relationship (including physicochemical aspects) of the following classes of drugs. (Biochemical approaches in drug designing wherever applicable should be discussed).

a) Antimetabolites (including sulfonamides).
b) Chemotherapeutic agents used in Protozoal, Parasitic and other infection.
c) Antineoplastic agents.
d) Anti-viral including anti - HIVagents.
e) Immunosuppressives and immunostimulants.

3. Amino acids, peptide, nueleotides and related drugs.
   a) Thyroid and Anti thyroid drugs.
   b) Insulin and oral hypoglycaemic agents.
   c) Peptidomimetics and nucleotidomimetics.
   d) Diagnostic agents.
   e) Pharmaceutical Aids.

PS 1802P PHARMACEUTICAL CHEMISTRY – VIII (LAB)
L-T-P : 0-0-4 Credit : 2

1. **Experiments designed on drug metabolism:**
   a) Preparation of S9 and microsomes from tissue homogenates and standardization of protein.
   b) Effect of phenobarbital pretreatment on microsomal cytochrome p-450, cytochrome b5, and NADPH-Cytochrome C-reductase and comparison of microsomes from control.
   c) Determination of microsomal aminopyrine demethylase and p- nitroanisole o-demethylase activities.
   d) Determination of microsomal azo- and nitroreductase activities.
2. Synthesis of selected drugs.
3. Establishing the pharmacopoeal standards and spectral studies.

Recommended Books:

1. Wilson and Grisvold's Text Book of Organic Medicinal and Pharmaceutical Chemistry.

2. Principles of Medicinal Chemistry by William O.Foye.
3. A Text Book of Medicinal Chemistry by S.N.Pandeya.
4. Medicinal Chemistry by Ashutoshkar.
5. Bentley's and Driver's Text Book of Pharmaceutical Chemistry.

PS 1803 PHARMACOGNOSY - VI
L-T-P : 3-0-0 Credit : 3

1. World-wide trade in medicinal plants and derived products with special reference to diosgenin (disocorea), taxol (Taxus sps) digitalis, tropane alkaloid containing plants, Papain, cinchona, Ipecac, Liquorice, Ginseng, Aloe, Valerian, Rauwolfia and plants containing laxatives.
2. A brief account of plant based industries and institutions involved in work on medicinal and aromatic plants in India. Utilization and production of phytoconstituents such as quinine, calcium sennosides, podophyllotoxin, diosgenin, solasodine, and tropane alkaloids.
3. Utilization of aromatic plants and derived products with special reference to sandalwood oil, mentha oil, lemon grass oil, vetiver oil, geranium oil and eucalyptus oil.
4. Historical development of plant tissue culture, types of cultures. Nutritional requirements, growth and their maintenance. Applications of plant tissue culture in pharmacognosy.
5. Chemotaxonomy of medicinal plants.
6. Marine pharmacognosy, novel medicinal agents from marine sources.
7. Natural allergens and photosensitizing agents and fungal toxins.
8. Herbs as health foods.
9. Herbal cosmetics.

PS 1803P PHARMACOGNOSY – VI (LAB)
L-T-P : 0-0-4 Credit : 2

i. Isolation of some selected phytoconstituents studied in theory.
ii. Extraction of volatile oils and their chromatographic profiles.
iii. Some experiments in plant tissue culture.

Recommended Books:
1. Text Book of Pharmacognosy by Kokate C K, Purohit A P, Gokhale S B (Nirali Prakashan, Pune)
2. Trease G.E. and Evans W.C., Pharmacognosy (Balliene Tindall, Eastbourne)
3. Text Book of Pharmacognosy by T.E.Wallis.(CBS Publishers & Distributors, New Delhi)
4. Tyler V.E., Brady L.R. and Robbers J.E., Pharmacognosy (Len & Febiger, Philadelphia)

PS 1804 PHARMACOLOGY – IV (Clinical Pharmacy and Drug Interactions)
L-T-P : 3-0-0 Credit : 3

1. Introduction to Clinical Pharmacy.
2. Basic Concepts of Pharmacotherapy.
   a) Clinical Pharmacokinetics and individualization of Drug Therapy.
   b) Drug Delivery Systems and their Biopharmaceutic & Therapeutic Considerations.
   c) Drug Use During Infancy and in the Elderly (Pediatries & Geriatrics).
   d) Drug use during Pregnancy.
   e) Drug induced Diseases.
   f) The Basics of Drug Interactions.
   g) General Principles of Clinical Toxicology.
   h) Interpretation of Clinical Laboratory Tests.
3. Important Disorders of Organ Systems and their Management:
   a) Cardiovascular Disorders-Hypertension, Congestive Heart Failure, Angina, Acute Myocardial

Infarction, Cardiac arrhythmias.

b) CNS Disorders: Epilepsy, Parkinsonism, Schizophrenia, Depression.
c) Respiratory Disease-Asthma.
d) Gastrointestinal Disorders-Peptic ulcer, Ulcerative colitis, Hepatitis, Cirrhosis.
e) Endocrine Disorders-Diabetes mellitus and Thyroid Disorders.
f) Infectious Diseases-Tuberculosis, Urinary Tract Infection, Enteric Infections, Upper Respiratory Infections.
g) Hematopoietic Disorders-Anemias.
h) Joint and Connective Tissue Disorders-Rheumatic Diseases, Gout and Hyperuricemia.
i) Neoplastic Diseases- Acute Leukaemias, Hodgkin's disease.

4. Therapeutic Drug Monitoring
5. Concept of Essential Drugs and Rational Drug use.

Recommended Books:

1. Remington the Science and Practice of Pharmacy
2. Clinical Pharmacology by Laurence, Bennett and Brown
3. Medical diagnosis and treatment by Tierney, Mc phee and Papadakis
4. Clinical Pharmacy & Therapeutics by Roger Walker, Edwards.
5. Clinical Pharmacy and Therapeutics by Herfindal, Gourley and Lloyd Hart.
6. Physiological basis of Medical Practice by John B. West
7. Drug Interactions by Ivan Stockley

PS 1805P Project Work and Viva - voce
L-T-P : 0-0-12 **Credit : 10**

ELECTIVES
(To be chosen one each against papers PS 1706and PS 1706P)

PS 17E1 COSMETIC TECHNOLOGY
L-T-P : 3-0-0 **Credit : 3**

UNIT -I
1. Fundamentals of cosmetic technology, classification of cosmetics, a brief study of raw materials used for Cosmetic preparations: surfactants, humectants, cream bases, aerosol propellants, perfumes, colours.

UNIT -II
2. Stability aspects of cosmetics: Shelf-life, effects of environmental factors like light, temperatures etc on product stability.
3. Quality control tests of different cosmetic products, Packaging of Cosmetics

UNIT -III
4. Hair Care Products: Hair structure, Shampoos, Conditioners, Setting lotion, Hair creams, Hair dyes.
5. Skin Care Products: Anatomy and physiology of skin, formulation of skin cleaners, moisturizers, sunscreen products, acne products, anti ageing creams.

UNIT -IV
6. Colour Cosmetics: Introduction, lip colour, nail polish, face make-up and eye make-up.
7. Dental products: Dentifrices, Oral rinses, Tooth powder, Tooth paste.
8. Personal Hygiene Products: Shaving creams, after shave products.

PS 17E1P COSMETIC TECHNOLOGY (LAB)
L-T-P : 0-0-4 **Credit : 2**

1. Preparation of selected cosmetic preparations representing the following classes:
   a) Shampoos
   b) Hair conditioners
   c) Hair creams
   d) Skin creams
   e) Nail polish
   f) Face powders
   g) Tooth pastes
   h) Tooth powder
   i) Shaving cream
   j) After shave lotion
2. Evaluation of any two products mentioned above
3. Collection of various packaging materials used for cosmetics and their description

(Each student shall collect at least 10 different types of containers.)

Recommended books:

1. Cosmetics: Formulation, manufacturing, and Quality control by P.P.Sharma
2. A Handbook of Cosmetics by B.M. Mithal, R.N. Saha
3. The Theory and Practice of Industrial Pharmacy by Lachman L., Liberman, H.A.
4. Modern Cosmetics by Thomson, E.G.
5. Paucher's Perfumes, cosmetics & soaps by W.A.Paucher.
6. Hary's cosmeticology by J.B.Wilkimsson.

PS 17E2 HERBAL DRUG TECHNOLOGY
L-T-P : 3-0-0 **Credit : 3**

UNIT -I

Definition of Herbal drug, Importance of Herbal therapies, Herbal verses conventional drugs, Safety in herbal drugs, Toxicity in Herbals and their interactions.

UNIT -II

Herbs used as nutraceuticals and healing agents Herbal cosmetics.

UNIT -III

Making and using herbal medicines for common ailments like cold, skin infections and diarrhoea.

Analytical Profiles of selected herbs- Brahmi Aradrographis paniculata, Aegle marmelos and Gymnema sylvestre.

UNIT -IV

Quality Control and Quality Assurance of Herbal ingredients as per W.H.O. guidelines.

Determination of tannins, Ash value, Extractable matter and Pesticide residues.

PS 17E2P HERBAL DRUG TECHNOLOGY (LAB)

L-T-P : 0-0-4 **Credit : 2**

1. Identification of sugar from plant extracts
2. Preparation of plant extracts and their standardization by analytical profiles (any five)
3. Quality Control tests for raw materials used in Herbal preparation

Recommended books:

1. Trease and Evan's Pharmacognosy 15th edition
2. Indian Herbal Pharmacopeia Vol-I and II
3. Quality Control methods for medicinal plant material by W.H.O., Geneva.
4. Quality Control of Herbal drugs by Dr. Pulak K. Mukherjee
5. Botanical safety hand book by Michael Meguffin, Christopher Hobbs published by American Herbal Product Association.
6. Herbal drugs by P.Mukherjee

PS 17E3 BIOASSAYS

L-T-P : 3-0-0 **Credit : 3**

UNIT -I

Definition , principles , and design of Bioassays.

Requirements applications, importance advantages and disadvantages of Bioassays

UNIT -II

Types of Bioassay (quantal and graded response Bioassys), Bioassay of agonists and antagonists, Biological variation, Biological standardization, Microbiological assay (antibiotics, vitamin B12), Bioassay in Humans

UNIT -III

Bioassay of some important drugs like Digitalis, Adrenaline, Noradrenaline, acetylcholine, Histamine, 5-hydroxy tryptamine, d-tubocurarine, Heparin, antibiotics, Vitamin-D,

UNIT -IV

Bioassay of Insulin, Oxytocin, Vassopressin, Growth Hormone, FSH, LH, Prolactin, Thyrotrophin, Corticotrophin, Androgen, Progesterone, Estrogen..

PS 17E3P BIOASSAYS (LAB)

L-T-P : 0-0-4 **Credit : 2**

1. To find out the strength of the given sample of acetylcholine by comparative bioassay using rectus abdominis muscle of frog.
2. To find out the strength of the given sample of acetylcholine by interpolation bioassay using rectus

abdominis muscle of frog.
3. To find out the strength of the given sample of acetylcholine by three-point bioassay using rectus abdominis muscle of frog.
4. To find out the strength of the given sample of acetylcholine by four-point bioassay using rectus abdominis muscle of frog.
5. To find out the strength of the given sample of d-tubocurarine by graphical bioassay using rectus abdominis muscle of frog.
6. To find out the strength of the given sample of acetylcholine by four-point bioassay using guinea pig ileum.
7. To find out the strength of the given sample of histamine by four-point bioassay using guinea pig ileum.
8. To find out the strength of the given sample of oxytocin by four-point bioassay using rat uterus.
9. To find out the strength of the given sample of 5-hydroxy tryptamine by four-point bioassay using rat fundus.
10. To find out the strength of the given sample of 5-hydroxy tryptamine by comparative bioassay using rat fundus.

Recommended books:

1. Sharma, H.L.; Sharma, K.K. General Pharmacology Basic Concepts
2. Barar, F.S.K. Essentials of Pharmacotherapeutics
3. Rang, H.P.; Dale, M.M.; Ritter, J.M.; Moore, P.K. Pharmacology
4. Satoshkar, R.S.; Bhandarkar, S.D.; Ainapure, S.S. Pharmacology and Pharmacotherapeutics
5. Sharma, V.N. Essentials of Pharmacology
6. Derasari and Gandhi's Elements of Pharmacology
7. Remington's Pharmaceutical Sciences
8. Indian Pharmacopeia
9. Pillai, K.K. Experimental Pharmacology
10. Kulkarni, S.K. Hand Book of Experimental Pharmacology

PS 17E4 HOSPITAL PHARMACY ADMINISTRATION

L-T-P : 3-0-0 **Credit : 3**

UNIT -I

1. The role of hospital pharmacy department and its relationship to other hospital departments and staff.
2. Hospital drug policy - Drug Committee, formulary and guidelines, other hospital committees such as infection control committee and research & ethics committee.

UNIT -II

3. Hospital Pharmacy management - Staff (Professional and non-professional), Materials (drugs, non-drugs consumables), Financial (drug budget, cost centers), planning infrastructure requirements (building, furniture and fitting, specialized Equipment, maintenance and repairs), Work load statistics, Hospital formulary.
4. Organization of Hospital Pharmacy Services,

UNIT -III

5. Drug Distribution: Purchasing, warehousing (Storage conditions, expiry date control, recycling of drugs, stock-taking, drug recalls), Drug distribution methods (ward stock, individual patient dispensing, unit doses), specific requirements for inpatients, causality / emergency theatre, ICU/ICCU, Drugs of dependence.

UNIT -IV

6. Manufacturing: Sterile and non sterile production, including total parenteral nutrition, IV additive service, Pre-Packing and labeling Quality control.

PS 17E4P HOSPITAL PHARMACY ADMINISTRATION (LAB)
L-T-P : 0-0-4 **Credit : 2**

1. Experiments based on sterilization of various types of materials used in Hospitals.
2. Practicals designed on the use of computers in Drug information Centre,.
3. Prescription filling documentation of information of drug interaction.
4. Manufacture of LVP used in hospitals.
5. Observing Drug distribution pattern in a local hospital and writing report.
6. Any other experiments to Substantiate theory.

Recommended books:

1. Hospital Pharmacy-Hassan WE, Lec and Febiger Publication ., 1999.
2. Text book of Hospital Pharmacy-Allowood MC and Blackwell, 1980, 1st ed.
3. Avery's Drug Treatment, 4th edition, Adis international limited
4. Managing Drug Supplt-2nd Edition, Management Sciences for health, Kumarian press, 1997.

PS 17E5 ADVANCED PHARMACEUTICAL ANALYSIS
L-T-P : 3-0-0 **Credit : 3**

UNIT -I

1. Theory, instrumentation and applications of the following Instrumental Methods of Analysis.

(i) X-ray fluorescence spectrometry
(ii) X-ray diffraction
(iii) Electron spin resonance spectroscopy (ESR)
(iv) Advanced chromatographic techniques like super critical fluid chromatography, size exclusion chromatography.
(v) Differential scanning calorimetry, Differential thermal analysis and Thermal gravimetric analysis,

UNIT - II

2. Theory and procedure involved in the qualitative and quantitative analysis of pharmaceutical properties and dosage forms containing the following drugs: (Biological and microbiological method excluded).
   - NSAID - Analgesics and antipyretics (Diclofenac sodium, Ketoprofen, Oxyphenebutazone, Paracetamol, Allopurinol, Aspirin + Caffeine)
   - Barbiturates (Phenobarbitone sodium)
   - Steroids (Nandrolone, Cortisone acetate, Fludrocortisone acetate, Prednisolone, Dexamethasone)
   - Antihistaminics (Mepyramine maleate, Chlorpheniramine maleate, promethazine hydrochloride, Cyclazine hydrochloride, Astemizole)
   - Alkaloids (Codeine, Opium, Vincristine, Ergotamine and Ergometrine)

UNIT -III

3. Theory and procedure involved in the qualitative and quantitative analysis of pharmaceutical properties and dosage forms containing the following drugs: (Biological and microbiological method excluded).
   - Antibiotics (Cycloserine, Chloramphenicol, Ampicillin, Rifampicin, Cefotaxim sodium)
   - Vitamins (Riboflavin, Nicotinamide, Pyridoxine hydrochloride, Folic acid, Cyanocobalamine)
   - Cardiovascular agents (Digoxin, Isosorbide dinitrate, nifedipine, Verapamil hydrochloride, Propranolol hydrochloride, Timolol maleate, Atenolol)
   - Hypoglycaemic agents (Insulin and its different forms, Chlorpropamide, glibenclamide, Metformine)
   - Sulphonamides (Sulphadiazine, Sulphamethoxazole, Sulphacetamide)

UNIT - IV

4. Theory and procedure involved in the qualitative and quantitative analysis of pharmaceutical preparations and dosage forms using the following reagents / reactions.

(i) Diazotisation followed by coupling.
(ii) Oxidation followed by complexation.
(iii) Condensation reactions using the reagents Para Dimethyl Amino Benzaldehyde (PDAB), Folin's reagent, Gibb's reagent and para Dimethyl Amino Cinnamaldelyde (PDAC) reagent.

PS 17E5P ADVANCED PHARMACEUTICAL ANALYSIS (LAB)
L-T-P : 0-0-4 **Credit : 2**

1. Estimation of following classes of drugs using different analytical methods.
   - NSAID - Analgesics and Antipyretics.
   - Barbiturates.
   - Sulphonamides.
   - Antibiotics.
   - Steroidal hormones Vitamins
   - Alkaloids
   - Cardiovascular drugs
   - Hypoglycaemic agents
   - Antihistaminics
2. Estimation of different classes of drugs using the following reagents.
   - Feric chloride.
   - Perchloric acid.
   - 2-6 Dichlorophenol indophenol.

Recommended books:

1. Instrumental methods of analysis by Scoog and West.
2. Chemical Analysis - Modern Instrumentation methods and techniques by Wiley.
3. Instrumental methods of analysis by Willard Den & Merrit.
4. Hand book of Instrumental techniques for analytical chemistry edited by Frank Settle by Prentice Hall Inc.
5. A text book of Pharmaceutical analysis by K.A.Conners (John Wiley)
6. Spectrometric identification of organic compounds by silverstein.
7. IP. BP. & USP.