

**SCHEME OF INSTRUCTION AND EXAMINATION
FOR
B. PHARMACY - II YEAR I SEMESTER**

| COURSE NO. | SUBJECTS | PERIODS/WEEK (50 Mts.) | | MARKS | DURATION OF EXAM. | |
|------------------|---|------------------------|------------|-------|-------------------|--------|
| | | Theory | Practicals | | Sessionals | Exams. |
| PYT.2.101 | Ph.Organic Chemistry - I | 4 | -- | 30 | 70 | 3 |
| PYT.2.102 | Pharmaceutical.Engineering – I | 4 | -- | 30 | 70 | 3 |
| PYT.2.103 | Pharmaceutical Analysis – I (Chemical Analysis) | 4 | -- | 30 | 70 | 3 |
| PYT.2.104 | Ph. Microbiology | 4 | -- | 30 | 70 | 3 |
| PYT.2.105 | Communicative English* | 4 | | 30 | 70 | 3 |
| PYP.2.106 | Ph. Org. Chemistry – I Lab | -- | 4 | 25 | 50 | 4 |
| PYP.2.107 | Pharmaceutical Analysis – I (Chemical Analysis) Lab | -- | 4 | 25 | 50 | 4 |
| PYP.2.108 | Ph. Microbiology Lab | -- | 4 | 25 | 50 | 4 |
| | | 32 | | 225 | 500 | |

Candidates admitted into B.Pharm II year directly from Diploma Stream (lateral entry) should study the papers PYT.1.104 – Mathematics, PYT.1.105 – Basic computer applications & PYP.1.110 – Basic Computer Applications Practicals.

**SCHEME OF INSTRUCTION AND EXAMINATION
FOR
B. PHARMACY - II YEAR II SEMESTER**

| COURSE NO. | SUBJECTS | PERIODS/WEEK (50 Mts.) | | MARKS | DURATION OF EXAM. | |
|------------------|---------------------------------|------------------------|------------|-------|-------------------|--------|
| | | Theory | Practicals | | Sessionals | Exams. |
| PYT.2.201 | Ph. Organic Chemistry – II | 4 | -- | 30 | 70 | 3 |
| PYT.2.202 | Pharmaceutical Biochemistry | 4 | -- | 30 | 70 | 3 |
| PYT.2.203 | Pharmaceutical Engineering – II | 4 | -- | 30 | 70 | 3 |
| PYT.2.204 | Pharmacognosy – I | 4 | -- | 30 | 70 | 3 |
| PYT.2.205 | Environmental Studies* | 4 | -- | 30 | 70 | 3 |

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|------------------|--------------------------------|----|----|-----|-----|---|
| PYP.2.206 | Ph. Org. Chemistry – II Lab | -- | 4 | 25 | 50 | 4 |
| PYP.2.207 | Pharm. Biochemistry Lab | -- | 4 | 25 | 50 | 4 |
| PYP.2.208 | Pharm. Engineering Lab | -- | 4 | 25 | 50 | 4 |
| | | | 32 | 225 | 500 | |

PHARMACEUTICAL ORGANIC CHEMISTRY – I

Subject Code : PYT 2.101 Sessionsal : 30
 Periods / week :4 Examination : 70
 Nature of exam: Theory Exam Duration: 3 Hrs

Unit – I

Structure and Reactivity of Organic Molecules

Hybrid orbitals, Molecular orbitals and Covalent bond, Bond angles, Heterolysis, Polarity of covalent bond, Polarity of Molecules, Dipole moments, Intermolecular forces, Boiling Point, Melting Point, Solubility,

Electronic effects: Inductive effect, Electromeric or Mesomeric effect and Resonance. Isomerism (structural and spatial).

Reaction Progress - Activation Energy, Energy diagrams of Reactants and Products.

Unit – II

Aliphatic Hydrocarbons

Nomenclature, Physical properties, General Methods of Preparation and Characteristic reactions of Alkanes, Alkenes and Alkynes; Heats of combustion or Heats of Hydrogenation, Homologous series, Free radical reactions of Alkanes (Halogenation), Catalytic reduction and Electrophilic addition reactions of Alkenes and Alkadienes, Markonikov's Addition, Anti Markonikov's Addition, Peroxide effect or Kharasch effect, Cis-Trans reduction of alkynes, Acidity of 1-Alkynes. Electrophilic addition reactions of alkynes, stability of conjugated alkadienes and their addition reactions.

General methods of preparation of Cycloalkanes: Nomenclature, ring size, stability, Bayer's strain theory, Sachse - Mohr theory, Puckered rings, Congifguration and Conformations of Cycloalkanes, axial and equatorial bonds, Cis-trans Isomers.

Unit – III

Halogen and Hydroxy Compounds

Nomenclature, General Methods of preparation, Relative reactivity of Halides and Hydroxy Compounds, primary, secondary and tertiary classes, Nucleophilic substitution reactions (SN^1 and SN^2) - Walden inversion, Elimination reactions (E^1 and E^2) - Sayetzeffs rule.

Nucleophilic substitution V s Elimination. Oxidation of alcohols;

Ethers: Nomenclature, Properties and Synthesis (Williamson's synthesis and Ziesel's Method).

Unit – IV

A) Carbonyl Compounds (Aldehydes and Ketones)

Nomenclature, General Methods of Preparation, relative reactivities of Carbonyl Compounds, Nucleophilic addition reactions, Addition-Elimination reactions - Schiff's bases, oxidative reactions.

B) Carboxylic Acids and Acid Derivatives

(Acid Halides, Anhydrides, Esters and Amides)

Nomenclature, General Methods of Preparation of Carboxylic acids, Relative acidity of Carboxylic acids, Action of alkalis, salt formation, Alpha - Halogenation and functional (Nucleophilic substitution) reactions of Carboxylic acids and methods of preparation of acid derivatives, Hydrolysis of acid derivatives, Reactivity and synthetic applications of malonic ester and aceto-acetic ester.

Unit – V

Nitrogen Compounds

A) Nitro Compounds

Nomenclature, methods of preparation

B) Amines:

Nomenclature, primary, secondary and tertiary types, Relative Basicity of amines, Reactions of amines, Action of Nitrous acid, alkylation and acylation, Nucleophilicity of amines, Hinsberg's method of separation of amines.

Aryldiazonium salts - Reactions (synthetic applications) of aryldiazonium salts.

Examination : One question from each unit with internal choice.

Text books

1. 'Organic Chemistry' by T.T.Morrison & R.Boyd. Prentice Hall of India Private Limited, New Delhi.
2. Organic Chemistry by FERGUSON

Reference Books

1. The Fundamental Principles of organic chemistry, by I.L.Finar, ELBS, London.
2. Organic chemistry by Cram & Hammond.
3. Text Books of Pharmaceutical Chemistry, by T.M.Atherden, Bentley and Drivers, Oxford University Press, London.

PHARMACEUTICAL ENGINEERING – I

Subject code : PYT 2.102 Sessional : 30
Periods / week : 4 Examination : 70
Nature of exam: Theory Exam Duration: 3 Hrs

Unit – I

Materials of Construction: Factors affecting the material selection for Pharmaceutical plants.

Ferrous Metals: Cast iron steels and Stainless steels,

Non-Ferrous Metals: Copper, Aluminum, Lead, Tin, Silver, Nickel, Zinc, Platinum, Chromium and their important alloys.

Nonmetals: Glass, Stoneware, Stone slate, Brick, Concrete, Asbestos, Rubber, Timber, Plastics.

Corrosion and its Prevention: Types of corrosion, factors influencing corrosion, theories of corrosion, methods of prevention of corrosion.

Definition of unit operations, unit processes. Steady and unsteady states, dimensionless equations, dimensional formulas, dimensional analysis, and dimensionless groups.

Unit – II

Fluid Flow: Fluid static's, manometers, types of flow, Bernoulli's theorem, losses in mechanical energy of flowing fluids, measurement of fluids flow rate - orifice, venturi, pitot and rotameter, flow meters.

Heat Transfer: Nature of heat flow,

Conduction: - Fourier's law, thermal conductivity, compound resistance in series, heat flow through a cylinder - mean radius and mean area.

Convection: - Natural and forced convection, temperature gradients in forced convection, surface and over all coefficients. Parallel current and counter current flow.

Radiation: -black body, Stefan Boltzaman law, and gray body. Heaters, heat interchangers, scraped surface exchangers, extended surface equipment.

Steam as heating medium: - properties and uses of steam traps, vacuum pumps, condensers, entrainment separators, foam and its prevention.

Unit – III

Transportation of Materials

Solids: - Classification, principles of construction & uses of different types of conveyers, detailed study of belt, screw and pneumatic conveyers.

Fluids: - Pipes, tubes, joints, fittings, valves, Different types of reciprocating & rotary pumps, air lift pumps, screw pumps, monopumps, peristaltic pumps.

Gases: - Fans, Blowers, types of compressors, ejectors, vacuum pumps, jet pumps.

Unit – IV

Humidification dehumidification and air conditioning: Definition of various terms, wet bulb and adiabatic saturation temperatures, humidity chart, determination of humidity, methods of increasing and decreasing humidity. Air conditioning - applications in pharmacy.

Refrigeration: Definition; compression and absorption; types of refrigeration cycles; coefficient of performance, refrigerants and their choice; Brine systems, load and applications in pharmacy.

Unit – V

Filtration: Laboratory filtration equipment, classification of industrial filters, sand filters, chamber press, plate & frame filter press, brief description of leaf filters, rotary continuous filters, top feed filters, streamline & meta filters, choice of filtration unit. Membrane filters, Air filtration. Filter operation - effect of pressure, filter aids, Filter media, factors affecting rate of filtration, pretreatment of materials. Filtration theory - Mechanism of filtration, Kozeny equation and its limitations.

Centrifugation: Theoretical considerations, large scale centrifuges classification, perforated & non perforated basket centrifuges, disc centrifuge bowls, tubular bowl centrifuges, horizontal centrifuges, continuous centrifuges, vertical solid bowl centrifuge, laboratory equipment.

Examination : One question from each unit with internal choice.

Text Books

1. **Pharmaceutical Engineering** by Prof. K.Samba Murthy
2. **Introduction to Chemical Engineering** by W.L.Badger & Banchoff, Macmillan Int. book company, London.
3. C.V.S. Subrahmanyam, J. Timma Setty, V. Kusum Devi and Sarasija Suresh, **Pharmaceutical Engineering, Principles and practices**, Vallabh Prakashan, New Delhi, 2007.

Reference Books

1. Elements of Chemical Engineering – Mc Cabe & Smith 4th edn. 2000.
2. Handbook of Chemical Engineering by Perry.

PHARMACEUTICAL ANALYSIS – I

(CHEMICAL ANALYSIS)

Subject code : PYT 2.103 Sessional : 30
Periods / week : 4 Examination : 70
Nature of exam: Theory Exam Duration: 3 Hrs

This course shall cover the theoretical basis of analysis with special reference to methods of assay mentioned in Indian Pharmacopoeia.

Unit – I

Computation of analytical results - Significant figures, Concept of error, precision, accuracy, specificity, sensitivity, detection limit, linearity and range, ruggedness, standard deviation
Rejection of doubtful values with special reference to volumetric and gravimetric analysis.
Calibration of analytical equipment.

Fundamentals of volumetric analysis, methods of expressing concentration, primary and secondary standards.

Unit – II

Physico-chemical concepts required for analysis such as electrolytic dissociation, Modern theory of acids, bases and salts - Bronstead - Lowry theory, Lewis electronic theory; chemical equilibrium, pH and buffer action, solubility product, common ion effect, hydrolysis of salts and amphoteric substances.

Principles of Neutralization reactions; Theory of indicators and Neutralization indicators.

Unit – III

Principles of oxidation-reduction titration's, redox, self-indicators and their use, reactions in pharmaceutical analysis precipitation.

Principles of gravimetric analysis - typical methods involving precipitation, coagulation, digestion, drying procedures, co-precipitation.

Unit – IV

Theory and applications of complexometric titration's, argentometry, iodometry, potassium iodate, potassium bromate, EDT A, non-aqueous titrations redox titration's, ammonium sulphate, titanous chloride. Principles of gas analysis.

Unit – V

Stoichiometry of Ionic equations and Solutions: The Mole concept, Measuring of Moles of Elements and Compounds; Percentage Composition; Empirical and Molecular Formula; Balancing of Chemical Equations; Some analytical problems and calculations based on mass balance, limiting reagent theoretical yield and percentage yield;

Examination : One question from each unit with internal choice.

Text Books

1. Pharmaceutical Chemistry, L.M.Antherden, Bentleys & Drivers, Oxford Univ. Press, U.K.
2. Vogel's Quantitative Inorganic Analysis by Bassett, R.C.Denny & B.H.Jeffery, ELBS, U.K.,

Reference Books

1. Practical Pharmaceutical Chemistry, Vol I & II by A.H.Beckett and J.B.Stanlake, The Athlone Press of the University of London.

PHARMACEUTICAL. MICROBIOLOGY

Subject code : PYT 2.104 Sessional : 30
Period / week : 4 Examination : 70
Nature of exam: Theory Exam Duration: 3 Hrs

Unit – I

Introduction to the Science of Microbiology and Microscopy. Groups of microbes (bacteria, fungi, virus and actinomycetes) classification, macro and micro morphology and taxonomy. Different methods of bacterial count. Nutrition, Cultivation, Isolation, Identification and Preservation of pure cultures. Organisms important in Pharmacy.

Unit – II

Different biochemical reactions employed in identification of organisms, stains and staining, tolerance, Physiology and reproduction of bacteria, actinomycetes, fungi, yeasts and viruses. Microbial genetics and Variation: Introduction, genetic organization, mutation, mutagens, different types of mutants, physical and chemical mutagenesis repair mechanism and their isolation.

Unit – III

Disinfections: Factors influencing disinfections, dynamics of disinfections, different groups of disinfectants and antiseptics and their evaluation and applications.
Sterilization: Premises and Equipment, detailed evaluation and application of different sterilization methods. Sterilization indicators and their importance.

Unit – IV

Microbial attack and host defense, virulence and pathogen city, primary and specific defensive mechanisms of body.

General Principles of immunology and their applications. Immunogenetics: Classification and principles of different types of immunity, Immune systems - humoral immunity, cellular immunity and tolerance. Phagocytosis, Hypersensitivity and other reactions.

General Principles of Serology and Chemical nature of antigens, antibodies. Different antigen - antibody reactions and their applications. Precipitation, agglutination and their significance in diagnosis and diagnostic tests. Different antigens of bacterial cells, monophasic and biphasic variation. Bacterial exotoxins and endotoxins, Toxoids.

Unit – V

General principles of infection and communicable diseases. Significant symptoms, General modes of transmission of the following epidemic and endemic diseases.

a) Tuberculosis, cholera, typhoid. b) Diphtheria, whooping cough. c) Plague, malaria, filariasis, influenza. d) Infective hepatitis, poliomyelitis.

Systematic studies of a few selected organisms - E.Coli, Pencillium sps, Streptomyces sps, Saccharomyces sps. Microbiology of water and milk.

Examination : One question from each unit with internal choice.

Text Books

1. Text book of Microbiology by Pelezair & Reid
2. Text book of Microbiology – Probisher

COMMUNICATIVE ENGLISH

Subject Code: PYT.2.105 Sessional : 30
Periods/Week: 3 Examination : 70
Nature of Examination: Theory Exam Duration: 3 Hrs

Unit – I

Role and Importance of Communication; Verbal and Non-Verbal Communication; Group Communication, Effective Communication; Barriers to communication; Communication Mediums; Participating in discussions, Conduct of Seminars, Conferences etc., Making Presentations through collection, evaluation, organizing the information; Interacting with learners and teachers; Role of Wit and Humor in Communication

Unit – II

Spoken English Vs Written English; Formal / Informal English (one way/two way); British/American/Indian English; How to introduce one self and others; How to tender apology; How to thank in different ways; Greetings; Some Polite Expressions; Agreements and Disagreements; How to use a dictionary; How to use a Thesaurus; Vocabulary Development; Synonyms and antonyms; Single word substitutes; comprehensions;

Unit – III

Communication through Letters; Official and Personal Letters; Letters of complaint; Letters of Enquiries; and Responses; Writing Memos, Circulars and Notices; What to avoid while writing; Writing Paragraph, Document and Scientific/Technical Report; Drafting & Delivering a Speech;

Unit – IV

Grammar in English: Tenses; Voice; Articles; Direct and Indirect speech; Degrees of Comparison; Common errors in English made by Indian Learners of English
Concepts of Learning and Listening: Types and Methods of Learning and Listening; Learning and Listening of Knowledge, Attitudes, Skills and Practices.

Unit – V

The following Four Essays from “Selections from Modern English” prose Edited by Haladhar Panda are prescribed.

1. “Our Own Civilization” - C.E.M. Joad
2. “ Andrew Carnegie” - E.H Carter
3. “ The Secret of work” - Swami Vivekananda
4. “The Generation Gap’ - Benjamin Spock

Examination : One question from each unit with internal choice.

Text Books

1. “Business Correspondence and report Writing” R.C.Sharma and Krishna Mohan, Tata McGraw Hill Publishers, New Delhi
2. “Communicative English” E. Suresh kumar, Raj Kamal Publications, Hyderabad
3. “Selections of Modern English Prose” Ed. By Haladhar Panda, Published by Universities Press (India) Pvt. Ltd., Hyderabad

PHARMACEUTICAL. ORGANIC CHEMISTRY – I

Subject code : PYP 2.106 Sessional : 25
Periods / week : 4 Examination : 50
Nature of exam: Practical Exam Duration: 4 Hrs

List of Experiments

1. Organic Chemistry laboratory techniques.
2. Experiments in simple qualitative analysis including preparation of derivatives.
3. Nitration : Preparation of Nitrobenzene from Benzene.
4. Halogenation : Preparation of p-Bromo acetanilide from Acetanilide.
5. Oxidation : Preparation of Benzoic acid from toluene or Benzylchloride
6. Reduction : Preparation of m-Nitroaniline from m-Dinitro Benzene.
7. Esterification : Preparation of n-Butyl acetate from n-Butyl alcohol.
8. Acetylation : Preparation of Acetanilide from Aniline.
9. Etherification : Preparation of β -Naphthyl methyl ether from β -Naphthol.
10. Hydrolysis (Saponification) : Preparation of Benzoic Acid from Methyl Benzoate OR Preparation of Benzoic acid from Benzamide.

Reference Books

1. B. S. Furniss, A. J. Hannaford, P. W. G. Smith and A. R. Tatchell, **Vogel's Text Book of Practical Organic Chemistry**, 5th Edition, Longman Singapore Publishers, Singapore, 1996.
2. R.K Bansel, **Laboratory Manual of Organic Chemistry**, 4th Edition, New Age International Publishers, New Delhi, 2005.
3. F.G Mann and B. C Saunders, **Practical Organic Chemistry**, 4th Edition, Orient Longman, Hyderabad, 2004.
4. Vogel A.I, **Elementary Practical Organic Chemistry Part – I, Small scale Preparations**, 2nd Edition, CBS Publishers & Distributors, New Delhi, 2004.

PHARMACEUTICAL ANALYSIS – I

Subject code : PYP 2.107 Sessional : 25
Periods / week : 4 Examination : 50
Nature of exam: Practical Exam Duration: 4 Hrs

List of Experiments

1. Calibration of Weights and Pipette and Burette.
2. Standardization of acid, bases, perchloric acid, potassium permanganate EDTA.
3. Experiments on Acidimetry and Alkalimetry.
4. Experiments on Oxidation and reduction reaction.
5. Experiments on Iodimetry and Iodometry.
6. Experiments based on complexometric titration.
7. Non-aqueous titration using perchloric Acid.
8. Experiments based on gravimetry, silver salt method.

Reference Books

1. A.H Beckett and J.B Stenlake, **Practical Pharmaceutical Chemistry**, Part – I, 4th Edition, CBS Publications, New Delhi, 2004.
2. B.H Jeffery and R.C Denny, **Vogel's Text book of Quantitative Chemical Analysis**, 6th Edition, Pearson Education, Delhi.2004.
3. **Indian Pharmacopoeia**, Controller of Publications, Delhi, 1996.

PHARMACEUTICAL MICROBIOLOGY

Subject code : PYP 2.108 Sessional : 25
Period / week : 4 Examination : 50
Nature of exam: Practical Exam Duration: 4 Hrs

List of Experiments

1. Basic equipments used in Microbiology Laboratory
2. Sterilization by dry heat and moist heat technique
3. Preparation of various media.
4. Aseptic transfer technique
5. Staining techniques
6. Study of bacterial motility by hanging drop technique
7. Biochemical reactions for identification of bacteria
8. Isolation of pure cultures
9. Enumeration & isolation of bacteria from air.
10. Bacteriology of milk and water
11. Preservation of cultures

Reference Books

1. F.C. Garg, **Experimental Microbiology**, CBS Publishers, New Delhi, 2003.
2. R.S Gaud and G.D Gupta, **Practical Microbiology**, 6th Edition, Nirali Prakashan, Pune, 2006.
3. R.S Gaud, G.D Gupta and S.B. Gokhale, **Practical Biotechnology**, 2nd Edition, Nirali Prakashan, Pune, 2004.
4. Vinita Kale and Kishore Bhusar, **Practical Microbiology Principles and Techniques**, Himalaya Publishing House, Hyderabad, 2005.
5. Ulhas Patil, J.S Kulkarni, A.B Chaudhari and S.B Chinchokar, **Foundation in Microbiology**, 3rd Edition, Nirali Prakashan, Pune, 2005.

PHARMACEUTICAL ORGANIC CHEMISTRY - II

Subject code : PYT 2.201 Sessionsal : 30
Periods / week : 4 Examination : 70
Nature of exam: Theory Exam Duration: 3 Hrs

Unit – I

Aromatic Hydrocarbons (Benzene and Derivatives)

Structure of Benzene, stability of Benzene (Heats of hydrogenation), Aromatic character – Huckel's ($4n + 2$ electron) rule. Nomenclature of Benzene derivatives. Electrophilic substitution reactions (Halogenation, Nitration, Sulphonation, Friedel-Crafts alkylation and acylation), Effect of substituent on Reactivity and orientation of monosubstituted Benzenes. Nucleophilic substitution in Halobenzenes. Acidity and Reactions of Phenols.

Polynuclear Hydrocarbons: Naphthalene and Anthracene: Structure, relative stability and aromaticity, Electrophilic substitution reactions - orientation, reduction and oxidation.

Unit – II

Stereo Chemistry

Stereoisomerism, conformational isomerism, Cis-trans (E & Z) isomerism, sequence rules for E & Z configurations. Enantiomerism and optical activity:

Plane of symmetry, asymmetry or chirality, plane polarized light, Relative (D & L) configurations, Absolute (R & S) configurations, sequence rules, Diastereomers, Meso structures, racemic modifications, concept of stereospecificity.

Unit – III

Heterocyclic Compounds Containing One Hetero Atom

Introduction, classification and nomenclature of Heterocyclic compounds, Ring structure, methods of preparation and characteristic reactions of pyrrole, furan, thiophene, Pyridine, Indole, Quinoline, Isoquinoline and Acridine. Structure and specific uses of two medicinally important compounds representing each of the heterocyclic systems.

Unit – IV

Heterocyclic Compounds Containing Two Hetero Atoms

Structure and preparation of Pyrazole, Imidazole, Benzimidazole, Oxazole, Isoxazole, thiazole, diazine, pyrimidines, pyrazine and phenothiazine.

Nomenclature and Ring Structure and specific uses of two medicinally important compounds representing each of the above heterocyclic systems; Benzofuran, Benzopyran, dioxane, cinnoline, phenazine, oxazine, triazine, triazole, tetrazole, phenam and cepham.

Unit – V

Synthetic Reagents and Reactions

Specific synthetic Applications (at least two) of the following reagents:

Lithium Aluminium Hydride (LAH), Lead Tetra Acetate (LTA), N-Bromosuccinimide (NBS), Selenium oxide, sodium periodate, perchloric acid,

Mechanism of the following reactions: Fries migration, Beckmann Re-arrangement, Birch reduction, Hoffman's hypobromite reaction, Oppenauer oxidation. MPV reduction, Arndt-Eistert synthesis.

Examination : One question from each unit with internal choice.

Text Books

1. 'Organic Chemistry' by T.T.Morrison & R.Boyd. Prentice Hall of India Private Limited, New Delhi and
 2. Organic Chemistry by FERGUSON.
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Reference Books

1. The Fundamental Principles of Organic Chemistry, by I.L.Finar, ELBS, London.
2. Pharmaceutical Chemistry, by T.M.Atherden, Bentley and Drivers, Oxford Univ. Press, U.K.,

PHARMACEUTICAL BIOCHEMISTRY

Subject code : PYT 2.202 Sessionsal : 30
Periods / week : 4 Examination : 70
Nature of exam: Theory Exam Duration: 3 Hrs

Unit – I

Biochemical organization of the cell and transport processes across cell membrane.

The concept of free energy, determination of free energy change from equilibrium constant and reduction potential, energy rich compounds, production of ATP and its biological significance.

Unit – II

Enzymes - Nomenclature & classification, Kinetics, mechanism of action and inhibition, clinical applications of enzymes, isozymes and coenzymes.

Carbohydrate metabolism: - Glycolysis, gluconeogenesis, glycogenolysis, glycogen synthesis, metabolism of galactose, role of sugar nucleotides in biosynthesis; pentose phosphate pathway. TCA cycle, its significance, Anapleurotic reactions, Effects of inhibitor and regulation of TCA cycle, Glyoxalate cycle.

Unit - III

Lipid metabolism - fate of dietary lipids; beta oxidation, oxidation of unsaturated fatty acids; synthesis of ketone bodies, biosynthesis, of saturated and unsaturated fatty acids, cholesterol metabolism, phospholipids and sphingolipids.

Unit – IV

Electron transport and biological oxidation. Nitrogen balance, metabolism of amino acids; biosynthesis of purines, pyrimidines and their nucleotides, formation of uric acid.

Integration of carbohydrate, lipid and protein metabolism. Biosynthesis of RNA and DNA, Physical and chemical mutagenesis, DNA repair mechanism, recombinant DNA, mechanism of protein synthesis and its regulation, inborn errors in metabolism.

Unit – V

Principles involved and methods used in qualitative & quantitative analysis of blood for -SGPT, SGOT, Bileubin, glucose, urea, creatinine, albumin, albumin/globulin ratio and their clinical significance. Principles involved and methods used in qualitative and quantitative analysis of urine for - glucose, ketone bodies, bile salts, bile pigments and albumin. Product inhibition, feedback inhibition, role of cyclic AMP in enzyme activation, repression and induction and control of enzyme synthesis by regulation of transcription.

Examination : One question from each unit with internal choice.

Text Books

1. Text Book of Biochemistry, by B.Harrow & A.Mazur, W.B.Saunders Co., Philadelphia.
2. Principles of Biochemistry, A.L.Lehninger, CBS publishers, New Delhi.
3. Text Book of Biochemistry, by Rama Rao.

Reference Books

1. Outlines of Biochemistry by E.E.Conn and P.K.Stumpf. John Wiley & Sons, New York.
2. Harper's Review of Biochemistry, D.W.Martin, P.A.Mayes & V.M.Redwell, Language Medical Publications

PHARMACEUTICAL ENGINEERING - II

Subject code : PYT 2.203 Sessionsal : 30
Periods / week : 4 Examination : 70
Nature of exam: Theory Exam Duration: 3 Hrs

Unit – I

Size reduction – Objectives, properties of solids, Classification of equipment. Important intermediate crushers & fine grinders, Cutting rolls, disk crushers, edge and end Runner mills, disintegrators, hammer mills, ball mills and their different modifications, colloid mill, impact mills, pin mills, fluid energy mills, particle size classifiers used with grinding mills.

Size separation – I.P.Grades of Powders, Sieves – Standards, materials of construction, sieving of powders – Particle size distribution and its measurement using sieves. Representation on data. Screening equipment for coarse and fine powders. Shifting by gyratory turbulence.

Fluid classification methods – Cyclone separators, air separators, bag filters, scrubbers, air filters, size separation by settling, double cone classifier. Laws of settling, sedimentation, Elutriation.

Leaching and Extraction – Solid liquid Extraction, theory, problems of crude drug Extraction, solvents, properties choice and recovery. Factors affecting choice of Extraction process and efficiency of Extraction. Maceration, percolation and continuous Extraction process. Diffusion batteries Extraction towers.

Liquid extraction – Principles, Small and large scale equipment, pod biel niak extractor. Expression equipment for small and large scale operation.

Unit – II

Evaporation – General principles, heat supply and vapour removal. Heat transfer, film coefficients, scale formation. Evaporators – Classification, pan, stills, short tube, long tube, vertical forced circulation with internal heating element, film and vapour compression evaporators. Evaporation under reduced pressure.

Distillation and condensation – Different mass transfer operations, theory applied to binary mixtures; Distillation methods – Equilibrium and differential distillations, azeotropic distillation, rectification, sieve plate and packed columns, HEPT. Steam distillation – theory, equipment and applications, Molecular distillation – theory, equipment and applications.

Automatic water stills, steam jacketed kettle, distillation under reduced pressure.

Unit – III

Drying – Theory of drying, Drying of damp solids, tray, vaccum tunnel, rotary and infrared dryer. Drying of slurries of solution – Drum, spray, freeze drying and fluidized bed drying.

Crystallisation – Importance of crystal purity, size, shape, geometry, habit, forms and types. Solubility curves and calculation of yields. Material and heat balances around Swenson Walker crystalliser. Miers supersaturation theory and its limitations. Nucleation mechanisms, crystal growth. Classification of crystallisers, Tank, agitated batch, Swenson Walker, single vacuum, circulating magma and Krystal crystallizer. Caking of crystals and its prevention.

Gas absorption – Importance in pharmacy. Properties and type of tower packing, Tower construction and other commercial absorbers and their operations, two phase flow through packed tower. Pressure and Mass Transfer Coefficients; Desorption.

Unit - IV

Mixing – Definition and objectives; Types of mixers; Solid – solid mixing: Selection of mixer; Mixing of viscous masses; Kneading and ban burry mixtures; Ointment mills, triple roller mill.

Liquid – liquid and gas liquid mixing equipment: Different types of mixing impellers, their characteristics, operation and application.

Absorption and Ion exchange – Ion exchange operations, Ion exchange principles different types of Ion exchangers behaviors of ion exchange resins, applications.

Unit – V

Compaction – Scope, measurement of Punch forces, transmission of force through powders, distribution of forces in powder mass, effect of pressure on relative volume, lubrication of diwall, adhesion and cohesion of particles, factors effecting strength of granules and strength of tablets.

Automatic process control systems – Process variables (temperature, pressure flow, level and vacuum) and their measurement; Elements of automatic process control and introduction automatic process control systems.

Examination : One question from each unit with internal choice.

Text Books

1. Pharmaceutical Engineering by Prof.K.Samba murthy
2. Introduction to Chemical engineering by W.L.Badger and Banchemo, Macrohill Int. book Co, London.
3. C.V.S. Subrahmanyam, J. Timma Setty, V. Kusum Devi and Sarasija Suresh, **Pharmaceutical Engineering, Principles and practices**, Vallabh Prakashan, New Delhi, 2007.

Reference books

1. Unit operations to chemical engineering by W.I.Macebe and J.C.Smith, Macrohill Int. book Co, London
2. The theory and practice of Industrial Pharmacy by L.Lachman, H.Lieberman and J.L.Kanig, Lea and Febiger Philadelphia.

PHARMACOGNOSY - I

Subject code : PYT 2.204 Sessionsal : 30
Periods / week : 4 Examination : 70
Nature of exam: Theory Exam Duration: 3 Hrs

Unit – I

Introduction to pharmacognosy, methods of classification of crude drugs. Systematic description and storage of crude drugs. Plant hormones and their applications

Cultivation - Advantages and disadvantages of obtaining drugs from cultivated and wild Plants. Variability of drug constituents due to exogenous and endogenous factors like altitude, light, temperature, rainfall, propagation by seeds, vegetative means, selection, mutation, hybridization and polyploidy.

Collection of Medicinal Plants - effect of season, time of collection and age of the plant on the quality of active principles. Treatment subsequent to collection - desirable and undesirable changes after collection / drying.

Unit – II

Plant Biosynthesis - Techniques employed in Biosynthetic pathways, precursor - product sequence, competitive feeding, sequential analysis. Study of basic metabolic pathways, Carbohydrate synthesis, Shikimic acid pathway, Isoprenoid biosynthesis.

Unit – III

Hazards - like infestation with spores of micro organisms eggs and steps to prevent the same. Drugs deterioration by non living factors like moisture etc., and steps to prevent deterioration. Adulterations of crude drugs and their detection. Quality control of crude drugs and Phytochemicals. Study of the following methods for evaluation, identity, purity, quality by organoleptic, microscopic, physical, chemical and biological characters; Moisture content determination, determination of foreign organic matters and analysis of volatile oils, quantitative microscopic exercises including lycopodium spore method, leaf constant, crude fibre content.

Unit – IV

Systematic Pharmacognostic study of following drugs

Carbohydrates - Agar, Tragacanth, acacia, starch, isabgol linseed, regenerated carbohydrate fibres, cellulose, alginates and tamarind; Fixed Oils, Fats and Waxes - Chaulmoogroil, neem oil, castor oil, olive oil, bees wax, spermaceti, carnaubawa, theorbroma oil, and lard.

Tannins - Myrobalan, Black catechu, Pale catechu, gal amla and arjuna.

Unit – V

Systemic Pharmacognostic study of the following Fibers: Cotton, Jute, Hemp, Rayon, Wool, silk and Nylon.

Drugs from mineral and animal origin - Kaolin, talc Bentonite, Cod liver oil, Shark liver oil, cantherides, Musk, Honey, and cochineal.

Proteins & Enzyme - Papain, Pepsi Gelatin, Pancreatin

Examination : One question from each unit with internal choice.

Text Books

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1. Pharmacognosy by Trease G.T and Evans w.e 12 ed, Baillers Tindall Easboume, UK.
 2. Pharmacognosy by e.K.Kokate, A.P.Purohit, S.B.Gokhale, Nirali Prakashan, Pune.

ENVIRONMENTAL STUDIES

Subject code : PYT 2.205 Sessionsal : 30
Periods / week : 4 Examination : 70
Nature of exam: Theory Exam Duration: 3 Hrs

Unit – I

The Multidisciplinary Nature of Environmental Studies

Definition, Scope and Importance; Indicators for Sustainable Development; Natural Resources: Forest, Land, Mineral, Food, Water and Energy Resources; Uses, Benefits, Safety, Security and over-exploitation; Role of an individual in conservation of natural resources. Sustainability Theory and Practice; Equitable use of resources for sustainable lifestyles; Ecosystem: Concepts, Types, Characteristic Features, Structure and Functions

Unit – II

Biodiversity and Its Conservation

Introduction, Definition, Types and Levels of Biodiversity; Genetic, Species and Ecosystem diversity; Species Richness; Indigenous Knowledge, Magnitude and Distribution of Biodiversity; Medicinal and Economic Value of biodiversity; Consumptive and Productive use; Biodiversity at Global, National and Local levels. Biogeographical Classification of India - India as a mega-diversity nation and Hot spots; Threats to biodiversity; Endangered and endemic species of India; Conservation of biodiversity: In-situ conservation of biodiversity. Relevance of Biotechnology and Nanotechnology in Sustainable Development, Production and Environment Protection

Unit – III

Environmental Pollution and Its Problems

Local and Global Issues - Definition, causes, effects and control measures of:
a) Air pollution, b) Water pollution, c) Soil pollution, d) Marine pollution, e) Noise pollution, f) Thermal pollution and g) Nuclear hazards

Role of an individual in pollution prevention and case studies of pollution.
Solid and Hazardous Waste Management: Causes, effects and control measures of urban and industrial wastes; Development of Value added products from Solid Wastes;
Waste Minimization in Manufacturing Industry: Alternative Methods and Routes for Process Development; Reduce, Recycle and Reuse; Cost Benefit analysis of a Process or Method and Importance of Mass Balance; Case studies with reference to Pharma Industry;
Green House Gas Effects: Climate change, global warming, acid rain and forest, ozone layer and ground water depletion.
Environmental Problems in India: Drinking Water, Sanitation and Public Health;

Unit – IV

Social Issues and the Environment

Human Population and Environment: Population Growth and Population Explosion;
Social Problems related to poverty, energy, water, shelter, infrastructure, food, health, sanitation, hygiene, land scape, livelihood, information, environment and value education. Effects of Human Activities on the quality of Environment: Urbanization; Communication, Transportation,

Industrialization and Green revolution;
Water conservation, Rain Water harvesting, Watershed Management;
Resettlement and Rehabilitation of People, its problems and concerns. Case Studies.
Environmental ethics; Civic Sense, Issues and Possible Solutions.
Disaster management plan: Natural and Man Made disasters, floods, earthquake, cyclone, tsunami, landslides, nuclear accidents, fire and bioterrorism;
Case studies related to social issues: Wasteland reclamation. Consumerism and waste products.

Unit – V

Institutional Setup and Legislation

Government Regulatory Bodies in Monitoring and Enforcement of Environmental Regulations;
Environment Protection Acts: Air (Prevention and Control of Pollution) Act. Water (Prevention and control of Pollution) Act, Coastal Regulation Zone (CRZ) Act, EIA Notification, Hazardous Waste Rules and Municipal Solid Waste Rules;

Right to Information Act, Wildlife Protection Act and Forest Conservation Act,

International Conventions on Environment: Stockholm, Rio, Basel, Aarhus, Ramsar and Kyoto.

Environment Impact Assessment (EIA) Studies: Definition, Classification, Direct, Indirect and Cumulative Assessment of Impacts; Reversible, Irreversible, Negative and Positive Impacts;
Eco Audit and Eco Labelling (ISO: 14000); Environmental Management Plan (EMP); Design for Environment; Relevance of Command Control Paradigm in Environmental Governance; Issues involved in enforcement of environmental legislation. Public awareness.

Case Studies.

Note: Atleast one field visit is must for studying of Environment in a Local Area / Ecosystem / Industry and also an Assignment on Environment.

Examination : One question from each unit with internal choice.

Text Books

1. Anjaneyulu . Y., Introduction to Environmental Sciences. B.S.Publications, 2003.
2. Murali Krishna K.V.S., Glimpses of Environment, Environment Protection Society, 2003

Reference Books

1. Agarwal, K.C.2001 Environmental Biology, Nidi Publ. Ltd Bikaner.
2. Bharucha Erach, The Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad – 380 013, India, Email: mapin@icenet.net (R)
3. Brunner R.C.,1989, Hazardous Waste Incineration, McGraw Hill Inc.480p
4. Clark R.S., Marine Pollution, Clarendon Press Oxford (TB)
5. Cunningham, W.P.Cooper, T.H.Gorhani, E & Hepworth, M.T.2001, Environmental Encyclopedia, Jaico Publ.House, Mumbai, 1196p
6. De A.K., Environmental Chemistry, Wiley Eastern Ltd.
7. Down to Earth, Centre for Science and Environment (R)
8. Gleick, H.P. 1993. Water in crisis, Pacific Institute for Studies in Dev., Environment & Security. Stockholm Env. Institute. Oxford Univ. Press. 473p
9. Hawkins R.E, Encyclopedia of Indian Natural History, Bombay Natural History Society, Bombay (R)
10. Heywood, V.H. & Watson, R.T 1995. Global Biodiversity Assessment. Cambridge Univ. Press 1140p.

11. Jadhav, H & Bhosale, V.M.19965. Environmental Protection and Laws. Himalaya Pub. House, Delhi 284 p.
12. Mckinney, M.L. & Schoch, R.M.1996. Environmental Science systems & Solutions, Web enhanced edition.639p.
13. Mhaskar A.K, Matter Hazardous, Techno-Science Publication (TB)
14. Miller T.G. Jr., Environmental Science, Wadsworth Publishing Co. (TB)
15. Odum, E.P 1971. Fundamentals of Ecology. W.B.Saunders Co.USA, 574p
16. Rao M.N.& Datta, A.K.1987. Waste Water treatment. Oxford & IBH Publ. Co.Pvt.Ltd.345p.
17. Sharma B.K., 2001. Environmental Chemistry. Goel Publ. House, Meerut
18. Survey of the Environment, The Hindu (M)
19. Townsend C., Harper J, and Michael Begon, Essentials of Ecology, Blackwell Science (TB)
20. Trivedi R.K., Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards, Vol I and II, Enviro Media (R)
21. Trivedi R.K. and P.K.Goel, Introduction to air pollution, Techno-Science Publications (TB)
22. Wagner K.D.,1998. Environmental Management. W.B. Saunders Co. Philadelphia, USA

(M) Magazine, (R) Reference,(TB) Textbook

PHARMACEUTICAL ORGANIC CHEMISTRY – II PRACTICALS

Subject code : PYP.2.206 Sessional : 25
Period / week : 4 Examination : 50
Nature of exam: Practical Exam Duration: 4 Hrs

List of experiments

1. Synthesis of 2,5 – Dimethyl pyrrole from Acetyl acetone
2. Synthesis of 2,5 – Dimethyl thiophene from Acetyl acetone
3. Synthesis of 1,2,3,4-tetra hydrocarbazole from Cyclohexanone.
4. Synthesis of 4,5 – Diphenylimidazole from Benzil
5. Synthesis of 3,5 - Dimethylpyrazole from Acetylacetone
6. Synthesis of 3,4-ethyl-1-phenyl-5-pyrazole from ethylacetoacetate
7. Synthesis of 3,5-Dimethyl isoxazole from Hydroxylamine
8. Synthesis of Benzimidazole from o – Phenylene diamine
9. Synthesis of Benzothiazole from o-Phenylene diamine
10. Synthesis of 2,3-Diphenyl Quinoline from o-Phenylene diamine and Benzil
11. Synthesis of Phenothiazon from Diphenylurea

Reference Books

1. B. S. Furniss, A. J. Hannaford, P. W. G. Smith and A. R. Tatchell, **Vogel's Text Book of Practical Organic Chemistry**, 5th Edition, Longman Singapore Publishers, Singapore, 1996.
 2. R.K Bansel, **Laboratory Manual of Organic Chemistry**, 4th Edition, New Age International Publishers, New Delhi, 2005.
 3. F.G Mann and B. C Saunders, **Practical Organic Chemistry**, 4th Edition, Orient Longman, Hyderabad, 2004.
 4. Vogel A.I, **Elementary Practical Organic Chemistry Part – I, Small scale Preparations**, 2nd Edition, CBS Publishers & Distributors, New Delhi, 2004.
 5. J. Clayden, N Greeves, S Warren and Wothers, **Organic Chemistry**, Oxford University Press, Delhi, 2001.
 6. RT Morrison and RN Boyd, **Organic Chemistry**, 6th Edition, Pearson Education, New Delhi, 2007.
 7. J. March, **Advanced Organic Chemistry, Reactions, mechanisms and structures**, 4th Edition, John Wiley & Sons, Singapore, 2003.
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PHARMACEUTICAL. BIOCHEMISTRY PRACTICALS

Subject code : PYP.2.207 Sessional : 25
Period / week : 4 Examination : 50
Nature of exam: Practical Exam Duration: 4 Hrs

List of Experiments

1. Qualitative reactions for carbohydrates, proteins and amino acids.
2. Estimation of blood cholesterol, Glucose, Urea, Creatinine.
3. Liver function test.
4. Qualitative determination of normal and abnormal constituents of urine
5. Quantitative Estimation of Glucose and uric acid in urine.

Reference Books

1. L.N David and M.C Michael, **Lehninger Principles of Biochemistry**, 4th Edition, Replika Press Ltd, India, 2006.
 2. U Satyanarayana and U Chakrapani, **Biochemistry**, 3rd Edition, Arunbha Sen books and Allied Pvt Ltd, Kolkata, 2006.
 3. K.M Robert, K.G Daryl, A.M Peter and W.R Victor, **Harper's Biochemistry**, 25th Edition, Lange Medical Publications, 2000.
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PHARMACEUTICAL ENGINEERING – II PRACTICALS

Subject code : PYP.2.208 Sessional : 25
Period / week : 4 Examination : 50
Nature of exam: Practical Exam Duration: 4 Hrs

List of Experiments

4. Determination of Reynolds number
 5. Determination of heat transfer coefficient by mechanisms.
 6. Determination of humidity of air by psychrometry & dew point method
 7. Verification of Stokes Law
 8. Efficiency of size reduction using different size reducing equipment.
 9. Determination particle size distribution by sieve analysis
 10. Rate of Drying of solids
 11. Purification by simple distillation.
 12. Drawing of symbols for unit operations
 13. Drawing of equipment used in unit operations (for scale up/scale down)
- Flow sheet Industries for manufacturing procedures of drugs.

Reference Books

1. C.V.S. Subrahmanyam, J. Thima Sety, V. Kusum Devi, and Sarasija Suresh, **Laboratory Manual of Pharmaceutical Engineering (Unit Operations)**, Vallabh Publications, New Delhi, 2006.
 2. M. Momin and Tejal Shah, **Practical Manual of Pharmaceutical Engineering**, B.S. Shah Prakashan, Ahmedabad, 2008.
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