

SYLLABUS
OF
M.Sc. PHARMACEUTICAL CHEMISTRY
(2011-2013)

SCHOOL OF STUDIES IN ENVIRONMENTAL
CHEMISTRY
JIWAJI UNIVERSITY
GWALIOR

STRUCTURE OF CURRICULUM

M.Sc. Pharmaceutical Chemistry

| Code No. | Paper | Exam | Int. Asst. | Total |
|------------------------|--|------|------------|-------|
| First Semester | | | | |
| PC-101 | Fundamentals of Quantitative Analysis and Separation Methods | 35 | 15 | 50 |
| PC-102 | Stereo-chemistry & Thermo- analytical Methods | 35 | 15 | 50 |
| PC -103 | Spectro-analytical Methods of Analysis – I | 35 | 15 | 50 |
| PC -104 | Electro-analytical Methods of Analysis | 35 | 15 | 50 |
| PC -105 | Practical-I | | | 50 |
| PC-106 | Practical-II | | | 50 |
| | Total | | | 300 |
| Second Semester | | | | |
| PC-201 | Environmental biotechnology | 35 | 15 | 50 |
| PC-202 | Spectro-analytical Methods of Analysis– II | 35 | 15 | 50 |
| PC -203 | Computer in Chemical Analysis | 35 | 15 | 50 |
| PC -204 | Elementary Electronics in Chemical Instrumentation | 35 | 15 | 50 |
| PC -205 | Practical-I | | | 50 |
| PC-206 | Practical-II | | | 50 |
| | Total | | | 300 |
| Third Semester | | | | |
| PC-301 | Pharmaceutical Analysis | 35 | 15 | 50 |
| PC-302 | Principles of Pharmacology | 35 | 15 | 50 |
| PC -303 | Principles of Drug Development | 35 | 15 | 50 |
| PC -304 | Advanced Instrumental Methods & Pharmaceutical Biotechnology | 35 | 15 | 50 |
| PC -305 | Practical-I | | | 50 |
| PC-306 | Practical-II | | | 50 |
| | Total | | | 300 |
| Fourth Semester | | | | |
| PC-401 | Clinical Research | 35 | 15 | 50 |
| PC-402 | Concepts of Industrial Management and Intellectual Property Rights | 35 | 15 | 50 |
| PC-403 to 406 | 12 to 16 Weeks Industrial Training, Report and Viva-voce | | | 200 |
| | Total | | | 300 |

SYLLABUS OF M.Sc. PHARMACEUTICAL CHEMISTRY (2010–2012)

First Semester

M.M.: 35

PC-101: Fundamentals of Quantitative Analysis and Separation Methods

Unit-I: Concepts involved in Analysis

Role of analytical chemistry, classification of analytical methods-classical and instrumental, types of instrumental analysis, selecting analysis method, neatness and cleanliness, laboratory operations and practices, good laboratory practices, techniques of weighing, errors, volumetric glassware-cleaning and calibration of glassware, sample preparation – dissolution and decompositions, selecting and handling reagents, laboratory notebooks, safety in the analytical laboratory, calibration and detection limits, proficiency testing.

Unit-II: Titrimetric and Gravimetric Methods of Analysis

General principles: Solvents in analytical chemistry, acid-base equilibria, concentration systems, stoichiometric calculation, acid-base titration, titration curves, acid base indicators, applications of acid-base titration, complexometric titration, metal-ion indicators, precipitation titration, Mohr's titration, Volhard's titration, adsorption indicators, Fajan's titration, titration curves in oxidation-reduction titration, redox indicators, applications of redox titrations.

Unit-III: Separation Techniques -I

(A) Solvent Extraction: Fundamental treatment, theoretical principle, classification, and factors favouring extraction, extraction equilibria, applications.

(B) Solid phase extraction and solid phase micro extraction, applications.

(C) Ion- Exchange: Theories, use of synthetic ion exchange in separation, chelating ion exchange resins, liquid ion exchangers, experimental technique.

Unit-IV: Separation Techniques -II

An introduction to chromatographic methods, paper, thin layer and column chromatography, theory of chromatography, classification of chromatographic techniques, retention time, relationship between retention time and partition coefficient, the rate of solute migration, differential migration rates, band broadening & column efficiency, kinetic variables affecting band broadening, Electrophoresis and capillary electrophoresis.

Unit-V: GC and HPLC

Instrumentation of GC and HPLC, applications in qualitative and quantitative analysis, comparison of GC and HPLC, Ion chromatography, pyrolytic gas chromatography, size exclusion chromatography, super critical fluid chromatography, affinity chromatography.

Syllabus M.Sc. Pharmaceutical Chemistry (2011-2013)

Books Recommended

1. D.A. Skoog, F.J. Holler and T.A. Nieman, Principles of Instrumental Methods, 5th ed., Thomson Asia Pvt. Ltd., Singapore (2003).
2. R.A. Day and A.L. Underwood, Quantitative Analysis, 6th ed., Prentice Hall of India Pvt. Ltd (1993).
- 3 G.D. Christian, Analytical Chemistry, 6th ed, John Wiley & Sons (2001).
4. S.M. Khopker, Environmental Pollution Analysis, 2nd ed., New Age International Pvt. Ltd.(2002).
- 5 A.I. Vogel, Textbook of Quantitative Chemical Analysis, 5th ed., Addison Wesley Longman Singapore (1999) ¹
- 6 G. W. Eving, Instrumental Methods of Chemical Analysis, 5th ed., Mc-Graw Hill Book Company (1985).
7. Willard, Merritt, Dean, and Settle, Instrumental Methods of Analysis, 7th ed., CBS Publishers & Distributors (1986).

Unit-I: Stereochemistry-I

(a) Conformational analysis: Conformation of n-butane and cyclohexane, stability of conformers and energy profile diagram.

(b) Optical activity: Criteria for optical activity, stereoisomers, enantiomers and diastereomers, erythro and threo isomers, a general idea of symmetry elements.

Unit-II: Stereochemistry-II

(a) Racemic Modifications: Conglomerate, racemate and racemic solid solutions, a general idea of stereo selective synthesis.

(b) Resolution of Racemic modifications: by Chemical separation, chromatography, preferential crystallization and asymmetric transformation (a brief idea only).

Unit-III: Statistical Treatment of Data

Types of errors, accuracy and precision, rounding off, significant figures, normal distribution of errors, statistical treatment of finite samples (mean, median, range & average deviation), t-test, confidence interval of the mean, standard error of a mean, test of significance, comparison of two means, F-test, rejection of data, Q-test, bivariate data, Quality control charts, relationship between variables, correlation & regression, principle of least squares. Standardization of analytical methods.

Unit-IV: Thermo-analytical Methods

Thermogravimetry, factors affecting thermogravimetric curves, derivative thermogravimetry (DTG), thermobalances, applications of thermogravimetry, differential thermal analysis, factors affecting DTA curve, instrumentation, applications of DTA.

Differential scanning calorimetry, theory, instrumentation, applications of DSC, thermometric titration, principle, classification, instrumentation and applications of thermometric titration.

Unit-V: Principles of Gravimetric Analysis

Stoichiometry of gravimetric reactions, formation and properties of precipitates, precipitation from homogeneous solution, nucleation, organic precipitations, applications of gravimetric analysis.

Books Recommended

1. D.A. Skoog, F.J. Holler and Nieman, Principles of Instrumental Methods, 5th ed., Thomson Asia Pvt. Ltd., Singapore (2003).
2. R.A. Day and A.L. Underwood, Quantitative Analysis, 6th ed., Prentice Hall of India Pvt. Ltd. (1993).
3. G.D. Christian., Analytical Chemistry, 6th ed, John Wiley & Sons (2000)
4. A.I. Vogel, Textbook of Quantitative Chemical Analysis, 5th ed., Addison Wesley Longman Singapore Ltd. (1999)
5. G. W. Eving, Instrumental Methods of Chemical Analysis, 5th ed., Mc-Graw Hill Book Company (1985)
6. Ernest L. Eliel and Samuel H. Wilen, Stereochemistry of Organic Compounds, John Wiley & Sons (2003).

Unit-I: Colorimetry and Spectrophotometry

An introduction to spectrophotometric methods, a brief idea of wave properties of electromagnetic radiation, theory of spectrophotometry and colorimetry, limitations of Beer's Law, classification of methods of colour measurement, instrumentation single beam and double beam, photometric error, applications of spectrophotometry to inorganic and organic compounds (quantitative calculations), near IR spectrophotometry, spectrophotometric titration.

Unit-II: Other Spectro-analytical techniques

(A) Introduction, general principle, instruments for nephelometry and turbidimetry, applications of nephelometry and turbidimetry to analytical chemistry.

(B) Dispersion Refractometry and Flame photometry

(C) Polarometry, circular dichroism (CD) and optical rotatory dispersion (ORD).

Unit-III: Emission Spectroscopy

Elementary idea of emission spectroscopy, introduction, elementary theory, instrumentation, types of flames, interferences, factors affecting flame photometry, applications to qualitative and quantitative analysis, limitations.

Unit-IV: Fluorescence and Phosphorescence Spectrophotometry

Theory of fluorescence and phosphorescence, quantum yield, factors affecting fluorescence and phosphorescence, relation between concentration and intensity, instrumentation, applications, an elementary idea of chemiluminescence.

Unit-V: Kinetic of Slow and Fast reactions (An elementary study keeping in view its applications in analytical chemistry)

(A) Rates of chemical reaction, expression for reaction rate, rate constants, order of reaction, methods for determination of order of reaction, Arrhenius equation, Collision theory, failure of collision theory, Absolute reaction rate theory, unimolecular reactions, mathematical formulation of Lindemann's theory, catalysed reactions, Theory of homogenous catalysed reactions, kinetics of enzyme catalysed reactions, elementary idea of micellar catalysis.

(B) Study of fast reactions by stopped flow method, relaxation methods, flash photolysis method, photochemical reactions, kinetics of photochemical combination of hydrogen and chlorine, branched chain reactions, oscillatory reactions, applications of kinetic methods in finding out optimum conditions for different reactions

Books Recommended

1. John. R. Dyer, Applications of Absorption Spectroscopy of Organic compounds, 9th ed.. Prentice Hall of India Pvt. Ltd. (1994).
2. Dudley H. Williams and Ian Fleming, Spectroscopic Methods in Organic Chemistry, 4th ed., Tata Mc-Graw Hill Book Company (1998).
3. R.M.Silverstein, G.Clayton Bassler and Terence C. Morrill, Spectroscopic Identification of Organic compounds, 6th ed, John Wiley & Sons (1998).
4. D.A. Skoog, F.J. Holler and Nieman, Principles of Instrumental Methods, 5th ed., Thomson Asia Pvt. Ltd., Singapore (2003).
5. R.A. Day and A.L. Underwood, Quantitative Analysis, 6th ed., Prentice Hall of India Pvt. Ltd. (1993).
6. G.D. Christian., Analytical Chemistry, 6th ed, John Wiley & Sons (2000)
7. A.I. Vogel, Textbook of Quantitative Chemical Analysis, 5th ed., Addison Wesley Longman Singapore (1999).

Syllabus M.Sc. Pharmaceutical Chemistry (2009-2011)

PC-104: Electro-analytical Methods of Analysis

M.M.: 35

Unit-I: Fundamentals

Electrochemical cells, solution structure, potential in electroanalytical cells, Nernst equation, electrode potential the ideal polarized and non-polarized electrodes, faradiac reaction, variables in electrochemical cells, factors affecting electrode reaction rate and current, decomposition potential, back potential and voltage.

Unit-II: Potentiometry

Introduction, reference electrodes, indicator electrodes, ion-selective electrodes and their applications in chemical analysis, instrumentation and measurement of cell unit, direct potentiometry, potentiometric titration, applications.

Unit-III: Polarography

Direct current polarography, basic principle, instrumentation, advantages and disadvantages of dropping mercury electrode, different kinds of limiting currents, components of polarographic waves, reversible and irreversible waves, pulse and A.C. polarography, applications of polarography to inorganic and organic compounds, elementary idea of stripping voltammetry, amperometric titrations.

Unit-IV: Conductometry and Coulometry

Conductometry as an analytical tool, applications of direct conductometric measurements, basis of conductometric titrations, applications of conductometry titration, constant current and controlled potential electro-gravimetry, separation of metals, coulometry at controlled potential, coulometry at constant current, applications.

Unit-V: Voltammetry

AC polarography, current sampled (TAST) polarography, normal pulse and differential pulse polarography, stripping voltammetry, linear sweep and cyclic voltammetry, chonopotentiometry, chronoamperometry.

Books Recommended

1. Allen J. Bard and Larry R. Faulkner, Electro-chemical Methods, 2nd ed., John Wiley & Sons (2001).
2. G.D. Christian, Analytical Chemistry, 6th ed, John Wiley & Sons (2001).
3. A.I. Vogel, Textbook of Quantitative Chemical Analysis, 5th ed., Addison Wesley Long man Singapore Ltd. (1999)
4. Galen W. Eving, Instrumental Methods of Chemical Analysis, 5th ed., Mc-Graw Hill Book company (1985).
5. Willard, Merritt, Dean, and Settle, Instrumental Methods of Analysis, 7th ed., C B S Publishers & Distributors (1986).

Second Semester

PC -201: Environmental Biotechnology

M.M.: 35

Unit I

1. Environment: Basic concepts and issues.
2. Environment pollution: Types, Methods for measurement of pollution.
3. Air Pollution: Its impact, assessment and control through biotechnology.
4. Water pollution: Its effect, control molecular methods for wastewater monitoring and its treatment (physical, chemical and biological processes).

Unit II

1. Microbial waste treatment: Aerobic processes-activated sludge, trickling Filters, aerated lagoons, Oxidation ponds
2. Anaerobic Processes: Biodegradation methods viz. anaerobic lagoons, Upflow anaerobic sludge blanket reactor.
3. Cleaner technologies: Fermentation, paper and plastic industry, Reducing environment impact of industrial effluents.
4. Solid waste treatment: Composting process- Types, parameters and its aim, Vermicomposting and its advantages.

Unit III

1. Biomedical waste and its management
2. Non conventional energy sources: Biofuels- Biogas, Biodiesel etc.
3. Biopesticides: Impact of biopesticides and its limitations, integrated pest management (IPM) – An ecological approach.
4. Environmental monitoring: Bioindicators.

Unit IV

1. Biomineralization: A decontamination process of heavy metal bearing wastes.
2. Environmental biocatalysis: Degradation of xenobiotics, degradation pathway, genetic basis and mechanism of genetic adaptation.
3. Bioremediation: *In situ* and *Ex situ* techniques, advantages of bioremediation, applications of genetically engineered microbes (GEM) in bioremediation.
4. Phytoremediation: Types and its applications.

Unit V

1. Hazardous waste management.
2. Basic concepts of Environmental Impact Assessment (EIA)
3. Global Environment problems: Ozone depletion, UV-B, Green house effect, acid rain, their impact and biotechnology approaches for management, Agenda 21.
4. Restoration of waste land / degraded ecosystem.

Books recommended

1. Wastewater Engineering Treatment, Disposal and Reuse. Metcalf and Eddy, Inc., Tata McGraw Hill, New Delhi.
2. Comprehensive Biotechnology. Vol. 4, M. Moo-Young (Ed-in-chief), Pergmon Press, Oxford.
3. Environmental Chemistry, A. K. De, Wiley Eastern Ltd., New Delhi.
4. Introduction to Biodeterioration, D. Allsopp and Seal, ELBS / Edward Arnold.
5. Environmental Biotechnology; Theory and Applications; G M Evans and J. C. Furlong.
6. Environmental Biotechnologies and Cleaner Bioprocess by Eugenia J Olguin et al.
7. Industrial water pollution control by W. Wesley Eckenfelder Jr.
8. Environmental Science Physical Principles and applications by Egbert Boeker et al.
9. Hazardous waste management by Chales A Wentz
10. Environmental Pollution and management of Waste waters by microbes by GR Pathode and PK Goel.

Unit-I: Atomic Absorption and Emission Spectroscopy.

Theory of atomic spectroscopy, the origin of spectral transition, the populations of energy levels, the factors influencing spectral width, atomic absorption spectroscopy, instrumentation, interferences, applications, various non-flame emission sources, applications, comparison of atomic emission and atomic absorption methods.

Unit-II: Infrared Spectroscopy

Theory of Infrared absorption, vibrational modes, vibrational coupling, instrumentation, dispersive and non-dispersive instrument, qualitative applications and interpretation of spectra, quantitative applications. A brief idea of Raman spectroscopy.

Unit-III: Nuclear Magnetic Resonance Spectroscopy

Theory of NMR, chemical shift and spin-spin splitting, relaxation process of saturation, environmental effects on NMR spectra, instrumentation, CW or FT NMR instrument, Rules governing the interpretation of first order spectra, applications to quantitative analysis.

Unit-IV: Carbon-13 NMR

Historical development, proton decoupling-broad band, Off-resonance and pulsed or gated decoupling, nuclear overhauser enhancement, polarization transfer experiments-DEPT and INEPT chemical shifts, spin-spin coupling impacts, application of ^{13}C NMR to structure determination, two-dimensional NMR spectroscopy, principle, the COSY experiment, the COSY experiment with double quantum filter (COSY-DQF), the NOESY experiment, three-dimensional NMR experiment.

Unit-V: Mass Spectrometry

Theory of mass spectrometry, practical considerations, ion production, depletion of ions, ion detector, calibration, other ionization techniques: chemical ionization, fast atom bombardment (FAB), and electrospray, interpretation of the mass spectrum of the compound, applications of mass spectrometry.

Books Recommended

1. John. R. Dyer, Applications of Absorption Spectroscopy of Organic compounds, 9th ed., Prantice Hall of India Pvt. Ltd. (1994).
2. Dudley H. Williams and Ian Fleming, Spectroscopic Methods in Organic chemistry, 4th ed., Tata Mc-Graw Hill Book company (1998).
3. R.M. Silverstein, G. Clayton Bassler, and Terence C. Morrill, Spectroscopic Identification of Organic Compounds, 6th ed., John Wiley & Sons (1998).
4. C.N. Ban well, Fundamentals of Molecular Spectroscopy, Tata Mc-Graw Hill Book company (1998).
5. Manas Chanda, Atomic Structure and Chemical Bond, Tata Mc-Graw Hill Book company (1998).

Unit-I: Fundamentals of Computers

An introduction, uses of computer in modern society, computer generation, classification of computers, block diagram of computer, components of computer, hardware & software of computer, input and output devices, memory (storage)- primary and secondary, exposure to number system: binary, octal, decimal, hexadecimal, conversion of numbers, A brief idea of the role of computer and microprocessors in analytical chemistry.

Unit-II: Operating Systems

Introducing operating System - Definition and functions, microsoft disk operating system (MS-DOS) internal and external commands, brief introduction to WINDOWS and UNIX. Protecting software and computer-related innovations.

Unit-III: Ms Office (MS - Word 97 and MS Excel 97)

MS Word 97: Introduction, components of screen, opening a file, typing, editing, copying, moving, inserting and saving the document, formatting features for font and characters, others features - page breaks, page set up, borders and shading, preview and printing of documents. Creating tables and columns in MS- Word 97.

MS Excel 97: Introduction to worksheets and charts, components of a worksheet, opening a new worksheet, working with a worksheet, saving, printing, editing and formatting of worksheet. Creating, modifying, saving and printing a chart in MS-Excel 97.

Unit-IV: Introduction to 'C'

Low level and high level languages, programming languages, getting started with 'C', programme structure in 'C', exposure to input/output, variables, constants, operators and control statements if, Else.....if, while, for, do.....while and switches.

Unit-V: Instrument and multimedia

Internet: Concept and definition, types of internet connection, modem.

E-mail: Introduction, WWW and different browsers

Multimedia: Introduction and application.

Books Recommended

1. Jim Keogh, Solving the Year 2000 problems, A P Professionals (1997).
2. E.Balagurusamy, Programming in Basic, 3rd ed., Tata Mc-Graw Hill Book company (1997).
3. Yashvant P. Kanetkar, Let Us C, 4th ed., B P B Publications (2002).
4. Alexis Leon, Methews Leon, Fundamentals of Information Technology, Leon press Chennai and Vikash Publishing house Pvt. Ltd.(1999).
5. F.W.Fifield and D. Kealey, Principles and practices of analytical chemistry, Blackwell Science, (2004)

PC -204: Elementary Electronics in Chemical Instrumentation

M.M.: 35

Unit-I: Fundamentals

Idea of potential difference, current, resistance and resistivity, idea of fixed and variable resistors, colour code, Ohm's law, Kirchoff's law, principle of Wheatstone bridge, electrical capacity, parallel plate capacitor, self inductance, mutual inductance, transformer - introduction to its construction. Frequency, time period, phase and average values of alternating currents, motion of charged particle in electric and magnetic fields.

Unit-II: Transducers and Measuring Instruments

Principles of moving coil galvanometer (dead beat type), voltmeter, ammeter and ohmmeter, basic principle of electronic analogue voltmeter, thermocouple, thermister, LED, LCD, photo-conductivity and photo-cell, concept of piezoelectricity, principle of scintillation, basic design of CR tube, photo emission and PMT. Principle of electrical oscillations, Hartley and Colpitts oscillators.

Unit-III: Semiconductor Devices -I

Qualitative ideas about free electron model. Intrinsic and extrinsic semiconductors. Conductivity and mobility and their temperature dependence. P-N junction diode. I-V characteristics and rectification.

Unit-IV: Semiconductor Devices -II

Zener diode and voltage regulation. Bipolar transistor, characteristics, load line and biasing in CE configuration. Current gain and basic CE amplifier, operational amplifier-ideal characteristics. Inverting and non-inverting amplifiers, summing amplifiers, integrator and differentiator.

Unit-V: Few Basic Circuits

Regulated constant voltage and constant current power supply, chopper stabilized DC amplifier, idea of invertors, interfacing a resistive transducer to an electrical circuit, idea of temperature measurement, schematic of a lamp regulator, direct reading spectrophotometer, conductivity meter, pH meter, basic gates, flip-flop, registers and counters.

Books Recommended

1. Albert Paul Malvino, Electronic Principles, 5th ed., Tata Mc-Graw Hill Book Company (1995).
2. R.S. Sedha, A Text Book of Applied Electronics, 1st ed, S.Chand & Company Ltd (1998).
3. B.L. Thareja and A.K. Thareja, A Text Book of Electrical Technology, 1st ed., S.Chand & Company Ltd (1998).
4. R.S. Khandpur, Handbook of Analytical Instruments, 3rd ed., Tata Mc-Graw Hill Book Company (1997)

Third Semester

PC-301: Pharmaceutical Analysis

M.M.: 35

Unit – I: Profile of a quality control laboratory for chemical division in pharmaceutical unit, routes of drug administration, structure activity relationship, adverse drug effect, LD₅₀ and ED₅₀ (a brief idea only).

Unit - II: General Chemistry, mode of action and method of analysis of drugs belonging to following classes:

- (a) **Antipyretics & analgesics**: Paracetamol, Aspirin and Ibuprofen
- (b) **Antibiotics**: Ampicillin, Amoxicillin and Cloxacillin
- (c) **Antifungal agents**: Clotrimazole and miconazole

Unit – III: (a) **Sulpha drugs**: Sulphanilamide, Sulphaguanidine and Sulphadiazine

- (b) **Antitubercular drugs**: Isoniazide and Rifampicin
- (c) **Expectorants**: Codeine phosphate and Papaverine hydrochloride

Unit – IV: (a) **Bronchodilators**: Ephedrine, Salbutamol and Theophylline

- (b) **Hypnotics and Sedative**: Phenobarbitone
- (c) **General Anesthetic**: Benzocaine

Unit – V: A brief chemistry and mode of action of following drugs (**method of analysis excluded**)

- (a) **Cardiac glycosides**: Digoxin and Digitoxin
- (b) **Antihypertensive**: Clonidine and Methyldopa
- (c) **Antileprotic drugs**: Dapsone and Clofazimine
- (d) **Anticancer agents**: Alkylating agents only

Books Recommended

1. Foye's principles of medicinal chemistry. David A. Williams, Thomas L. Lemke, Fifth Edition. Lippincott Williams & Wilkins.
2. Essentials of medicinal Pharmacology, K.D.Tripathi, 4th Edition . Jaypee Brothers Medical Publishers Ltd.
3. Medicinal chemistry Vol. I & II. A. Burger, Willey interscience, 1970
4. Pharmacology & Pharmacotherapeutics, Vol. I & II. R.S. Satoskar & S.C. Bhandarkar, Popular Prakashan 1978.
5. A Textbook of medicinal chemistry. P. Parimoo.

PC - 302: Principles of Pharmacology

M.M.: 35

Unit 1: Pharmacokinetics I

Physicochemical factors in transfer of drugs across membranes, Drug absorption, bioavailability and routes of administration, Distribution of drugs.

Unit 2: Pharmacokinetics II

Excretion of drugs, Metabolism of drugs Clinical pharmacokinetics, Clearance-distribution, Half-life, Extent and rate of bioavailability, Therapeutic drug monitoring.

Unit 3: Pharmacodynamics

Mechanism of drug action, Drug receptors, Receptors for physiological regulatory molecules, Physiological receptors: Structural and functional families, Regulation of receptors, Quantitation of drug-receptor interactions and effects.

Unit 4: Membrane Transportation

Membrane transportation in therapeutic drug response, Membrane transporters and adverse drug response, Basic mechanisms of membrane transport, Kinetics of transport, Molecules structure of transporters.

Unit 5: Pharmacogenetics

Importance of pharmacogenetics to variability in drug response, Genomic basis of pharmacogenetics, Pharmacogenetic study-design consideration, pharmacogenetic phenotypes, Pharmacogenetic and drug development.

Books Recommended

1. L.L. Brunton, J.S. Lazo, K.L. Parker, The Pharmacological Basis of Therapeutics, 11th ed., Magraw Hill, US, (2006).

PC - 303: Principles of Drug Development

M.M.:35

Unit I: Evaluation of the Evidence

Clinical trials, Observational studies, Drug history, Disease -induced alterations in pharmacokinetics.

Unit II: Interaction between drugs

Pharmacokinetics interactions caused by diminished drug delivery to the site of action, Pharmacokinetic interaction that increase drug delivery to the site of action.

Unit III: Pharmacokinetics interactions

Pharmacokinetics interactions, Age as a determinant of response to drugs, Genetic determination of the response to drugs, Pharmacodynamic characteristics of a drug that determine its use in therapy, Pharmacodynamic variability, Therapeutic Index.

Unit IV: Adverse drug reaction and drug toxicity

Advance drug reaction and drug toxicity, Therapeutic drug monitoring, Drug development and its regulation, Role of clinician in adverse reaction.

Unit V: Structural features and pharmacologic activity

Optical and geometric isomerism and pharmacologic activity, Influence of optical isomerism on pharmacological activity, Influence of geometrical isomerism on pharmacologic activity, conformational isomerism and pharmacological activity, Effect of conformational isomerism on biological activity of drugs.

Books Recommended

1. L.L. Brunton, J.S. Lazo, K.L. Parker, The Pharmacological Basis of Therapeutics, 11th ed., Magraw Hill, US, (2006).

PC 304: Advanced Instrumental Methods & Pharmaceutical Biotechnology

M.M.:35

Unit - I – Diffraction Techniques

General theory and instrumentation of neutron diffraction and X-rays diffraction. Application of X-rays diffraction for polymer characterization and structure of complexes. Applications of neutron diffraction to structure of magnetic materials.

Unit - II - Industrial Process Instruments and Automatic Analysis

Overall analytical procedures for analysis of an organic and inorganic material, industrial process analyzer, infrared process analyzer. On-line potentiometric analyzer, process gas chromatography, on-line GC/Mass and GC/IR, continuous on-line process control, automatic chemical analysis, automatic elemental analyzer.

Unit III: Immunology and Immunological Preparation: Immune system, cellular humoral immunity, antigen and haptens, antigen and antibody reactions and their applications. Hypersensitivity. Active and passive immunization; Vaccines- their preparation, sterilization and storage.

Unit IV: Genetic Recombination & Antibiotics: Transformation, conjugation, transduction, protoplast fusion, gene cloning and their applications. Development of hybridoma for monoclonal antibodies. Study of drugs produced by biotechnology such as-Activase, Humulin. Historical development of antibiotics. Anti microbial agents, sulfa drugs, Penicillins broad spectrum antibiotics and methods used for their standardization.

Unit V: Fermentation technology & Microbial transformation: Historical development and scope of fermentation technology. Fermenters, its design, control of different parameters. Design of fermentation process, Isolation of fermentation products with special reference to penicillin, streptomycin, tetracycline and vitamin B₁₂.: Introduction, types of reactions mediated by microorganism, selection of organisms, bio-transformation process and its improvement with special reference to steroids.

Books Recommended

1. D.A. Skoog, F.J. Holler and Nieman, Principles of Instrumental Methods, 5th ed., Thomson Asia Pvt. Ltd., Singapore (2003).
2. R.A. Day and A.L. Underwood, Quantitative Analysis, 6th ed., Prentice Hall of India Pvt. Ltd. (1993).
3. G.D. Christian., Analytical Chemistry, 6th ed, John Wiley & Sons (2001).
4. Willard, Merritt, Dean, and Settle, Instrumental Methods of Analysis, 7th ed., C B S Publishers & Distributors (1986).
5. L.L. Brunton, J.S. Lazo, K.L. Parker, The Pharmacological Basis of Therapeutics, 11th ed., Magraw Hill, US, (2006).

Fourth Semester

PC-401: Basic Principles of Clinical Research

M.M.: 35

UNIT – I: Introduction of Clinical research

History, terminology, events: serious adverse events (SAE), investigational new drug safety reports (INDSR), reporting, investigational product (IP), principles & precaution and risk minimization, post marketing surveillance, managing blinded therapy cases, consent: informed consent, compensation: compensation for participation.

UNIT – II: Clinical trials & Good clinical practices (GCP), guidelines and related management.

GCP guidelines, principles of ICH GCP, ethical principles related to GCP, clinical trials, SOPs, regulation: obtaining clinical trial permission, application for permission, report: clinical trial report, trial management: data monitoring committee (DMC).

UNIT – III: Bioethics, devices, essential documents in clinical research

Ethics committee: independent EC & institutional EC, EC approval, quorum in EC, EC review & records, applied ethics & healthcare, contribution to clinical practices, devices: devices in clinical trials, essential documents: essential documents for the conduct of a clinical trial.

UNIT – IV: Generic drugs, herbal products, investigator in clinical trials

Comparing generic brands with original brand, herbal product: clinical trial of herbal product, investigators, laboratory, phases of trial.

UNIT- V: Bioequivalence, bioavailability & pharmacovigilance

General concepts, therapeutic equivalence evaluations: methods for determining bioequivalence, minimizing the need for bioequivalence studies, bioequivalence testing: evaluation of bioequivalence data, bioequivalence assessment and data evaluation, criteria for bioequivalence, study design, pharmacoepidemiology and pharmacovigilance.

Books Recommended

1. Lippincott Williams & Wilkins, The Science and Practice of Pharmacy, vol. I & II, 21st edition, Remington, Wolters Kluwer Health (India) Pvt. Ltd., New Delhi (2005).
2. Arun Bhatt, Clinical Trials and Good Clinical Practice in India, 1st edition, D.K. Publications, Mumbai (2006).

PC – 402: Concepts of Industrial Management and Intellectual Property Rights

M.M.:35

UNIT – I: Concepts of Industrial Management

Nature and significance of management, functions of management, social responsibilities of management. New industrial policy. Multinationals. Nature, scope and significance of personnel functions in modern organizations. Human resource planning, recruitment and selection process, employees training.

UNIT – II: Intellectual Property Rights

TRIPs – Its scope and options, the changing R & D processes and IPR, The IPR tool kit, patents, the patenting process, patent cooperation treaty.

UNIT – III: Intellectual Property Protections of Living Species

Compatibility between conventions, protecting inventions in biotechnology, protections of traditional knowledge, biopiracy and documenting traditional knowledge, some case studies: The basmati rice issue, revocations of turmeric patent, revocation of neem patent.

UNIT – IV: Exercising and Enforcing of Intellectual Property Rights

Rights of an IPR owner, licensing agreements, criteria for patent infringement, case studies of patent infringement, IPR – a contract, unfair competitions and control, provisions in TRIPs, some case studies.

UNIT- V: Role of Patents in the Pharmaceutical Industry

Recent changes in IPR laws impacting pharmaceutical industry, intellectual cooperation in the pharmaceutical industry, some case studies

Books Recommended

1. Fisher, Schoenfeldt, and Shaw, Human Resources Management, 3rded. , All India Publishers and Distributors, Chennai (1997).
2. P.B. Ganguli, Intellectual Property Rights: Unleashing the Knowledge Economy, Tata Mc Graw Hill (2001)
3. Steve Smith, The Quality Revolution, 1st ed., Jaico Publishing House (2002).
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M.Sc. Pharmaceutical Chemistry – 105 and 106
Ist semester
Practical Examinations

M.M.: 35

One day 6-8 hrs. (Each course)
Two exercises to be given in examination

CLASSICAL

1. Neutralization titration
 - (a) Determination of Acidity.
 - (b) Determination of free carbon dioxide.
 - (c) Determination of alkalinity.
2. Complexometric titration
 - (a) Determination of temporary and permanent hardness.
 - (b) Determination of total, calcium and magnesium hardness.
3. Precipitation titration
 - (a) Determination of chloride.
4. Redox titration
 - (a) Determination of ferrous iron.
 - (b) Determination of copper.

INSTRUMENTAL

1. Spectrophotometric/ Colorimetric determination
 - (a) Determination of nickel.
 - (b) Determination of hexavalent chromium.
2. Conductometric determination
 - (a) Determination of strength of acid against standard alkali.
 - (b) Find out the strength of mixture of acids in an unknown mixture.
3. pH metric determination
 - (a) Determination of strength of acid against standard alkali.
 - (b) Find out the strength of mixture of acids in an unknown mixture.

M.Sc. Pharmaceutical Chemistry – 205 and 206
2nd semester
Practical Examinations

M.M.: 35

One day 6-8 hrs. (Each course)
Two exercises to be given in examination

CLASSICAL

1. Physico-chemical analysis of water
 - (a) Determination of total dissolved and suspended solids.
 - (b) Determination of residual chlorine.
 - (c) Determination of chlorine demand.
 - (d) Determination of bicarbonate and carbonate alkalinity.
 - (e) Find out the concentration of sulphite.

2. Measurement of organic pollutant in the water
 - (a) Determination of Dissolved Oxygen (DO).
 - (b) Determination of Biological Oxygen Demand (BOD).
 - (c) Determination of Chemical Oxygen Demand (COD).

INSTRUMENTAL

1. Spectrophotometric/ Colorimetric determination
 - (a) Determination of nitrite.
 - (b) Determination of phosphate.
 - (c) Determination of sulphide.

2. Conductometric determination
 - (a) Determination of strength of alkali against standard acid.
 - (b) Find out the strength of mixture of acids in an unknown mixture against N/10 NaOH.

3. pH metric determination
 - (a) Determination of strength of alkali against standard acid.
 - (b) Find out the strength of mixture of acids in an unknown mixture against N/10 NaOH.

M.Sc. Pharmaceutical Chemistry – 305 and 306
3rd semester
Practical Examinations

M.M.: 35

One day 6-8 hrs. (Each course)
Two exercises to be given in examination

CLASSICAL

1. Find out the partition coefficient of iodine between CCl₄ and water.
2. Find out the COD of given industrial effluent.
3. Find out the DO of given industrial effluent.
4. Determination of adsorption isotherm of acetic acid from aqueous solution of activated charcoal.
5. Determination of saponification value of oil sample.
6. Determination of iodine value of given sample.

INSTRUMENTAL

1. Spectrophotometric/ Colorimetric determination
 - (a) Find out the composition of binary mixture calorimetrically.
 - (b) Simultaneous determination of Mn and Cr spectrophotometrically.
2. Conductometric determination
 - (a) Determination of solubility and solubility product of sparingly soluble salts.
 - (b) Find out the strength of mixture of acids in an unknown mixture against N/10 NH₄OH.
3. pH metric determination
 - (a) Find out the degree of dissociation of weak acid/weak base.
 - (b) Find out the strength of mixture of acids in an unknown mixture against N/10 NH₄OH.
4. Cyclic voltammetric determination
 - (a) To determine i_p , E_p and test of reversibility of the reaction of an organic compound.
5. Polarographic determination
 - (a) To determine the $E_{1/2}$ of the sample using d.c. Polarograph.
6. Chromatographic determination
 - (a) Identification of a sample compound and its separation from a binary mixture by
 - (i) Paper chromatography (ii) Thin layer chromatography and (iii) Electrophoresis.
7. Polarimetric determination
 - (a) Study of mutarotation of sugar solution by polarimetry.