North Maharashtra University, Jalgaon.

Syllabus of

Second Year B.Pharmacy [Sem III &Sem IV]

(CGPA Pattern)

W.E.F. Academic Year 2013-14

T 2.3.1Pharmaceutics III (Physical Pharmacy-I)

(Theory) (3 Hrs/week)

Sr. No.	Topic	Hrs.
	SECTION-I	
1	**States of Matter** **A. Gases and liquid** Introduction:-Kinetic Molecular Theory. Real gases & Ideal gases, Deviation from gas theory, effects of temperature and pressure, compressibility factor; Critical phenomenon,Critical constant and their determination; van der Waal's equation and critical state, correction for pressure and volume, law of corresponding states (Equation only, no derivation), Methods for liquefaction of gases:- Faraday's method, Linde's process, and Claude's process. Aerosols:- Introduction, Definition, Advantages, Disadvantages, Applications. Application of liquefaction to aerosols i.e. principle of aerosols. Brief explanation of Propellants & their classes. (No discussion about nomenclature of Propellants). **B. Solids** Types of solids, Crystallization, Definition of Habit, Faces of crystal.X-ray crystallography: Braggs equation its derivation. Methods of crystal analysis, Bragg's method and powder method. Polymorphism: Definition, Enantiotropy and Monotropy, examples and Pharmaceutical applications of polymorphism. Detection techniques of polymorphism. **NOTE: Problems only using Bragg's equation to calculate'd' and 'n'.**	**08**
2	**Thermodynamics** Definition, Introduction, limitations. Thermodynamic terms & basic concepts: Homogeneous & Heterogeneous systems, Types of Thermodynamic systems{like Isolated, Closed & Open system}, Intensive & Extensive properties, Thermodynamic processes{like Isothermal, Adiabatic, Isobaric, Isochoric & Cyclic processes}. First law of thermodynamics: Various forms of first law & its significance, Concept of reversible & irreversible processes. Concept of Enthalpy. Introduction to exothermic & endothermic reactions. Heat of reaction, Heat of formation, Heat of combustion. Hesse's law of constant heat summation & its applications;Second law of thermodynamic and Third law of thermodynamics, Concept of Gibbs and Helmholtz free energy. Statement and introduction of Zeroth law. **NOTE: No Derivations only equations.**	**06**
3	**Diffusion and Dissolution** **A. Diffusion:** Definition, Introduction, Diffusion related phenomenon like Dialysis, Osmosis,microfiltration and ultrafiltration. Pharmaceutical applications of diffusion, terms used in diffusion {steady state, non steady state & sink condition}.Sink condition and its significance. Fick's first law of diffusion: flux, statement, mathematical equation, Applications. Fick's second law of diffusion: statement, mathematical equation.	**08**

	Diffusion cells: Various types of diffusion cells. Simple diffusion cell. Detail explanation of Horizontal & Vertical type cells. **B. Dissolution:** Definition, Introduction, Pharmaceutical applications of dissolution, Noyes and Whitney equation. Official dissolution test apparatus {Rotating basket & Paddle type only}. Powder dissolution: Hixson – Crowell cube root law and its significance.	
	Number of lectures	**22**
	SECTION II	
4	**Complexation** Definition, Introduction, Classification of complexes, Pharmaceutical and Medical applications of complexation. Methods of preparation & analysis.	**04**
5	**Solution of Non Electrolytes** Properties and types of solutions, Ideal & real solution, Escaping tendency, Raoulte's law and deviation from Roulte's law. Henry's law. Boiling point diagram, Azeotrops. Colligative properties: Lowering of vapor pressure- methods to study {like Manometric, Isopiestic, Hill and Blades apparatus, Osmometer}. Elevation of boiling point- methods to study {like Landsberger- Walker & Cottrell's method}. Depression of freezing point methods to study {like Beckman's method &Rast's camphor method}. Osmotic pressure: semipermiable membrane and osmotic pressure. Measurement of osmotic pressure {like Pfeffer's, Berkeley & Hartley's method, modern osmometer}. Brief explanation of isotonic solution, Van't Hoff & Morse equation for osmotic pressure. NOTE: Problems for determination of molecular weight based on above Colligative properties.	**08**
6	**Solution of Electrolytes** Definitions, Introduction. Electrolysis, Faraday's laws of electrolysis: First law- Statement, mathematical equation, Second law- Statement, mathematical equation, Conductance: specific and equivalent conductance, Conductometric titrations, conductance and degree of dilution, Colligative properties of solution of electrolyte, Arrhenius theory and Debye- Huckel theory.	**06**
7	**Solubility and Distribution Phenomenon** Solute, solvent and solution. General principles and types of solvent. Solubility of gases in liquids, effect of temperature, pressure, chemical reaction and salting out of gases. Solubility of liquids in liquids. Solubility of salts: solubility of slightly soluble electrolyte, solubility of weak electrolyte- influence of pH, influence of solvent, combine influence of pH and solvents, , influence of surfactants: Distribution coefficient{Nernst coefficient}. Phase rule – 1 component system.	**05**
	Number of lectures	**23**
	TOTAL NUMBER OF LECTURES	**45**

BOOKS RECOMMENDED

1. Martin, Swarbrick: Physical pharmacy
2. C.V.S. Subrahmanyam: Text Book of Physical Pharmaceutics, IInd edition, VallabhPrakashan
3. Glasstone and Lewis: Elements of physical chemistry
4. Maron and Pruton: Physical chemistry
5. Alfonso R.Gennaro, Remington:The Science and Practice of Pharmacy (Mack Publishing Co.)
6. Lachman and Liebermann: Theory and practice of Industrial Pharmacy
7. Bahl and Tuli: Physical Chemistry
8. Eugene Parrott: Pharmaceutical Technology
9. E A Rawling: Bentleys Text book of Pharmaceutics
10. Gurdeep Raj: Advanced Physical chemistry
11. P. G. Yeole: Highlights of Pharmacovigilance, Studium Press I Pvt Ltd.

P 2.3.1Pharmaceutics III (Physical Pharmacy-I)

(Practical) (3 Hrs/week)

1. Determination of density of given unknown liquid samples* (minimum two samples).
2. Determination of specific gravity of given unknown liquid samples* (minimum two samples).
3. Determination of molecular weight of given substance by Rast's camphor method* (minimum two samples).
4. **Conductometric titrations:**
   a) Determination of normality of given acid by conductometric titration*.
   b) Verification of Ostwald's dilution law*.
5. **Distribution coefficient** **
   a) Determination of partition coefficient of iodine between carbon tetrachloride and water.
   b) Determination of partition coefficient of benzoic acid between water and benzene.
6. **Diffusion** (minimum two experiments)
   a) Demonstration of diffusion cell.
   b) To perform *in vitro* diffusion study of salicylic acid using diffusion cell acrosscellophane membrane*.
   c) To perform *in vitro* diffusion study of salicylic acid using diffusion cell across dialysis membrane*.
7. **Dissolution**
   a) Demonstration of dissolution test apparatus (USP Type-I and Type-II apparatus).
8. Determination of Critical Solution Temperature (CST) of phenol-water system**.
9. Determination of solubility of given substance by gravimetric analysis**.
10. Determination of solubility of given substance by titrimetric analysis**.

*** Indicates minor experiment**
**** Indicates major experiment**

BOOKS RECOMMENDED

1. Dr. Derle D. V. - Experimental physical pharmacy
2. H. N. More and Ashok Hajare- Practical Pharmaceutics (Physical Pharmacy)
3. R. S. Gaud, G. D. Gupata- Practical Physical Pharmacy
4. Dr. U. B. Hadkar, T. N. Vasudevan, K. S. Laddha– Practical Physical pharmacy
5. Engeen Parrot– Practical Pharmaceutical Technology
6. C.V.S. Subrahmanyam, S.G. Vasantharaju –Laboratory manual of Physical Pharmacy
7. U. B. Hadkar- A Hand Book of Practical Physical Pharmacy & Physical Pharmaceutics
8. C. VijayaRaghavan- A Practical Hand Book of Physical Pharmaceutics

T2.3.2 PHARMACEUTICAL CHEMISTRY- IV (ORGANIC CHEMISTRY-II)

(Theory) (3 Hrs/ week)

Sr. no.	Topic	Hours
	SECTION-I	
1.	a) **Classes of reactions** :- Nucleophilic and Electrophilic reactions b) Concept and types of Tautomerism c) Resonance and rules for Resonance. d) Electronegativity and concept of Aromaticity. e) Theories of Acidity and Basicity.	**06**
2.	**Chemistry of Carbohydrates :-**Introduction, Classification, Mutarotation, Killiani- fischer synthesis, Ruff degradation, Epimerization, Cyclic structure of carbohydrates, Determination of Ring size of D-glucose.	**07**
3.	**Chemistry of Proteins:-**Geometry of peptide linkage, Formation of peptide bond, Determination of structure of peptides, Methods of peptide synthesis, Zwitterion ion, Isoelectric point.	**07**
4.	**Concept of Racemic mixture and methods of resolution of Racemic mixture**	**03**
	Number of lectures	**23**
	SECTION-II	
5	a) Introduction and Classification of Rearrangements. b) Molecular Rearrangement Reaction with their Mechanism and Examples given below- Benzoin condensation, Chichibabin reaction, Fries rearrangement, Benzilic acid rearrangement, Manich reaction, Reformatsky reaction, Perkins reaction, Knoevenagel reaction, Witting reaction, Lossen rearrangement, Schimidt's reaction, Hoffman's degradation reaction, Beckman rearrangement**,** Malonic ester synthesis,Cope rearrangement	**20**
6	**Chemistry of heterocyclic compounds** – Structure and numbering of the following Heterocyclic compounds – Furan, Thiophene, Pyrrole, Pyrazole, Thiazole, Imidazole, Oxazole, Iso-oxazole, Pyridine, Pyrimidine, Indole, Benzimidazole, Quinolone, Isoquinoline, Purine.	**02**
	Number of lectures	**22**
	TOTAL NUMBER OF LECTURES	**45**

P-2.3.2 PHARMACEUTICAL CHEMISTRY-IV (ORGANIC CHEMISTRY-II)

(Practical) (3Hrs/week)

1) Synthesis/preparation involving more than one step. **
a. p-Ditroaniline form acetanilide
b. Benzylic acid form Benzoin
c. Synthesis of quinoline (skraup method)

2) Separation of Binary mixtures (at least 4) **

3) Quantitative determination of organic compounds via function groups:*

- Phenolic group by bromination method
- Alcoholic group by acetylation method
- Carbonyl group by hydroxymine hydrochloric – pyridine method
- Amino group by bromination method.
- Ester group by hydrolysis method

Minimum 12 experiments should be covered
*** Indicate Minor experiments ** Indicate Major experiments**

Books Recommended:

1. Elementary practical organic chemistry – A.I Vogel Part III – quantitative organic analysis,ELBSLongmann, London
2. Practical organic chemistry by F.C. Mann and B.C. Saunders, ELBS Longmann, London
3. I.P. 1985 and 1966 Govt. of India, Ministry of Health 3rd Edition 1985, 4th Edition 1996.
4. Practical pharmaceutical chemistry vol I and II by Beckett and J.B. Stanlake, Stahlone Press ofUniversity of London.
5. Text Book of Practical organic chemistry by A.I. Vogel ELBS Longmann, London.

T2.3.3 Pharmacognosy-II

(Theory) (3 Hrs / week)

Sr. no.	Topic	Hours
	SECTION-I	
1	**Phytochemical Screening of Natural Products** a. Principles of extraction, Different methods of extraction including maceration, percolation, hot continuous extraction (Soxhlet), supercritical fluid extraction and other advanced techniques with their merits and demerits. b. Preliminary Phytochemical investigation of natural products**.**	**11**
2	**Resins** a. Introduction, Classification, Physical & Chemical properties, distribution, General extraction methodology and analysis of resins. b. Biological source, collection, preparation, chemical constituents, Identification tests, uses, adulterants and substituent of Asafoetida, Guggul, Podophyllum, capsicum, Ginger, turmeric. c. Biological source & uses of Balsam of Tolu, Balsam of Peru, Benzoin, Myrrh, Storax, Colophony, Jalap.	**7**
3	**Fibres** a. Study of Fibers Used in Pharmacy Such As Cotton, Silk, Wool, Nylon, Glass-Wool, Polyester and Asbestos.	**3**
	Number of Lecture	**21**
	SECTION II	
4	**Tannins** a. Definition, classification, chemistry, methods of extraction and analysis of tannins. b. Biological source, collection, preparation, chemical constituents, Identification tests, uses, adulterants and substituent of Pale Catechu, Black Catechu, Gall and Myrobalan, Bahera, Arjuna, Ashoka, Pterocarpus**.**	**8**
5	**Volatile Oils** a. Introduction, Classification, Physical & Chemical properties, occurrence/distribution, General extraction methodology and analysis of volatile oil. b. Pharmacognosy of Fennel, coriander, cassia, clove, Cinnamon c. Biological source, collection, chemical constituents, Identification tests, uses, adulterants and substituent of Dill, Caraway, Ajowan, Cardamom, Nutmeg, Eucalyptus oil, Lemon grass oil, Oil of Citronella, Orange peel oil, Mentha oil, Lavender, Musk, Palmrosa, Vaj, Jatamansi	**14**
6	**Pharmaceutical aids** a. Study of pharmaceutical aids like Talc, Diatomite, Kaolin,Bentonite, Gelatin	**2**
	Number of lecture	**24**
	TOTAL NUMBER OF LECTURES	**45**

P2.3.3. Pharmacognosy - II

(Practical) (3Hrs / week)

1. Demonstration of percolation and continuous extraction technology (Soxhlet apparatus).
2. Chemical test of resinous crude drugs*.
3. Study of morphology*, histology and micro chemical test** of Fennel, coriander, cinnamon, Clove, Eucalyptus, Ginger
4. Extraction of volatile oil**
5. Extraction of Capsicum oleo resin and Ginger oleo resin**
6. Identification of phytoconstituents by General chemical tests* for alkaloids, glycosides, steroids, flavonoids and tannins
7. Study of fibers by chemical test.*
8. Extraction and Estimation of total tannins. **

***Indicates Minor experiments**
**** Indicates Major experiments**

Books Recommended

1. Horborn J. B. Phytochemical methods, Chapman and Hall, International Edition, London.
2. Kokate C. K. Purohit A. P. and Gokhale S. B. , Pharmacognosy (degree) NiraliPrakashan
3. Kokate C. K. Practical Pharmacognosy, VallabhPrakashan, Delhi.
4. Brain K. R. and Turner T. D., The practical Evaluation of phytopharmaceuticals, Wright-Scientechnica, Bristil.
5. Guenther, E, Me, Essential oils-4 D Van Nostrand CO Inc, New York.
6. PulokMukharji, Quality control of Herbal drugs.
7. Medicinal Plants of India, Indian Council of Medical Research, New Delhi.
8. Pharmacopoeia of India, 1985, 1996, Govt. of India, Ministry of Health and Family Welfare.
9. Iyengar M.A., Study of Crude Drugs, Manipal Power Press, Manipal.
10. IyengarM.A. ,Pharmacognosy Lab Manual. Manipal Power Press, Manipal.
11. The Wealth of India, Raw Marerials (All Volumes), Council of Scientific and Industrial Research, New Delhi.
12. Trease, G.E. and Evans, W.C. Pharmacognosy, 12th Edition, BailliereTindall, Eastbourne, U.K.
13. Wallis, T.E. Analytical Microscopy, J.A. Churchill Limited, London.
14. Wallis, T.E. Textbook of Pharmacognosy, J.A. Churchill Limited, London.
15. Tyler, V.E., Brady, R., Pharmacognosy
16. V.D.Rangari, Pharmacognosy and Phytochemistry Volume I & II.
17. Pharmacognosy, Phytochemistry, Medicinal Plants 2nd Edn. – Jean Bruneton

18. Quality Control Methods for Medicinal Plants – WHO, AITBS Publication.
19. Martindale, the extra pharmacopoeia, pharmaceutical society of great Britain London.
20. Official Methods of Analysis, Association of Official Analytical Chemists publication, Washington.
21. Pharmacopoeia Of India, 1985, 1996, Govt. Of India, Ministry Of Health and Family Welfare.
22. Terpenoids in Plants by Pridham J. B., Academic Press, New York
23. Pharmacognosy by Ansari
24. Experimental Phytopharmacognosy –A Comprehensive Guide By SS Khadabdi, DeoreSl, and BA Baviskar, NiraliPrakashan, Pune.
25. Standardization Of Botanicals- Testing & Extraction Methods Of Medicinal Herbs By V. Rajpal, Eastern Publisher, New Delhi

T2.3.4 PHARMACEUTICAL ANALYSIS-I

(Theory) (3 Hrs/ week)

Sr. no.	Topic	Hours
	SECTION-I	
1	**Data handling in analytical chemistry:** Types of errors, Experimental errors, significant figures, arithmetic operations and errors, propagation of errors, statistical treatment of analytical measurements: random errors, confidence limits, precision and accuracy, tests of significance of differences, detections limits, sampling. Significance of quantitative analysis in quality control, different techniques of analysis, preliminaries and definitions, Selection of sample, Fundamentals of volumetric analysis, methods of expressing concentrations, primary and secondary standards.Stoichiometric Calculations	**04**
2	**Applications of Microsoft Excel in pharmaceutical Analysis**	**02**
3	**Aqueous Acid-Base titrations:** • Law of mass action, hydrolysis of salts, neutralization curves, • Theory of indicators, choice of indicators, mixed indicator. • Applications in assay of Benzoic acid, Boric acid, Aspirin.	**05**
4	**Non-Aqueous titrations:** • Types of solvents, end point detection, • Application in assay of Sodium acetate, Sodium benzoate, Norfloxacin tablet.	**04**
5	**Oxidation-Reduction titrations:** • Theory of redox titration, measurement of electrode potential. • Oxidation-reduction curves, redox Indicators. • Titrations involving potassium permanganate, potassium dichromate, potassium bromate, potassium iodate, cerium (IV) sulfate, Iodine (Iodimetry and Iodometry), titanous chloride. • Applications in assay of Ferrous sulfate, Ascorbic acid, Isoniazide, Hydrogen peroxide.	**08**
	Number of lectures	**23**
	SECTION-II	
6	**Argentometric titrations:** • Theory, factors affecting solubility of a precipitate, titration methods- • Mohr's, Volhard's, Gay lussac, and Fajan's method, indicators. • Applications in assay of Potassium chloride, Sodium chloride and Ammonium chloride.	**04**
7	**Complexometric Reactions and Titrations:** • Theory, formation of complex and its stability, titration curves • Concepts in equilibria and formation constants (kf) of metal ion-ligand complexes and distribution of complex ion species in solution • Metallochrome indicators (no structures), types of EDTA titrations • Application in assay of Magnesium sulfate,Lead nitrate and calcium gluconate • Use of complexation as an titrimetric analytical tool	**06**

8	**Gravimetric analysis:** • Precipitation techniques, solubility products, colloidal state, supersaturation, coprecipitation, post precipitation, digestion, filtration, ignition, weighing and calculation. • Application in assay of Alum by oximereagent, Calcium as calcium oxalate andmagnesium as magnesium pyrophosphate.	**06**
9	**Miscellaneous methods of analysis:** • Diazotization titrations, • Kjeldahl's method of nitrogen determination • Oxygen flask combustion method.	**06**
	Number of lectures	**22**
	TOTAL NUMBER OF LECTURES	**45**

Books Recommended:

1. IP, USP, BP, European Pharmacopoeia, International pharmacopoeia
2. Pharmaceutical analysis-Higuchi and brochmann
3. Practical Pharmaceutical Chemistry Part-II – Beckett &Stenlake
4. The quantitative analysis of drugs- Garrat
5. Analytical chemistry- MEITES H.B.
6. Analytical chemistry- Garry Chrisian
7. Principles of instrumental analysis- Skoog
8. Vogel textbook of quantitative chemical analysis
9. Instrumental methods of analysis- Willard, Dean
10. Instrumental methods of analysis-Ewing.
11. Textbook of Pharmaceutical analysis- K.A. Connors
12. Instrumental methods of analysis- ChatwalandAnand

P2.3.4 PHARMACEUTICAL ANALYSIS-I

(Practical) (3 Hrs/ week)

Sr. No.	Experiments
	Instructions:-The students should have a clear understanding of the principle and working ofa typical analytical balance, the precautions to be taken during handling of analyticalbalance, methods of weighing and errors of weighing. The students should also beacquainted with use of appropriate apparatus for various analytical procedures.
1.	Calibration of analytical weights and of volumetric apparatus like volumetric flask , pipetteburette etc.*
2.	**Acid Base Titrations**: Preparation and standardization of acids (HCl, H2SO4) Bases (NaOH). Assays involving Direct and Back titrations. Benzoic acid, Boric acid, Aspirin**
3.	**Non –aqueous Titrations**: Preparation and standardization of perchloric acid and sodium/ potassium/ lithium methoxide solutions* Assays of amines or amine hydrochlorides, sodium acetate, Norfloxacin tablet**
4.	**Oxidation – reduction Titrations**: Preparation and standardization of redox titrants such as potassium permanganate, Ceric ammonium sulphate , potassium dichromate , iodine , sodium thiosulfate etc.* Assays of oxalic acis/ hydrogen peroxide, Ferrous ammonium gluconate, Ascorbic acid/Analgin **
6.	**Complexometric Titrations**: Preparation and standardization of EDTA solution.* Assay of magnesium sulfate, lead nitrate, calcium gluconate, Hardness of water**
7.	**Precipitation Titration**: Preparation and standardization of titrants like Silver nitrate, Ammonium thiocyanate.* Assay of Sodium chloride, Potassium chloride, Ammonium chloride**
8.	**Gravimetric Analysis**: Determination of Alum by Oxime reagent, Sulphate as Barium sulphate/ Ni as Ni DMG complex**
9.	**Miscellaneous methods** : Nitrogen determination by Kjeldahl method** Sodium nitrite titration. (Demonstration)

***Indicate Minor experiments ** Indicate Major experiments**

Books Recommended:

1. IP, USP,BP, European Pharmacopoeia, International pharmacopoeia
2. Pharmaceutical analysis-Higuchi and brochmann
3. The quantitative analysis of drugs- Garrat
4. Analytical chemistry- MEITES H.B.
5. Analytical chemistry- Garry Chrisian
6. Principles of instrumental analysis- Skoog
7. Vogel textbook of quantitative chemical analysis
8. Textbook of Pharmaceutical analysis- K.A. Connors
9. Guide for safety in chemical laboratory- Van Nostrand Reinhold co.
10. Practical Pharmaceutical Chemistry Part-I - Beckett and Stenlake

T2.3.5 A. P. H. E. -II

(Theory) (3 Hrs/ week)

Sr. no.	Topic	Hours
	SECTION-I	
1.	**Cardio vascular system** a) Anatomy of heart a) Blood vessels and circulation b) Pulmonary, coronary & systemic circulation c) Conduction and ECG d) Cardiac cycle and Heart Sounds f) Blood Pressure, maintenance and regulation	**08**
2.	**Urinary System** a) Parts of the Urinary System and Gross structure of the kidney b) Structure of Nephron c) Physiology of Urine Formation and Micturition d) Renin Angiotensin System – Juxtra- Glomerular apparatus e) Maintenance of Acid-Base balance	**07**
3.	**Fluid & electrolyte balance**	**03**
4.	**First Aid :** Emergency treatment of shock, snake bite, burns, poisoning, fractures and resuscitation methods	**02**
5.	**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).	**03**
	Number of Lectures	**22**
	SECTION-II	
6.	**Respiratory System** **a)**Anatomy of respiratory organs and functions b) Mechanism and regulation of respiration c) Physiology of respiration: Transport of respiratory gases d) Respiratory volumes and vital capacity e) Neural and chemical regulation of respiration O_2 and CO_2 carriage and hypoxia f) Definitions of Hypoxia, Asphyxia, Dysbarism, Oxygen Therapy and resuscitation	**08**
7.	**Digestive System** a) Anatomy of Gastro intestinal Tract (GIT) b) Anatomy, Secretions and functions of-Salivary glands, Stomach, Liver, Pancreas, Intestine c) Digestion and absorption	**07**
8.	**Reproductive system** a) Male and female reproductive systems b) Their hormones- Physiological role c) Physiology of menstruation, ovarian cycle d) Spermatogenesis e) Sex determination (genetic basis) f) Pregnancy and its maintenance and parturition g) Contraception and Contraceptive devices	**07**
	Number of Lectures	**23**
	TOTAL NUMBER OF LECTURES	**45**

Books Recommended:

1. Guyton & Hall. Textbook of medical physiology, Elsevier.New Delhi, 2000 10th edition.
2. Vander, Sherman, Luciano. Human Physiology.Mc-Graw Hill Publication New Delhi 1998, 7th edition.
3. Tortora G.J. Principles of anatomy & physiology. Harper Collins College Publishers, New York 1996 8thedition.
4. Chatterjee C.C. Human Physiology.Medical allied agency.Kolkata 2003 11th Edition.
5. Ross and Wilson. Anatomy and Physiology in health and illness. Churchill Livingstone 2001.9th edition.
6. AB Mc Naught and Callander R., " Illustrated Physiology", B.I. Churchill Living Stone, NewDelhi, 987.1st edition.
7. ChaudhrySujit K., "Consise Medical Physiology", New Cenrtal Book Agency, Calcutta, 1993.2nd edition
8. Douglas E., Kelly, Richard Wood and Allen C. Enders, " Bailey`s TextBook of Microscopic Anatomy", Williams and Wilkins publishers, London, 1984. 18th Edition
9. Elaine N. Marieb, "Human Anatomy and Physiology", Addison Wesley, New York, 1997 4th edition.
10. Inderbir Singh, " Text Book of Human Histology with Colour Atlas, Jaypee Brothers, New Delhi, , 2002. 4th edition.
11. Park J.E. and Park K., "Preventive and Social Medicine", BanarasidasBhanot, India, 1991. 13th edition

P 2.3.5 A. P. H. E. -II

(Practical) (3 Hrs/week)

1) Study of various systems using Charts/ Models#

   Cardio vascular system

   Urinary System

   Respiratory System

   Digestive System

2) Simple experiments involved in the analysis of normal and abnormal urine: Collection of specimen, appearance, determination of PH, protein, urea and creatinine,bilesalts,bile pigments, ketone bodies**

3) Estimation of i) SGPT ii) SGOT from blood sample

3) Physiological experiments on nerve muscle preparation

4) Determination of vital capacity, experiments on spirometry*

#-Experiments for preliminary knowledge and may be examined in form of identification/spotting

*** Indicate Minor Experiment ** Indicate Major Experiment**

Books Recommended-

1. Ranade V.G., Pradhan S, Joshi P.N. Text Book of Practical Physiology. Pune VidyarthiGrihaPrakashan, Pune, 1997

2. Mukherjee K.L. Medical Laboratory Technology.Tata McGraw Hill. New Delhi, 1999 4th edition (Vol.I,II,III)

T2.3.6PATHOPHYSIOLOGY OF COMMON DISEASES-I

(Theory) (3 Hrs/ week)

Sr. no.	Topic	Hours
	SECTION-I	
1	Basic Principles of cell injury and adaptation, causes, pathogenesis and morphology. Mechanism of wound healing, factors influencing healing of wounds.	**03**
2	**Inflammation.** A) Acute inflammation, Chemical mediators in inflammation. B) Chronic inflammation.	**03**
3	**Immunity –** Transplantation and immunological tolerance, allograft reactions, transplantation antigens, mechanism of rejection of allograft. Autoimmunity I) Criteria for autoimmunity II) Classifications of autoimmune diseases in man, mechanism of autoimmunity.	**04**
4	**Hypersensitivity** I) Hypersensitivity type I,II,III,IV II) Biological significance of hypersensitivity. III) Allergy due to food, chemicals and Drugs.	**04**
5	**Pain** Pain syndromes- Headache; assessment, structures involved in headache and head pain. Types of headaches- migraine, cluster headache, muscle contraction, (tension headaches) , headaches affecting elderly Joint pain: - Degenerative joint diseases- osteoarthritis, - types, causes and abnormalities assessment. Rheumatoid arthritis- causes abnormalities, course and prognosis, assessment, subjective, objective management. Gout-cause abnormalities, chronic changes, tophaceous gout- asymptomatic hyperuricemia, chronic gout, maintenance.	**05**
6	**Types of Acid-Base derangements-** Deficiency of water and solute balance, Pathogenesis, causes and management, Buffers;Different buffer systems in the body, Dehydration, Hypernatremia, Hyperosmolar state, Excess fluid and electrolyte (Na), Hypervolemia, Hyperkalemia, Hypokalemia, Respiratory acidosis, Respiratory alkalosis, Metabolic acidosis, Metabolic alkalosis.	**03**
	Number of Lectures	**22**
	SECTION-II	
7	**Central Nervous System:** Seizure and epilepsy, neural basis of epilepsy, types of epilepsy, Ischemia infarction (stroke) and intracranial hemorrhage, anoxia, brain death. Alzheimer's disease, Dementias, Parkinsonism, Schizophrenia, Depression and Mania	**05**

8	IV) Nutrition- adequate diet. Malabsorption syndrome, intestinal and pancreatic malabsorption, abnormal bacterial flora, steatorrhea. Protein calorie malnutrition vitamins, obesity, pathogenesis of starvation	**06**
9	**Disorders of gastrointestinal tract(GIT):** Disorders of esophagus: - Achalasia, gastro-esophageal reflux and reflux oesophagitis, causes consequences and management. Disorder of stomach, small intestine and large intestine - Peptic ulcer disease-acute ulcer, chronic peptic ulcer, tuberculosis of intestine, Acute intestinal obstruction. Constipation, diarrhea, Hirschsprung's disease(General disorders of GIT e. g. vomiting Nausea, Flatus etc should also be covered) Ulcerative colitis, Crohn's disease	**06**
10	**Disorders of liver**- Infectious hepatitis, types of hepatitis, liver changes in viral hepatitis, assessment-course and complications. Alcoholic liver diseases – fatty liver, Alcoholic hepatitis, cirrhosis. Laennec's cirrhosis, Portal hypertension, hepatic encephalopathy. II) Disorders of the gall bladder and bile ducts- Gall stone formation-types of gall stones assessments and management. Acute cholecystitis –causes and pathological changes. III) Disorders of exocrine pancreas- pancreatitis acute and chronic– types, causes, abnormalities, assessment and management.	**05**
11	**Biological effects of radiation :**Radioactive elements used in pharmaceuticals	**01**
	Number of Lectures	**23**
	TOTAL NUMBER OF LECTURES	**45**

Books Recommended:

1) Robbins Pathologic. Basis of Disease Harcourt Asia Pte.ltd. New Delhi 2000 6th edition

2) Harsh Mohan. Textbook of Pathology Jaypee New Delhi 2002, 4th edition

3) Davidson′s Principles and Practice of Medicine. Churchill Livingstone, London1999, 18th edition

4) Harrison's. Principle of Internal Medicine.Mc–GrawHill . New Delhi, 2005.16th edition (Vol.I,II)

T 2.4.1 Pharmaceutics IV (Physical Pharmacy II)

(Theory) (3 Hrs/week)

Sr. No.	Topic	Hrs.
	SECTION I	
1	**Chemical Kinetics:** Introduction, Definition, Applications, Rate , order, and molecularly of reaction, mathematical treatment of Zero order reaction, First order , Second order reaction, Half-life& shelf life of reaction. Complex reaction {consecutive, parallel, reversible reactions}. Determination of order of reaction {graphical, substitution &half-life method} ; energy of activation: effect oftemperature, Arrhenius equation and shelf life determination, collision theory, and transition state theory. **Catalysis**:-Definition, types, characteristics, promoters, catalytic poisoning & autocatalysis. **Accelerated stability studies:-** Introduction, objective, Garrett& Carper method, Free & Blythe method, limitations. **NOTE: - Problems for determination of rate constant, half-life& shelf life on zero, first & second order reactions.**	**08**
2	**Interfacial phenomenon:** Introduction, Surface tension & surface free energy; Young Laplace equation; measurement of surface tension and interfacial tension- capillary rise method, Du Nouy ring method, drop method {like drop number & drop weight method}, spreading of liquids; adsorption at liquid interfaces: study of surfactants including like wetting and antifoaming agent; HLB determination and importance with respect to suspension & emulsion, electrical properties of interfaces: Electrical double layer, Nernst and zeta potential.	**06**
3	**Rheology:-** Introduction, Definition, Applications, concept of viscosity, Newton's law of flow, Kinematic, Relative, Specific, Reduced & Intrinsic viscosity. Newtonian system, Non- Newtonian system- Plastic flow, Pseudoplastic flow, Dilatent flow. Thixotropy, Brief explanation of Bulges & Spurs, rheopexy, measurement of thixotropy and its applications, Negative thixotropy. Viscosity Measurements- selection of viscometer for Newtonian and non-Newtonian system {like Capillary, Falling sphere, Cup & bob, Cone & plate viscometer. Viscoelasticity.	**07**
	Number of lectures	**21**
	SECTION II	
4	**Colloids:** Introduction, Definition, shape and size of colloidal particles, pharmaceutical applications of colloids, Classification of colloids and their method of preparation in brief. **Optical properties**- Faraday Tyndall effect, light scattering and electron microscopy; turbidity. **Kinetic properties**- Brownian motion, diffusion, osmotic pressure, viscosity & sedimentation. **Electric properties-** Basic concepts {like electric double layer, Nernst & Zeta potential} Electrokinetic Phenomenon- Electrophoresis, electro osmosis, Donnan membrane equilibrium and its application. Stability of colloidal system: DLVO theory, Schulz Hardy rule, coacervation,; sensitization and protective	**03** **04**

	colloids, gold number,solubilization of colloids: include factors affecting it ; Kraft point and Cloud point. NOTE:- Problems for determination of Molecular Wt. of colloids based on diffusion, viscosity & sedimentation.	**02**
5	**Coarse Dispersions:-** **A. Suspensions:** Interfacial properties of suspended particles, theory of sedimentation, sedimentation of flocculated particles, sedimentation parameters, formulation of suspensions, structured vehicles, rheological consideration, physical stability of suspension **B. Emulsions:-**Types, applications, theories of emulsification, Physical stability of emulsions, Evaluation of stability, Preservation of emulsion, rheologic properties of emulsion, microemulsions.	**08**
6	**Micromeritics:** Definition, Applications of micromeritics in Pharmacy, Introduction to fundamental & derived properties, Fundamental properties:- Particle size and size distribution, number & weight distribution Methods to determine particle size - method, practical consideration, applications advantages & disadvantages of Optical microscopy, Sieving, Sedimentation, Coulter counter. Methods to determine Surface area {like Adsorption & air permeability method}, pore size, derived properties, porosity and packing density and bulkiness, flow properties, compaction.	**07**
	Number of lectures	**24**
	TOTAL NUMBER OF LECTURES	**45**

BOOKS RECOMMENDED

1. Martin, Swarbrick: Physical pharmacy
2. C.V.S. Subrahmanyam: Text Book of Physical Pharmaceutics, IInd edition, VallabhPrakashan
3. Glasstone and Lewis: Elements of physical chemistry
4. Maron and Pruton: Physical chemistry
5. Alfonso R. Gennaro, Remington:The Science and Practice of Pharmacy (Mack PublishingCo.)
6. Lachman and Liebermann: Theory and practice of Industrial Pharmacy
7. Bahl and Tuli: Physical Chemistry
8. Eugene Parrott: Pharmaceutical Technology
9. E A Rawling: Bentleys Text book of Pharmaceutics
10. Gurdeep Raj: Advanced Physical chemistry

P 2.4.1 Pharmaceutics- IV (Physical Pharmacy- II)

(Practical) (3 Hrs/week)

1. Determination of velocity constant of Methyl acetate **
2. Determination of surface tension of given liquid*
3. Determination of critical micelle concentration of surfactant with stalagmometer**
4. Determination of Viscosity and relative viscosity of liquids*
5. Determination of HLB of glycerylmonosterate*
6. Determination of specific surface area of charcoal by adsorption method**
7. Determination of composition of sucrose solution by viscosity method**
8. Determination of viscosity by Brookfield viscometer (One semisolid formulation) **
9. Determination of particle size distribution of any material by**
   a) Sieve analysis
   b) Microscopy
10. To prepare and evaluate suspension **
11. To determine the derived properties of powders*
12. To study the thixotropic behavior of calamine lotion I. P. by Brookfield Viscometer**

*** Indicate minor experiments ** Indicate Major experiments**

Books Recommended-

1. Dr. Derle D. V. - Experimental physical pharmacy
2. H. N. More and Ashok Hajare- Practical Pharmaceutics (Physical Pharmacy)
3. R. S. Gaud, G. D. Gupata- Practical Physical Pharmacy
4. Dr. U. B. Hadkar, T. N. Vasudevan, K. S. Laddha– Practical Physical pharmacy
5. Engeen Parrot– Practical Pharmaceutical Technology
6. C.V.S. Subrahmanyam, S.G. Vasantharaju –Laboratory manual of Physical Pharmacy
7. U. B. Hadkar- A Hand Book of Practical Physical Pharmacy & Physical Pharmaceutics
8. C. VijayaRaghavan- A Practical Hand Book of Physical Pharmaceutics

T.2.4.2 Pharmaceutical Microbiology

(Theory) (3 Hrs/week)

Sr.No.	TOPICS	Hrs.
	SECTION I	
1.	**Brief History of Microbiology:** Scope & Applications in Pharmaceutical Sciences	**02**
2.	**Microscopy:** Simple Microscope, Compound Microscope & Electron Microscope. Resolving Power, Numerical Aperture, Magnification & Oil immersion Lens.	**04**
3.	**Structure Of Bactria:** Size, Shape, Bacterial cell wall, Plasma Membrane, Capsule, Spore, Pili, Flagella, Nucleoid, Plasmid.	**05**
4.	**Viruses:** Characteristics of Viruses& Reproduction of Viruses.(Lytic & Lysogenic Cycle),Cultivation of viruses.	**05**
5.	**Control of Microbes:** Different techniques of Sterilization-Dry heat sterilization, Moist heat sterilization, Filtration, Radiation sterilization. Disinfection , properties & application of Disinfectant.	**06**
	Number of Lectures	**22**
	SECTION II	
6.	**Immunology:** Concept of immunity, Types of immunity, Antigen, Antibody (Immunoglobulin) & its Types.	**05**
7.	**Immunology &DefenseMechanism:** Monoclonal Antibody, Autoimmunity, Complement Pathway.	**05**
8.	**Microbial Pharmaceuticals:** Vaccine, Types of vaccine, Large scale production of antibiotic (Seed Lot System of vaccine & toxoid), Edible vaccine, DNA vaccine, Applications of vaccine.	**05**
9.	**Pharmaceutical Microbiology:** Sterility test, Antibiotic Assay, Microbial Limit test, Pyrogentesting, Preservative Efficacy test, Carcinogenic test.	**04**
10.	**Industrial Microbiology:** Culture, Types of Culture, Preservation techniques of culture, Uses of Culture, Lyophilization.	**04**
	Number of Lectures	**23**
	TOTAL NUMBER OF LECTURES	**45**

Books Recommended:

1. Pleazar,Chan And Krig.-Microbiology
2. Frobisher.-Fundamentals of Microbiology
3. Stephan P. Denyer,N.A.Hodges,S.P. Gormao.-Hugo and Rusells Pharmaceutical Microbiology
4. Cooper and Gun..- Tutorial Pharmacy
5. ChandrakantKokare.-Pharmaceutical Microbiology
6. J.L.Ingraham,C.A.Ingraham,.-Introduction to Microbiology
7. Torrontam.-Foundation in Microbiology
8. J.C.Black-Microbiology Principles and Examinations,John Wiley and sons
9. Pathak and Palan-Immunology
10. Casedo-Industrial Pharmacy
11. Hugo and Russel –Pharmaceutical Microbiology

P-2.4.2 Pharmaceutical Microbiology

(Practical) (3 Hrs/week)

1.	Study of Compound Microscope*
2.	**Study of Lab Apparatus**: Autoclave ,Hot air oven,Incubator, pH Meter,Antibiotic zone reader,Colony counter,Refrigerator.*
3.	**Media Preparation**-* (Nutrient Agar, Macconkeys Agar)
4.	Air Micro Flora*
5.	Sterility Test*
6.	Streak Plate Method*
7.	Pour Plate Method*
8.	Spread Plate Method*
9.	Monochrome Staining**
10.	Grams Staining**
11.	Negative Staining**
12.	Microbial Assay of Penicillin. (Diffusion Assay)**
13.	Kirby Bauer antibiotic sensitivity test**
14.	Study of Oligodynamic Action**
15.	Study of Permanent Slides of Yeast ,Aspergillus,&Penicillium protozoa*
16.	Preparation of Bacterial Culture on Nutrient Agar Slant*

*** Indicate minor experiments ** Indicate Major experiments**

Books Recommended:

1. Cappuccino and Sherman –Microbiology of Laboratory manual, Pearson Education

2. Indian Pharnacopoeia-1996

T 2.4.3 Pharmacognosy – III

(Theory) (3 Hrs / week)

Sr.No.	TOPICS	Hrs.
	SECTION I	
1	**Glycoside** • Introduction, Classification, Physical & Chemical properties, Distribution, General extraction methodology of Glycoside. • Biological source, diagnostic features, morphology, chemical constituents, chemical tests, uses, adulterants and substituent of the following: **1.** Saponins:Liquorice*, Ginseng, Dioscorea*, Sarsaparilla, Solanum and Brahmi*. **2.** Cardio active Sterols: Digitalis*, Squill, Strophanthus and Thevetia **3.** Anthraquinone cathartics: Aloe*, Senna*, Rhubarb and Cascara **4.** Others:Psoralea, Ammimajus, Ammivisnaga, bitter almond, Gentian, Andrographis*, Saffron, Chirata ,picrorrhiza and Quassia. ***Detail Pharmacognostic study**	**13**
2	**Marine Pharmacognosy: N**ovel medicinal agents from marine sources.	**3**
3	**Natural allergens and plant toxins.**	**3**
4	**Natural pesticide & insecticides** – Introduction to herbicide, fungicides, fumigants and rodenticides- Neem, Tobacco, Pyrethrum	**3**
	Number of Lectures	**22**
	SECTION II	
5	**Study of Traditional Drugs** Common & Vernacular Names, Botanical Sources, Morphology, Chemical Nature of Chief Constituents, Common Uses and Marketed Formulations of Following Indigenous Drugs: Amla, Kantkari, Shatavari, Tylophora, Bhilawa, Bach, Punamava, Chitrack, Apamarg, Gokhru, Shankhapushpi, Adulsa, Tinospora, Methi, Lahsun, Palash, Guggal, Gymnema, Shilajit, Nagarmotha and Neem.	**10**
6	**Complementary and Alternative Medicine** • Indian Traditional Systems of Medicine: Introduction, Principle, Preparations and Standardization of Ayurvedic Medicine Ex: Asavas, Arishtas, Tailas, Churna and Bhasmas. • Introduction and Principle of Unani, Siddha, Homeopathy and Aromatherapy	**10**
7	**Chemotaxonomy of Medicinal Plants** • Introduction and significance of chemotaxonomy with special reference to flavonoids and terpenoids.	**03**
	Number of Lectures	**23**
	TOTAL NUMBER OF LECTURES	**45**

P 2.4.3. Pharmacognosy – III

(Practical) (3 Hrs / week)

1. Identification of traditional crude drugs by morphology* (Minimum Eight drugs listed in theory).
2. Study of morphology*, microscopical** and powder * characteristics of some important glycoside containing crude drugs (Minimum six drugs listed in theory).
3. Standardization of Asava and arishtaayurvedic traditional formulations (Physical *& chemical parameters**)
4. Preparation and standardization of churna*
5. Preparation and standardization of Taila**
6. Estimation of total saponin from liquorice or Gokhru**

***Minor experiments**

****Major experiments**

Books Recommended

1. Horborn J. B. Phytochemical methods, Chapman and Hall, International Edition, London.
2. Kokate C. K. Purohit A. P. and Gokhale S. B. , Pharmacognosy (degree) NiraliPrakashan
3. Kokate C. K. Practical Pharmacognosy, VallabhPrakashan, Delhi.
4. Brain K. R. and Turner T. D., The practical Evaluation of phytopharmaceuticals, Wright-Scientechnica, Bristil.
5. PulokMukharji, Quality control of Herbal drugs.
6. Medicinal Plants of India, Indian Council of Medical Research, New Delhi.
7. Nadkarni A. K. Indian Materia Medica, 1-2, Popular Prakashan Pvt. Ltd.Bombay.
8. Pharmacopoeia of India, 1985,1996, Govt. of India, Ministry of Health and Family Welfare.
9. Iyengar M.A., Study of Crude Drugs, Manipal Power Press, Manipal.
10. IyengarM.A. ,Pharmacognosy Lab Manual. Manipal Power Press, Manipal.
11. The Wealth of India, Raw Marerials (All Volumes), Council of Scientific and Industrial Research, New Delhi.
12. Trease, G.E. and Evans, W.C. Pharmacognosy, 12th Edition, BailliereTindall, Eastbourne, U.K.
13. Wallis, T.E. Analytical Microscopy, J.A. Churchill Limited, London.
14. Wallis, T.E. Textbook of Pharmacognosy, J.A. Churchill Limited, London.
15. Tyler, V.E., Brady, R., Pharmacognosy
16. V.D.Rangari, Pharmacognosy and Phytochemistry Volume I & II.
17. Herbal Pharmacopoeia, IDMA, Mumbai
18. A.N. Kalia, A textbook of Industrial Pharmacognosy, CBS Publishers and Distributors
19. Herbal drugs industry by R.D. Chaudari.
20. Pharmacognosy, Phytochemistry, Medicinal Plants 2nd Edn. – Jean Bruneton
21. Quality Control Methods for Medicinal Plants – WHO, AITBS Publication.
22. Ayurvedic Formulary of India, Govt. of India, New Delhi
23. Ayurvedic Pharmacopoeia of India, All Volumes
24. Pharmacopoeial standard of Ayurvedic Formulation, Minister of Health welfare ,Govt. of India, New Delhi
25. Indian Herbal Pharmacopoeia

26. Chopra R. N., Nayar S. L. and Chopra I. C., Glossary of Indian Medicinal plants CS I R, New Delhi.
27. Gibbs R Darnely, Chemotaxanomy of Flowering Plants 4 volumes, McGill, University Press.
28. Martindale, the extra pharmacopoeia, pharmaceutical society of great Britain London.
29. Kokate C. K. Practical Pharmacognosy, VallabhPrakashan, Delhi.
30. Marine Natural Products Chemistry by Faulkner D. J. and Fenical W. H., Plenum Press, New York.
31. Official Methods of Analysis, Association of Official Analytical Chemists publication,Washington.
32. Peach K, and Tracey M. V., Modern methods of plant analysis, 1-4, Narosa Publishing house, New Delhi
33. Experimental Phytopharmacognosy –A Comprehensive Guide By SS Khadabdi, DeoreSl, and BA Baviskar, NiraliPrakashan, Pune.
34. Standardization Of Botanicals- Testing & Extraction Methods Of Medicinal Herbs By V. Rajpal, Eastern Publisher, New Delhi

T.2.4.4. Pharmaceutics-V (Hospital Pharmacy)

(Theory) (3 Hrs/week)

Sr.No.	TOPICS	Hrs.
	SECTION I	
1.	**Hospital - its Organization and functions** Definition, Classification based on various criteria (Types of hospitals), functions, Status of health delivery systems in India. Role of hospitals in the health delivery systems.	**03**
2	**Hospital Pharmacy- Organization, administration governing body and Management** History and Development, Definition, functions and objectives of hospital pharmacy, Location, Layout & flow chart of material and men, personnel and facilities required, including equipments. Requirements and abilities required for Hospital pharmacists. Medical staff, Infrastructure & work load statistics, clinical departments, support service, dietetic service, nursing service, medical records department, pathology service, Blood bank.	**06**
3	**Drug Distribution system in Hospital (In-patient services& Out-patient services)** Types of services i) Individual prescription method ii) Floor stock method iii) Unit dose drug distribution method iv) Satellite pharmacy services, central sterile services, Bed side pharmacy, Prepackaging	**02**
4	**Hospital drug policy** a) Hospital committees - Infection committee - Research and ethical committee b) developing therapeutic guidelines c) Hospital pharmacy communication – Newsletter	**02**
5	**Pharmacy and Therapeutic Committee** Purpose of committee, committee name, membership, frequency of meeting, the committee agenda, functions of the committee, Generic vs. brand named drugs, Evaluation of drugs, Recommended reference materials, committees role in the adverse drug reaction program, Drug experience reporting, Automatic stop order for dangerous drugs, committees role in developing emergency drug list.	**05**
6	**Hospital Formulary** Format and appearance of the formulary, distribution of the formulary, keeping the formulary current, use of non-formulary drugs, (PPI),the legal basis of the formulary system, Anti substitution laws and the formulary, preparation of the formulary, formulary vs. Drug catalogue or list, selection of guiding for admission or deletion of drug , contains, prescription writing, format, size, loose –leaf vs. bound, publication, formulary drug listing service formulary drug listing service preparation, categorizing and indexing, sample pharmacologic index, text, specialty formularies.	**05**

	Number of Lectures	**23**
	SECTION II	
7	**Hospital Pharmacy Services** a) Procurement & warehousing of drugs and Pharmaceuticals b) Inventory control Definition, various methods of Inventory Control ABC, VED, EOQ, Lead time, safety stock	**03**
8	**Medical Stores** Objectives, Layout facilities; Procedures for procurement of drugs and supplies from medical stores depot, manufacturer, distributor, local market; procedure and limits of emergency purchase.	**02**
9	**Manufacturing of Pharmaceuticals in Hospitals** **Sterile manufacture**- Large and small volume parenterals, facilities, requirements, layout production planning, man-power requirements, Total parenteral nutrition. **Non-sterile manufacture**-Liquid orals, externals (Manufacture of Ointments, lotion and creams), Bulk concentrates. Procurement of stores and testing of raw materials.	**05**
10	**Record AndReports:** a. Patient Historical and Medication Profile. b.Adverse Reactions. c. Patient Treatment Records and Auxiliary Reporting.	**03**
11	**Surgical Dressing** Like cotton, gauze, bandages and adhesive tapes including their pharmacopoeial tests for quality. Other hospital supply eg. I.V.sets, B.G. sets, Ryals tubes, Catheters, Syringes etc	**03**
12	**Radio Pharmaceuticals – Handling and packaging** Introduction to particulate radiation, half life, therapeutic and diagnostic radiopharmaceuticals, facilities required, protection of operators, preparation of radiopharmaceuticals kits.	**03**
13	**Application of computers** In maintenance of records, inventory control, medication monitoring, drug information and data storage and retrieval in hospital retail pharmacy establishment.	**03**
	Number of Lectures	**22**
	TOTAL NUMBER OF LECTURES	**45**

P.2.4.4. Pharmaceutics-V (Hospital Pharmacy)

(Practical) (3 Hrs/week)

1. Study of Proforma for patient data collection
2. Study of Patient Counseling Interview Techniques**
3. Calculation of cost of prescription**
4. Role of Hospital Pharmacist in Ward Round Participation
5. Assessment of drug interactions in the given prescriptions**
6. Assessment of suspected adverse drug reactions in the given prescriptions
7. Preparation of parenteral products by the following methods
   Asceptic technique, involving sterilization by filtration Involving terminal steam sterilization
8. Answering Drug information queries.
9. Inventory control
10. Sterilization of following classes of products **
    a. All glass syringes, with metallic needles
    b. Surgical dressings
    c. Surgical Equipments
    d. Surgeon's Gloves (Rubber)
    e. Ointment bases (Petroleum based)
    f. Powders (Starch, talcum)
11. Any other experiment illustrative of theory

****Indicate Major Experiment**

List of Assignments:

1. Design and Management of Hospital pharmacy department for a 300 bedded hospital.
2. Pharmacy and Therapeutics committee – Organization, functions, and limitations.
3. Development of a hospital formulary for 300 bedded teaching hospital
4. Preparation of ABC analysis of drugs sold in one month from the pharmacy.
5. Different phases of clinical trials with elements to be evaluated.
6. Various sources of drug information and systematic approach to provide unbiased drug information.
7. Evaluation of prescriptions generated in hospital for drug interactions and find out the suitable management.
8. Demonstration of some common surgical instruments, hospital equipments and health accessories

Note: Conduct minimum ten experiments and five assignments from aforesaid list.

Book Recommended for Theory & Practical's:-

1. Merchant &Qadry , Text book of Hospital Pharmacy - (B.S. Shah Prakashan)
2. William .E. Hassan, Hospital Pharmacy (Lea and Febiger)
3. Parmar N S, Health education and Community Pharmacy
4. WHO consultative group report
5. Robin J Harman, Hand book of Pharmacy (The Pharmaceutical Press) Winfield, Richards--Pharmaceutical Practice
6. A text book of Hospital PharmacybyS.H.Merchant& Dr. J.S. Qadry. Revised by R.K.Goyal& R.K. Parikh
7. R.P.S. Vol.2. Part –B; Pharmacy Practice section.
8. Handbook of pharmacy – health care. Edt. Robin J Harman. The Pharmaceutical press.
9. Don A. Balligton, Second Edition, Pharmacy Practice for Technicians, New Age International Publishers.
10. G. Parthsarathi, Clinical Pharmacy & Therapeutics
11. H. P. Tipnis, Clinical Pharmacy
12. Roger Walker, Clinical Pharmacy & Therapeutics

T2.4.5 Pharmaceutical Chemistry-V (Biochemistry)

(Theory) (3 Hrs/ week)

Sr. no.	Topic	Hours
	SECTION I	
1.	**Animal Cell:-** Structure and Functions of different organells, like Nucleus, Plasma membrane, Endoplasmic reticulum, Lysosomes, Golgi apparatus, Mitochondria.	**02**
2.	**Biomembranes:-**Structure of composition, transport hypothesis, active and passive, facilitated transport, Na^+, K^+ pump and Diffusion.	**03**
3.	**Carbohydrates: -**Introduction, Classification and role of Carbohydrates	**02**
4.	**Proteins and amino acids:-** **Proteins:-**Introduction, Functional classification, Structures(Primary, Secondary, Tertiary and Quaternary). **Amino acids:-** Classification, physicochemical reaction with ninhydrin and formaldehyde, different methods for separation of amino acids (Paper chromatography and ion exchange chromatography)	**05**
5.	**Lipids:-** Definition, Classification, Functions, Types of fatty acids and its biological role, Acid value, Saponification value, Iodine value, Rancidity.	**04**
6.	**Vitamins and Co-enzymes:-**Definition and classification of Vitamins, Structure and biochemical function of fat soluble and water soluble vitamins, Biochemical role of coenzymes.	**06**
	Number of Lectures	**22**
	SECTION II	
7.	**Carbohydrate metabolism:-**Glycolysis (aerobic and anaerobic), TCA cycle, ETC, Gluconeogenesis, Glycogenesis, Glucogenolysis, Pentose phosphate pathway.Pharmaceutically Important Carbohydrates and their applications.	**05**
8.	**Protein metabolism:-**Digestion of proteins, Transamination, oxidative deamination, non-oxidative deamination, Urea cycle.	**03**
9.	**Lipid metabolism:-**β-oxidation, oxidation of fatty acids, biosynthesis of fatty acids and cholesterol, HDLP, LDLP, clinical significance.	**05**
10.	**Enzymes:-**Definition, Classification, properties, mechanism of enzyme action. Factors affecting rate of enzymatic reaction, enzyme inhibition with types, Isoenzymes, pharmaceutical applications of enzymes.	**05**
11.	**Nucleic acid:-** Nucleoside, nucleotide, structure of DNA, functions of DNA, Watson and crick model of DNA, DNA as a genetic material, DNA replication, Genetic code, Transcription and translation, Lac operon, Types of non-genetic RNA with their roles in protein synthesis.	**05**
	Number of Lectures	**23**
	TOTAL NUMBER OF LECTURES	**45**

P 2.4.5Pharmaceutical Chemistry-V (Biochemistry)

(Practical) (3Hrs/week)

Sr.no.	Experiments
1.	Qualitative tests for Carbohydrates**
2.	Qualitative tests for Proteins** A. Precipitation reaction B. Color reactions
3.	Quantitative estimation of carbohydrates by Folin Wu method **
4.	Quantitative estimation of glucose in urine by Benedicts method **
5.	Titration to find out acidity of gastric juice by titrating it against potassium hydroxide or sodium hydroxide*
6.	Identification of given fat sample*
7.	A study of activity of enzyme salivary amylase*
8.	Determination of ascorbic acid using dye 2,6-dichlorophenol indophenol*
9.	Determination of Acid value of given fat sample. *
10.	Electrophoresis, paper electrophoresis of serum protein. (Demonstration).*
11.	Separation of amino acids by paper chromatography. (Demonstration)*
12.	Separation of Lipids by thin layer chromatography. (Demonstration)*

Minimum 12 experiments should be covered

*** Indicate Minor experiments ** Indicate Major experiments**

Books Recommended:

1. Harpers review of Biochemistry-Martin
2. Textbook of biochemistry-D Satyanarayan
3. Textbook of Clinical chemistry- Alex Kaplan and Laverve
4. Principles of biochemistry-Lehinger
5. Textbook of biochemistry- Ramarao
6. Practical Biochemistry-David T. Plummer
7. Practical Biochemistry-Pattabhiraman

T2.4.6 PATHOPHYSIOLOGY OF COMMON DISEASES-II

(Theory) (3 Hrs/ week)

Sr. No.	Topic	Hrs.
	SECTION-I	
1	Pathophysiology and management of Cancer :Types, causes, pathogenesis and treatment	**05**
2	**Disorders caused by biological and environment agents:** Etiological agent of diseases, diagnosis of infectious diseases-test selection, specimen ,collection, preservation, transportation, testing and data interpretation infectious diseases Sexually transmitted diseases STD (HIV), pneumonias, SARS, leprosy, malaria, food poisoning, Diarrhea/Dysentery (Bacterial and amoebic), typhoid, tuberculosis.	**05**
3	**Endocrine disorders-** Pituitary gland- growth hormone- Dwarfism, Gigantism, Adrenal gland-Addison's disease,Cushing syndrome Thyroid gland-Hypo and Hyperthyroidism Sex hormones- Hirsuitism, Gynecomastia, virility, impotence etc Pancreas-Diabetes	**05**
4	**Disorder of respiration:** Chronic disorders- chronic obstructive pulmonary diseases-Atelectaxis, Emphysema, Asthma, diffuse interstitial lung disease. Acute disorder of respiratory system, Acute respiratory failure, Pneumonia, pulmonary embolism.	**04**
	Number of Lectures	**19**
	SECTION-II	
7	**Disorders of Urinary System-** Renal failure- Chronic renal failure, Acute renal failure- Obstructive renal failure, pre-renal acute failure, acute tubular necrosis, Urinary tract infections and pyelonephritis – lower urinary tract infection, acute pyelonephritis, chronic pylonephritis. Glomerular Disease:- types of glomerulonephritis and nerphrotic syndromes	**05**
8	**Disorders of CVS-** Hypertension, Ischemic Heart Diseases- Angina: types and causes diagnosis of ischemic heart disease, management of ischemia and angina pectoris. Atherosclerosis, Arrhythmia, Myocardial Infarction. CCF-Types of heart failure, causes of heart failure heart cell changes in the heart failure, consequences of decreased myocardial contractility. Clinical manifestation of congestive heart Failure and their pathophysiological basis, management of chronic heart failure. Types of shock, mechanisms and principles	**08**
9	**Diseases related to carbohydrate metabolism –** diabetes mellitus and OGTT, Carbohydrate metabolism(inborn errors), Glycogen storage disease, Galactosemia, lactose intolerance, glycosuria or mellituria	**03**

10	**Diseases of protein energy malnutrition-** Kwashiorkor and Marasmus Diseases Aromatic amino acid metabolism , Hartnup's disease, Phenylketonuria (PKU), Albinism, Alkaptonuria, Different Tyrosinemias, Sulphur containing amino acid metabolism; Cystinosis, Cystinuria, homocysteinuria, Disease of Branched chain amino acid metabolism; maple syrup urine disease Disorders related to urea cycle metaboli,smHistidinemia, Hyperprolinemia type I , Hyperprolinemia type II	**03**
11	**Disease related to lipid metabolism –** Obesity, atherosclerosis Hyperlipidemia, Hyperlipoproteinemias, Hypercholesterolemias, Hypocholesterolemias, Lipotropic Factors II) Abnormalities in Lipoproteinaemia , Glycogen Storage Diseases.	**02**
12	**Organ function tests** a. Liver function tests b. Renal function tests-blood urea nitrogen, creatinine, uric acid, creatinine clearance c. Gastric function tests- rennin, pepsin fractional test meal, stimulation of gastric secretion, hyper secretion and its treatment d. Thyroid function tests- determination of hormones- T3, T4, TSH uptake studies. e. Pancreatic function tests- Diabetes – Type – I Type- II-OGTT, glycated Hemoglobin and microalbuminurea,amylase,lipase	**05**
	Number of Lectures	**26**
	TOTAL NUMBER OF LECTURES	

Books Recommended:

1) Robbins Pathologic. Basis of Disease Harcourt Asia Pte.ltd. New Delhi 2000 6th edition

2) Harsh Mohan. Textbook of Pathology Jaypee New Delhi 2002, 4th edition

3) Davidson′s Principles and Practice of Medicine. Churchill Livingstone, London1999, 18th edition

4) Harrison's. Principle of Internal Medicine.Mc–Graw Hill. New Delhi, 2005.16th edition (Vol.I,II)