UNIVERSITY OF RAJASTHAN
JAIPUR

SYLLABUS

M.A./M.Sc. PHARMACEUTICAL
CHEMISTRY

(ANNUAL SCHEME)

M.A./M.Sc. (Previous) Examination  2020
M.A./M.Sc. (Final) Examination  2021
**Syllabus: M.Sc. Pharmaceutical Chemistry**

**M.Sc. PHARMACEUTICAL CHEMISTRY**

(Two Year Course)

**Paper, Course No., Course, Duration of Exam., Max. Marks & Min. Marks**

**M.Sc. I YEAR (PREVIOUS)**

<table>
<thead>
<tr>
<th>Paper</th>
<th>Course No.</th>
<th>Course</th>
<th>Duration Hours</th>
<th>Max. Marks</th>
<th>Min. Marks</th>
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</thead>
<tbody>
<tr>
<td>Paper-I</td>
<td>PHC-1</td>
<td>Instrumental Techniques for Chemical Analysis</td>
<td>3</td>
<td>100</td>
<td>50</td>
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<tr>
<td>Paper-II</td>
<td>PHC-2</td>
<td>Basics of Computers</td>
<td>3</td>
<td>50</td>
<td>30</td>
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<tr>
<td>Paper-III</td>
<td>PHC-3</td>
<td>Bio-inorganic/Biophysical /Bio-organic Chemistry</td>
<td>3</td>
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<td>50</td>
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<td>Paper-IV</td>
<td>PHC-4</td>
<td>Organic Chemistry</td>
<td>3</td>
<td>100</td>
<td>50</td>
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<tr>
<td>Paper-V</td>
<td>PHC-5</td>
<td>Pharmaceuticals-I and Toxicology</td>
<td>3</td>
<td>100</td>
<td>50</td>
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<tr>
<td>Paper-VI</td>
<td>PHC-6(A)</td>
<td>Mathematics for Chemists*</td>
<td>3</td>
<td>50</td>
<td>18</td>
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<tr>
<td>or</td>
<td>PHC-6(B)</td>
<td>Biology for Chemists**</td>
<td></td>
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**Practical**

<table>
<thead>
<tr>
<th>Duration</th>
<th>Marks</th>
<th>200</th>
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<tr>
<td>14 hrs</td>
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* For students without Mathematics in B.Sc.
** For Students without Biology in B.Sc.

**Total Marks: 700**

**M.Sc. II YEAR (FINAL)**

<table>
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<tr>
<th>Paper</th>
<th>Course No.</th>
<th>Course</th>
<th>Duration Hours</th>
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<th>Min. Marks</th>
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<tbody>
<tr>
<td>Paper-VII</td>
<td>PHC-7</td>
<td>Pharmaceuticals, Biotechnology</td>
<td>3</td>
<td>100</td>
<td>50</td>
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<tr>
<td>Paper-VIII</td>
<td>PHC-8</td>
<td>Pharmaceuticals-II</td>
<td>3</td>
<td>100</td>
<td>50</td>
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<td>Paper-IX</td>
<td>PHC-9</td>
<td>Pharmaceutical Chemistry-I</td>
<td>3</td>
<td>100</td>
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<td>Paper-X</td>
<td>PHC-10</td>
<td>Pharmaceutical Chemistry-II</td>
<td>3</td>
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<td>Paper-XI</td>
<td>PHC-11</td>
<td>Chemical Engineering</td>
<td>3</td>
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<td>Paper-XII</td>
<td>PHC-12</td>
<td>Pharmaceutical Technology and Management</td>
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**Practical**

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<tbody>
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**Total Marks: 700**

**Grand Total (M.Sc. Previous & Final): 1400**

Practicals the terminal examination will be held at the end of
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that in case where a candidate requires more than 25% marks in order to reach the minimum aggregate as many marks out of those actually secured by him will be taken into account as would enable him to make up the deficiency in the requisite minimum aggregate.

5. That Thesis/Dissertation/Survey Report/Field work shall be type written and submitted in triplicate so as to reach the office of the Registrar atleast 3 weeks before the commencement of the theory examinations. Only such candidates shall be permitted to offer Dissertation/Field Work/Survey Report/Thesis (if provided in the scheme of examination) in lieu of a paper as have secured atleast 55% marks in the aggregate of all the papers prescribed for the previous examination in the case of annual scheme irrespective of the number of papers in which a candidate actually appeared at the examination.

6. In case of any clarifications or ambiguity the rules for university M.Sc. Chemistry annual scheme will be followed.

M.Sc. PHARMACEUTICAL CHEMISTRY
(2 Years Programme, Annual Scheme)
M.Sc. I Year (Previous)

PHC-I: Instrumental Techniques for Chemical Analysis
Time: 3 hours Max Marks: 100

Unit-I

Ultraviolet-visible Spectroscopy: Introduction, energy of electronic excitations, absorption laws, chromophores and auxochromes, solvent effects on UV absorption, conjugated dienes, the Woodword Fieser rules for dienes, enones, UV spectra of polynuclear aromatics, hydrocarbons and heterocycles.

IR Spectroscopy: Introduction, force constants, stretching and bending modes, and their energy, absorption by various functional groups, fingerprint region, overtones, combination tones, Fermi resonance, factors influencing vibration frequencies, variation in the carbonyl frequencies, introduction to FTIR spectroscopy.

Unit-II

Nuclear Magnetic Resonance Spectroscopy: Introduction, equivalent and non-equivalent protons, chemical shifts, factors affecting chemical shifts, spin-spin coupling, splitting patterns (AX, AB, AMX, ABX), spin decoupling, deuterium labelling, chemical exchange, coupling constants (geminal, vicinal, long-range), NOE, shift reagents.
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UNIT-I

13C NMR Spectroscopy: Introduction, 13C chemical shifts, off resonance spectra, 13C-H and 13C-1H coupling, introduction to FT NMR spectroscopy, interpretation of 13C spectra of simple molecules.

UNIT-III

Mass Spectrometry: Electron impact line diagram of mass spectrometer, molecular ion peak, base peak, metastable ion, doubly charged ion, nitrogen rule, isotopic abundance and calculation of molecular formula, isotopic profile of halogen compounds, fragmentation patterns, simple cleavage, retro-Diels Alder cleavage, hydrogen transfer, rearrangement like scrambling, ortho effect, McLafferty rearrangement. Fragmentation pattern of simple aliphatic and aromatic compounds. Elementary idea of chemical ionization and negative ion mass spectrometry.

UNIT-IV

ORD, CD, Octant rule, Cotton effect and their application in determination of stereo-structures, α-axial haloketone rule.

Spectrophotometry: Fundamental concepts, instrumentation for absorption measurement, applications of absorption spectroscopy to qualitative and quantitative analysis.

X-Ray Crystallography: Fundamental concepts, unit cells and Bravais lattices, Miller Indices, diffraction of X-rays by crystalline solids.

UNIT-V

Simple structural problems based on UV, IR, 1H NMR, 13C NMR and MS spectrometry.

Books Recommended


PHC-2: Basics of Computers

Max. Marks: 50

UNIT-I

Time: 3 hours

Introduction to Computers: Characteristics, history, generation, classification, hardware, software, programming languages, computer architecture and I/O devices, secondary storage devices, networking, computer applications.

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UNIT-II

Computer Organisation: Basics of primary memory and CPU, overview of number system; decimal, binary, octal and hexadecimal, representing real values, integer, and real arithmetic.

UNIT-III

Introduction to MS-Office: MS-word, MS-excel, MS-PowerPoint, MS-access.

UNIT-IV

Algorithm Development: Problem analysis, flow chart, data flow diagram, fields, vectors and files, searching, sorting and merging, basic concepts of simulation.

UNIT-V

Computer Programming in FORTRAN/BASIC: (The language features are listed here with reference to FORTRAN. The instructor may choose another language such as BASIC or C and the features may be replaced appropriately). Elements of the computer language. Constants and variables. Operations and symbols. Expressions. Arithmetic assignment statement. Input and output. Format statement. Termination assignment statement. Conditional statements such as IF or GO TO statement. LOGICAL variables. Double precision variables. Subscript variable and DIMENSION. DO statement. FUNCTION and SUBROUTINE. COMMON and DATA statements.

Books Recommended:

7. PHC-3: Bioorganic, Bio-organic and Biophysical Chemistry

Max. Marks 100

UNIT-I

Time: 3 hrs.

(I) Role of bulk and trace metal ions in biological systems

Micronutrients, active transport of Na, K, Mg and Ca ions across biological membranes, elements of bioenergetics with special reference to elements of high energy phosphate bond.
(II) Chlorophylls and their role in photosynthesis.
(III) Haemoglobin & Myoglobin
(IV) Iron storage and transport, Copper proteins
(VI) Nitrogen fixation, its mechanism, nitrogenase, dinitrogen complexes as models for nitrogen fixation.
(VII) Role of metals & non-metals in metabolism, metal & non-metals deficiency, toxicity, use of coordination compounds in medicine.

Unit-II: Molecular Orbital Theory
Molecular Orbital Treatment of structure of hydrogen molecule and hydrogen molecule ion. Molecular orbitals of homo and heteronuclear diatomic molecules, correlation diagrams, self consistent field equation and molecular orbital energies. MO theory of polyatomic molecules of the type AX2, AX3, AX4, AX5, AX6.
Details of Crystal Field Theory for weak and strong field complexes, comparison of VBT and CFT theories. Measurements of 10 Dq and factors affecting it. Thermodynamic aspects of crystal fields. John-Teller effect, Complexes, of non cubic symmetry.

Unit-III:
Brief review of laws of thermodynamics, concept of enthalpy, free energy, entropy, fugacity and activity, partial molal properties, chemical potential and their determination, thermodynamic function of mixing of free energy and mixing of entropy respectively. Formulation of equilibrium law, equilibrium constant and its variation with pressure and temperature, reaction isotherms and reaction isochores. Osmosis, osmotic pressure, thermodynamics of osmosis and the Donnan equilibrium.

The activities of ions in solution, the mean activity coefficient, Debye Huckel limiting law for calculating mean activity coefficients, significance of ionic strength in reactions.
The stability of colloids and the formation of micelles and critical micelle concentration, electrokinetic potential and electrical double layer in the stability of colloids. Micellar catalysis and inhibition in simple first and second order reactions. Stability of biomolecules in solution, denaturation, methods of stabilization, lipid membrane confirmation and bioprocess applications. Corrosion, the type of corrosion, the rate of corrosion, inhibition of corrosion, passivity, corrosion control pourbax diagram.

Unit-IV
Recapitulation of differential rate laws, rate constants and reaction order, integrated rate laws and their characteristics reaction approaching equilibrium, reversible, parallel and consecutive first order reactions, microscopic reversibility and detailed balance, mechanism of photochemical chain (H2+Br2) and oscillating reactions (B.Z. reaction)
Viscosity of a liquid, diffusion, Ficks law of diffusion, mobility of an ion, encounter pairs, diffusion controlled reactions in liquid, relaxation time for one step reaction, primary kinetic salt effect, diffusion and Brownian motion, kinetics of hydration of CO2.

Unit-V
Rate of surface processes, catalytic activity at the surface, adsorption and catalysis, mechanism of surface reactions, catalyst support, catalyst preparation, kinetic parameter of heterogeneous catalytic reaction. Rates in homogeneous catalyst and acid base catalysis. Pharmaceutical applications of surface phenomenon, enzymes, purification, characteristics of enzymes, kinetics of enzyme catalysis and inhibition only for 1:1 enzyme-substrate system.

Books Recommended:
5. Surface Chemistry, Adamson.
6. Physical Chemistry, Alberty.
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PHC-I : Organic Chemistry

Max. Marks : 100

Unit-I

Concept of Aromaticity: Huckel’s rule and its limitations, Benzenoid and non-benzenoid compounds, cyclopentadienyl anion, tropolyl cation, syndones, azulenes, annulenes, heteroannulenes, kekulene, catenanes, fullerenes (C_{60}), non-aromaticity versus antiaromaticity, homoaromaticity.

Methods of Determining Mechanisms: Mechanisms of esterification and hydrolysis reactions. Applications of Hammett and Taft equations with respect to structure and reactivity.

Structure, formation and proofs of participation in chemical reactions of the following:
1. Non-classical carbonium ions, neighbouring group participation
2. Carbenes
3. Nitrenes
4. Benzynes

Unit-II


Unit-III

Reagents in Organic Synthesis: N-Bromosuccinimide, SeO_{2}, Gilman’s reagent, Lithium disopropylamide (LDA), Osmium tetroxide, tetracyclohexylearboximide, 1,3-dithiane (reactivity Umpolung), phase-transfer catalysis, Wilkinson’s catalyst, Raney nickel, lead-tetraacetate, periodic acid, peracids, diazomethane, ozone.

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Unit-IV

Synthetic applications, mechanisms and stereochimistry (wherever applicable) of the following organic reactions and molecular rearrangements: Wolff-Kishner, Clemmensen, Birch, Meerwein-Ponndorff-Verley (MPV), reductions, Oppenauer oxidation, Baeyer-Villiger oxidation, Michael addition, Dieckmann, Stobbe condensation, Mannich, Reformatsky, Wittig, Carothers, Gatterman, Stork-enameine, Ulmann, Gabriel synthesis of primary amines. Amin-Eisier synthesis, Aldol, Perkin, Hofmann, Lossen, Curtius, Schmidt, Beckmann, Fries, Favorovski, Wolf, Pinacol-pinacolone, Sharpless asymmetric epoxidation, Barton, Wagner-Meerwein rearrangement.

Unit-V

Pericyclic Reactions: Woodward-Hoffmann rules for conversation of orbital symmetry in concerted reactions, analysis of electrocyclic, cycloaddition (Diels-Alder reaction and Ene reaction) and sigmatropic reactions using:
1. Symmetry correlation diagrams.
2. HOMO-LUMO interactions.
3. Hückel-Mobius concept.
   Sigmatropic rearrangement (Cope, Ugi, Claisen).

Books Recommended:

PHC-5: Pharmaceuticals-I & Toxicology

(The Pharmacological basis of Therapeutics)

Max. Marks : 100

UNIT-I

Pharmacokinetics: Introduction, defining drug absorption, disposition and elimination using pharmacokinetics, important pharmacokinetic parameters used in defining drug disposition and in therapeutics, use of pharmacokinetics in drug development process.

Pharmacodynamics: Introduction, enzyme stimulation, enzyme inhibition, sulphonamides, membrane active drugs, drug receptors.
receptors, receptors for physiological regulatory molecules, regulation of receptors, classification of receptors and drug effect, action of drugs not mediated by receptors, quantization of drug-receptor interactions and elicited response.

UNIT-II

Drug metabolism: Definitions and concepts, types of metabolic reactions effecting xenobiotics, specificities and selectivities in xenobiotic metabolism, biological factors effecting drug metabolism, biotransformations, metabolic reactions, conjugate reactions, significance of drug metabolism in medicinal chemistry.

Principles of toxicology and treatment of poisoning: Introduction, doseresponse relationship, risk, spectrum of undesired effects, descriptive toxicity tests in animals, LD-50, incidence of acute poisoning, prevention of further absorption of poison; enhanced elimination of poison, antagonism or chemical inactivation of an absorbed poison.

Principles of therapeutics: Therapy as science, individualization of drug therapy, drug regulation and development, therapeutic jungle, sources of drug information.

UNIT-III

Drugs affecting cholinergic mechanism: Introduction, aspects of cholinergic system, cholinergic drugs, anticholinesterase agents, antidote for ACHP inhibitors, memory and Alzheimers disease, cholinergic blocking agents, neuromuscular blocking agents.

Drugs affecting androgenic mechanism: Androgenic concepts and synthesis, catabolism, catecholaminergic receptors, indirect sympathomimetics α-receptors.

UNIT-IV

Steroids and therapeutically related compounds: Primary therapeutic classes, structural variation for modifying pharmacokinetic properties, sex hormones, estrogens and progestins, antiestrogens, androgens and anabolic agents, antiandrogens, chemical contraceptive agents. Other methods of chemical contraception, LH-RH agonists and antagonists, adrenal cortex hormones, cardiac steroids, other activities of steroids.

UNIT-V


Detailed toxicity (mild/moderate/severe toxicity wherever applicable) and treatment of drugs such as salicylates, paracetamol, opium, quinine, ethyl alcohol, nicotine, digitalis, barbiturates, etc.
Carbohydrates and metabolism: Configuration and chemical transformations of carbohydrates, absolute configuration of carbohydrates, general concepts, energetics and control in metabolic pathways. Glycolysis and citric acid cycle, phospho- and glycolipids.

Books Recommended:
3. Pharmaceutical Biotechnology-Vyas and Dixit
4. Industrial Microbiology- L.C. Casida
9. Coulson & Richardson, Chemical Engineering, PHC-8: PHARMACEUTICALS-II

Max. Marks: 100  Time: 3 hours

Unit I

Analgesics and ant-inflammatory agents: Introduction, classification of pain, classification of analgesics, mild analgesics, prostaglandins, nonsteroidal anti-inflammatory agents, opioids and strong analgesics, the opiate receptor, endogenous reception, ligands, multiple opiate receptors.

Antimicrobial drugs: The antibiotics, cell wall synthesis inhibitors, cell wall biosynthesis, the β-lactam ring - the enchanting structure and other bicyclic β-lactams, monolactams, β-lactamase inhibitors, antibiotics inhibiting protein synthesis. Local antinfective agents, the 4-quinolones, nonbenzodiazepino compounds, parasitic diseases, drugs used in the chemotherapy of protozoal infections-malaria, leishmaniasis, amoebiasis, giardiasis, trichomiasis, antifungal agents, antiviral agents, urinary tract antinfectives, antituberular agents, antileprosy agents, anthelmintics, sulphonamides, trimethoprim, sulphanilamethoxazole.

Unit IV
Structure, stereochemistry, nomenclature and therapeutic uses of Vitamins: Fat soluble vitamins (A, D, E and K), water soluble vitamins (folic acid, B₁, B₂, B₆, B₁₂, and C).

General and local anaesthetics: Ethers, halogenated hydrocarbons (halothane), cyclopropane, nitrous oxide, intravenous anaesthetics (barbiturates), local anaesthetics; cocaine and synthetic compounds, esters, benzoic acid derivatives, amines, miscellaneous anaesthetics.

Hormones and Related Drugs: Steroids, sex hormones and related compounds estrone, androgen, progesterational agents, contraceptives, adrenal cortex hormones, thyroid hormones and antithyroid drugs, pancreatic hormones, hypothyroidism hormones.

Disinfectants and Antiseptics: Phenol and homologs (chlororesol, chloroxylenol, hexachlorophene, amylmetaeresol), dyes, hydroxybenzoic acid, hydroxyquinolines, quaternary ammonium compounds, halogen derivatives, chloramine, dibromopropionate, isethionate, chloroethidine HCl, Dyes (crystal violet, brilliant green), thiomersal, alcohol.

Books Recommended:
1. Introduction to Medicinal Chemistry, Alex Fringua, Wiley-VCH
2. Wilson and Gisvolds, Text Book of Organic Medicinal and Pharmaceutical Chemistry
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Pharmaceutical Chemistry, Ed, Robert F. Dorge.

PHC-9 : Pharmaceutical Chemistry-1
Max. Marks : 100 Time : 3 hours

Unit-I
From Discovery to Market : The development of pharmaceuticals.
Introduction, historical development, classification and nomenclature of drugs, evolution of drug development, cost of drug development, the drug development process, chemistry, preclinical studies, transition from practical to clinical, planning the drug development process, clinical research, the conduct of clinical trials, regulatory review during the conduct of clinical trials.

Drug Design : Development of new drugs: Introduction, procedure followed in drug design, the search for lead compounds, molecular modification of lead compounds, prodrugs and soft drugs, produgs: Introduction, produrg formation of compounds containing various chemical groups, multiple produrg formation, soft drugs: design of soft drugs.

Unit-II
Structure-Activity Relationship (SAR) : Factors affecting bioactivity, resonance, inductive effect, isostericism, bioisostericism, spatial considerations, biological properties of simple functional groups, theories of drug activity, occupancy theory, rate theory, induced-fit theory, quantitative structure-activity relationship (QSAR) : History and development of QSAR, drug receptor interactions, the additivity of drug contributions, physicochemical parameters, lipophilicity parameters, lipophilicity contribution and calculation of partition coefficients, polarizability, electronic parameter, ionization constants, steric parameters, chelation parameters, surface activity parameters, redox potential, indicator variables, quantitative model. Hansch analysis, Free-Wilson analysis, their application, relationship between Hansch and Free-Wilson analysis (the mixed approach), non-linear relationship, introduction to other QSAR approaches.

Unit-III
Design of enzyme inhibitors, 9-alkylpurines, 9-mercaptopurines and allpurines, active site-directed irreversible enzyme inhibition, suicide enzyme inhibitors. Introduction to molecular modeling using computers, uses of molecular modeling manual use, further computer programming, X-ray crystallography.

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Structure-based drug design: Process of structure-based drug design, deactivation of certain drugs necessary for T cells functioning, determination of the active site with special reference to cytometrykin design of inhibitors.

Antibiotics : Synthesis and therapeutic uses of penicillin G, penicillin V, ampicillin, amoxycillin, cefalaxin, cefazolin, cefaclor, ceforanide, griseofulvin, chloramphenicol, adriamycin, mitomycin C.

Unit-IV
Isolation, synthesis, stereochemistry (structure elucidation excluded) and therapeutic importance of:
Anticancer drugs : Catharanthus alkaloids (vinorelbine), taxol and its analogs podophyllotoxin (etoposide, teniposide), camptothecin, maytansine.
Antimalarial drugs : Cinchona alkaloids (quinine), artesunate.
CNS drugs : Opium alkaloids (morphine and its congeners), cannabinoids, reserpine.
Cardiovascular drugs : Cardiac glycosides (digoxin, digitoxin), diuretics, warfarin, ajmaline, reserpine, vincamine, guggul lipid.

Unit-V
Anaesthetic drugs : Cocoa alkaloids (cocaïne), antiarrhythmics quinidine, antiinflammatory-glyceryl ether, antiasthma drugs - ephedrine, antifertility - gossypol.
Prostaglandins : General study, nomenclature, biological activity, biosynthesis, structure of PG E2 and synthesis of key intermediates.

Books Recommended:
1. Natural Products Chemistry, A Mechanistic and B synthetic Approach to Secondary Metabolism, K.B.G. Torsell, John Wiley & Sons Ltd.
2. Natural Products, their chemistry and biological significance, Mann, Davidson, Hobbs, Banthorpe and Harborne, Longman.
5. Introduction to Medicinal Chemistry, Alen-Gringuist, Wiley-VCH.

PHC-10 : Pharmaceutical Chemistry-II
Max. Marks : 100 Time : 3 hours

Synthesis....
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Antineoplastic agents: Mechloretamine, cyclophosphamide, melphalan, chlorambucil, busulfan, uracil mustard, fluorouracil, 6-mercapto purine, methotrexate.

Analgesics and Antipyretics: Pethidine, diclofenac, acetaminophen, phenacetin, aspirin, antipyrine, aminopyrine, phenylbutazone, oxyphenbutazone.

Antiinflammatory agents: Indomethacin, ibuprofen, diclofenac, naproxen.

Antimalarias: Chloroquine, amodiaquine, primaquine, proguanil, trimethoprim, mefoprin.

Unit-II

Antihelminthics: Quinacrine, niridazole, thiabendazole, mebendazole.
Antibacterials: Sulphonamides, sulphanilamide, sulphacetamide, salazopyrine, sulphacetamide sodium, silver sulphadiazine, furazolidone, nildixic acid, ciprofloxacin, norfloxacin.
Antileprosy agents: Dapsone, MDT (dapsone, clofazimine and rifampicin).
Antitubercular agents: Aminosalicylic acid, isoniazid, ethambutol, thiambutone, Ethionamide.

Unit-III

Antifungal agents: Benzoic acid, salicylic acid, econazole.
Anticholinergic agents: Dicyclomine, cyclopentolate, nefopam.
Antihistaminic agents: Chlorpheniramine, cimetidine, ranitidine, diphenhydramine, mepyramine, promethazine, chlorcyclizine.
Antidiabetic agents: Tolbutamide, glipizide, chlorpropamide.
Recent developments in diabetic therapy.
Diuretics: Thiazide, thiazide, amiloride, chlorothiazide, frusemide, bumetanide.

Unit-IV

Psychoactive drugs:
Sedatives and Hypnotics: Barbiturates, nitrazepam, thiopental, sodium, glutethimide, nitrazepam.
Anticonvulsants: Phenobarbital, primidone, phenytoin.
Antianxiety agents: Meprobamate, diazepam, clorazepate, alprazolam, buspirone.

Unit-V

Antipsychotics: Chlorpromazine, fluphenazine, prochlorperazine.
Antifertility agents: Norethynodrel, norethynodrel, norgestrel, mestranol, 17a-ethyl estradiol, tamoxifen, centoehromen.
Anti AIDS: AZT
Cardiovascular agents:
(i) Antiarrhythmic: Procaainamide, Disopyramide.

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(i) Antihypertensive: Guanethidine, methyldopa, clonidine, metoprolol.

Books Recommended:
3. Introduction to Medicinal Chemistry, A. H. Grimshaw, Wiley - VCH.

PHC-11: Chemical Engineering

Max. Marks: 50

Unit-I

Fluid flow: Manometers, decanters, pipe fitting and valves. Bernoulli equation, pumps, reciprocating pumps, rotary pumps, centrifugal pumps (excluding theory), fans, blowers and compressors, vacuum pumps, venturimeters, orifice meters.
Heat Transfer: Modes of heat transfer, heat exchange.
Mass Transfer: Principles of stage processes, Drying: A brief description of the basic principles and applications of the following dryers: tray dryers, flash dryers, rotary dryers, thin film dryers, drum dryers, and spray dryers.

Unit-II

Distillation: Vapor-liquid equilibrium, partial vaporisation, partial condensation, partial pressure, (Dalton's law), relative volatility. Types of distillation: fractional distillation of binary mixtures, fractionating columns, calculations of number of plates for Lewis-Sorel and Mc Cabe Thiel methods, efficiency of number of plates, distillation, azeotropic distillation, extractive distillation, steam distillation.

Unit-III

Filtration: Introduction, classification of filters, filter process chamber, process, plate and frame filters, shell and tube filters, rotary drum filter, filter aids and auxiliaries. Filtration theory, constant pressure filtration, constant rate filtration, washing of filter cakes. Centrifugation: batch top driven centrifuge, batch below driven centrifuge, disk type centrifuge.
Crystallization: Principles of crystal growth, super saturation, nucleation, rate of crystallization, fractional crystallization, crystal growth, types of crystallization.

Unit-IV

Chemical Process Development: Process design development, technical evaluation of new project, plant location, plant layout, plant
Unit Processes
Industrially feasible C-C bond formation and cleavage: reactions, oxidations, reductions, sulphonation, nitration, halogenation and their applications to manufacture of known drugs.

Books Recommended:
4. Max Peters, Elementary Chemical Engineering.

PHC-12: Pharmaceutical Technology and Management
Max. Marks: 50
Time: 3 hours

Unit-I
Introduction to different pharmaceutical dosage forms and various modes of administration.
Processing of Tablets: Types of tablets, granulation - manufacture of granules, their basic characteristics and properties with reference to different types of substances. Various additives included in formulation of tablets. Compression of tablets, compressing machines and their tooling, processing problems and their remedy, standardisation and evaluation of tablets as per official standards.

Unit-II
Coating of Tablets: Principles and equipment, taste masking, sugar coating, tensile strength of films, evaluation of coated tablets, defects of films.
Microencapsulation: Its importance and applications in pharmaceutical formulations, techniques and equipment for microencapsulation.

Unit-III
Quality assurance: GMP, cGMP, GLP, GCP, TQM, ISO-9000, process validation, Pharmacopoeia (IP, USP, BP) and assay, regulatory

M.Sc. Pharamaceutical Chemistry Practical
Max. Marks: 200
Time: 14 hrs.
(Spread over 2 days)

1. Preparation of organic compound of medicinal interest involving 2 to 3 steps
2. Techniques of purification: Vacuum distillation, column chromatography, sublimation, separation and identification of the components of a tablet using preparative TLC.
3. Separation and identification of components of ternary organic mixture using chemical methods and spectral data
4. Preparation and evaluation of the following.
Emulsion, simple syrup, aqueous iodine, strange iodine, calamine lotion, boroglycerine, tannic acid, glycerine, phenol, glycerine, peppermint water, rose water, non-staining iodine ointment cum methyl salicylate, formulation of ointment, stability studies of tablets, capsules, syrups.

5. Perform one of the following experiments:
   1) Quantitative applications of IR spectroscopy.
   2) Identification of isomers using proton NMR.
   3) Determination of specific rotation of ibuprofen and determination of percentage in the unknown sample.
   4) Volumetric determination of ibuprofen in the given tablet.
   5) Spectrophotometric determination of aspirin content in the soluble aspirin tablet.
   6) Spectrophotometric determination of paracetamol in the tablet.
   7) Extraction and spectrophotometric determination of oxyphenylbutazone.
   8) Analysis of ampicillin trihydrate.
   9) Determination of Vitamin B1 in given tablet.
   10) Determination of Vitamin B2 in given tablet.
   11) Determination of ephedrine hydrochloride in given syrup.
   12) Determination of tetracycline in the given capsule.
   13) Determination of phenobarbitone in the given cough syrup.
   14) Extraction of cholesterol from gall stones and its analysis.
   15) To perform I.P. monograph of tablet.
   16) To perform I.P. monograph of hard gelatine capsule.
   17) Evaluation of injections.
   18) Determination of chloramphenicol in given capsule.

6. Viva-voce

7. Laboratory Record

[Signature]

By, Registrar
(Academic)
University of Rajasthan
Jaipur