M.Sc. Prospectus No. 20111242
Sem.I to IV (Pharm. Chem.)

SANT GADGE BABA
AMRAVATI UNIVERSITY

विज्ञान विभाग
(FACULTY OF SCIENCE)

PROSPECTUS
OF
M.Sc.PART-I (SEMESTER-I & II)
EXAMINATIONS 2010-2011
&
M.Sc. PART-II (SEMESTER-III & IV)
EXAMINATIONS 2011-2012

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विद्यापीठातील पूर्णूपीत जिवंत कोणासोही पुनरुक्तित किंवा प्रकाशित करता वेगार
नाही.’

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SANT GADGE BABA AMRAVATI UNIVERSITY
SPECIAL NOTE FOR INFORMATION OF THE STUDENTS

(1) Notwithstanding anything to the contrary, it is notified for general information and guidance of all concerned that a person, who has passed the qualifying examination and is eligible for admission only to the corresponding next higher examination as an ex-student or an external candidate, shall be examined in accordance with the syllabus of such next higher examination in force at the time of such examination in such subjects papers or combination of papers in which students from University Departments or Colleges are to be examined by the University.

(2) Be it known to all the students desirous to take examination/s for which this prospectus has been prescribed should, if found necessary for any other information regarding examinations etc., refer the University Ordinance Booklet the various conditions/provisions pertaining to examination as prescribed in the following Ordinances.

Ordinance No. 1 : Enrolment of Students.
Ordinance No. 2 : Admission of Students.
Ordinance No. 4 : National cadet corps.
Ordinance No. 6 : Examinations in General (relevent extracts)
Ordinance No. 18/2001 : An Ordinance to provide grace marks for passing in a Head of passing and Improvement of Division (Higher Class) and getting Distinction in the subject and condonation of deficiency of marks in a subject in all the faculties prescribed by the Statute NO.18, Ordinance 2001.
Ordinance No. 9 : Conduct of Examinations (relevent extracts)
Ordinance No. 10 : Providing for Exemptions and Compartments.
Ordinance No. 19 : Admission of Candidates to Degrees.
Ordinance No. 109 : Recording of a change of name of a University student in the records of the University.

PATTERN OF QUESTION PAPER ON THE UNIT SYSTEM.

The pattern of question paper as per unit system will be broadly based on the following pattern:

(1) Syllabus has been divided into units equal to the number of question to be answered in the paper. On each unit there will be a question either a long answer type or a short answer type.

(2) Number of question will be in accordance with the unit prescribed in the syllabi for each paper i.e. there will be one question on each unit.

(3) For every question long answer type or short answer type there will be an alternative choice from the same unit. However, there will be no internal choice in a question.

(4) Division of marks between long answer and short answer type question will be in the ratio of 40 and 60

(5) Each short answer type question shall contain 4 to 8 short sub question with no internal choice.

Dineshkumar Joshi
Registrar
Sant Gadge Baba
Amravati University.
Syllabus Prescribed for M.Sc. Pharmaceutical Chemistry

Semester I

ISA-I: Inorganic Chemistry

Unit I
(A) Symmetry: Molecular symmetry, representation of symmetry operations as matrices, set of symmetry operations of molecules satisfying the conditions of point groups, multiplication tables.


Unit II

(B) Molecular orbital theory: A brief introduction to ICAD method. Resonance integral, energy level diagrams for O2, F2, CO, CO2, PH3, BF3, NO, NO2, NO3 and H2O. Molecular orbital description of tetrahedral and octahedral complexes of transition metals.

Unit III
Crystal Field Theory: Splitting of energies of orbital under octahedral, tetrahedral and square planar environment, magnetic properties of complexes in terms of CFT. Crystal field stabilization energy and heats of ligation, Lattice energy, Terms and Symbols, Selection rules, Hole formulation, electronic spectra of co-ordination complexes. (Orgel diagrams of d1-d9 tetrahedral and Octahedral Complexes. Limitation of CFT. Stability of co-ordination complexes and factors effecting the stability. Nephelauxetic effect, ligand field theory. Calculation of B and 10Dq from spectral data.

Unit IV
Introduction to ligands complexes and their reactivity: Thermodynamics stability in aqueous medium, general classification of ligands, Ligand substitution or exchange reaction to 4-coordinate square planer Complexes and 6-coordinate octahedral complexes. Redox or electron transfer Reactions. Outer and inner sphere mechanisms for multielectron redox reaction and ligand field considerations. Photochemical reaction of chromium and Ruthenium complexes. Fluoxional molecules iso- and heteropolyacids, metal clusters. Spin crossover in coordination compounds.

Unit V
(A) Industrial application of organometallics: General considerations, Homogenous catalysis by organometallics (Alkene Hydrogenation, Hydroformylation, pi-acid metal complexes, activation of small molecules by coordination

(B) Bioinorganic Chemistry: Metal ions in Biology, Molecular mechanism of ion transport across membranes; ionophores. Photosynthesis, PSL, PSH; nitrogen fixation, iron uptake proteins, cytochromes and ferrodoxins. Iron-sulphur proteins.

Books Recommended:
1. R.S. Drago, Physical Methods in inorganic Chemistry, Affiliated East-West Press (Section 1& 2).
2. H.B. Gray, Electrons and Chemical Bonding. (Section 2).
6. N.N. Greenwood and A.Earnshaw Chemistry of elements,Pergamon Press(Section 7).
7. Christopher master, Homogenous Transition metal catalysis (Section 8).

ISA2: Organic Chemistry

Unit I
Nature and Bonding in Organic molecules: Delocalized chemical bonding, conjugation, cross-conjugation, resonance, hyper-conjugation, bonding in fullerenes. Aromaticity in benzenoid and non-benzenoid compounds, alternant and non-alternat hydrocarbons Hückel’s rule, energy level of pi-molecules orbitals, annulenes, anti-aromaticity, homo-aromaticity. Aromatic character and chemistry of cyclopentadiene anion, tropylium cation, tropene and tropelene.

Unit II
Stereochemistry: Conformational analysis of cycloalkanes (5 – 8 membered rings), decalines, effect of conformation on reactivity, steric strain due to unavoidable crowding. Elements of symmetry, chirality, molecules with more than one chiral center, three and erythro isomers, method of resolution, optical purity, enantiotopic and diastereotopic atoms, groups and faces, stereospecific and sterseselective synthesis.
Asymmetrical synthesis, optical activity in absence of chiral carbon (biphenyl, allenes and spiranes). Stereochemistry of the compounds containing N, P and Sulphur.

Unit III
Selective organic name reaction: Aldol, Perkin, Stobbe, Dieckmann condensations; Hoffmann, Schmidt, Lossen, Curtius, Baeyer-Villiger reaction, Pinnacol rearrangement, Beckmann rearrangement the reaction and their mechanisms.

Unit IV
Chemistry of Heterocyclic compounds: Nomenclature of heterocyclic compounds. Heterocyclic ring system with one heteroatom: structure, synthesis and reactions of pyrrole, furan, thiophene, â-lactam and pyridine. Heterocyclic ring system with two heteroatom: structure, synthesis and reactions of imidazole, oxazole, thiazole, pyrazole, pyridine and pyrazine.

Unit V (A)
Nucleophilic aliphatic substitution: SN1 and SN2 reactions mechanisms, kinetics, structure and reactivity, stereochemistry, SN1 vs SN2 – role of solvents
(B) Electrophilic aromatic substitution: reactions mechanisms, proof for the mechanism, sulphonation, reversible reaction, theory of reactivity, theory orientation and synthesis, halogenations and Friedel-Craft reaction.

1SA-3 : Physical Chemistry

Unit I
Chemical statistical thermodynamic I

Unit II
Chemical statistical thermodynamic II

Unit III
Phase rule

Unit IV
Chemical Kinetics
Recapitulation of first, second and third order rate laws opposing reactions, parallel reactions, consecutive reactions. Photochemical reactions, quantum yield, transfer of excitation energy, actinometry, chain reactions, and oscillator reactions.


Unit V
Surface Chemistry and Catalysis:

1SA-4 : General Analytical Chemistry

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.

Books Recommended

Semester I
Lab I
ISA-5 : Organic Chemistry Practical
Marks: 50

Some of the following experiments to be taught
Unit I: - Basic Techniques
a) Calibration of thermometer and finding melting point, mixed melting point and boiling point.
b) Purification and drying of organic solvents.
c) Crystallization
d) Distillation, Fractional distillation, Distillation under reduced pressure.

Unit II: - Qualitative Analysis
Separation and identification of components of a mixture of two organic compounds (two solids, one solid and one liquid and all two liquids) using chemical methods or physical techniques. Purification of the compounds by crystallization. Chromatographic techniques (Minum of 10 mixtures to be done).

Unit III: - Quantitative Analysis
Student is expected to carry out following estimations
1) Estimation of Vitamin “C” Iodometry.
2) Estimation of Glucose by Benedict’s solution.
3) Estimation of Phenol by KBrO₃-KBr.
4) Estimation of Formaldehyde by Iodometry.
5) Estimation of Aldehyde by Oxidation method.
6) Estimation of Glucose in blood.
7) Estimation of Proteins in serum.
8) Fat determination in milk.
9) Determination of blood cholesterol.
10) Determination of acid and alkaline phosphatase.
11) Estimation of uric acid in serum and urine.
12) Estimation of chloride in serum and urine.
13) Estimation of liver glycogen.
14) Estimation of free fatty acids in serum.
15) Determination of creatinine and creatin in blood and urine.

Practical I
Organic Chemistry Practical
Time: 6-8 Hrs. (One day examination) Marks: 50
1) Exercise-1: Basic Techniques - 05 Marks
2) Exercise-2: Qualitative Analysis - 15 marks
3) Exercise-3: Quantitative Analysis - 10 marks
4) Record - 05 Marks
5) Viva-voce - 05 Marks
6) Internal Assessment - 10 Marks
Total Marks = 50 Marks

Semester I
ISA-6 : Laboratory II
Physical Chemistry Practical
Total Hours: 90 Hrs. (9 Hrs. /week)
Time: 6-8 Hrs. Marks: 50
Use of computer programs 5 terms of practicals
Treatment of experimental data, X-Y plots, programs with data preferably from Physical Chemistry practicals. Student will operate two packages I) MS-Word and II) MS-Excel.
Part-A
1) To study the surface tension concentration relationship for the solution and determination of surface excess concentration by using Gibb’s Adsorption equation.
2) To compare the cleansing power of two samples of detergents by surface tension method.
3) Distribution of solute between two immiscible solvents.
4) Kinetics of hydrolysis of an ester and comparison of relative strength of two acids.
5) To determine the rate constant of a reaction between ethyl acetate and caustic soda solution at two different temperatures and energy of activation.
6) Study the effect of catalyst on the decomposition of hydrogen peroxide.
7) Study the phase diagram of Naphthalene and Benzoic acid.
8) To study the effect of concentration of an electrolyte (KCl, NaCl) on the solubility of organic acid.

Part-B
1) Standardization of acid with a standard solution of base using pH meter.
2) Determine the pK values of amino acids by pH metry.
3) Titration of strong acid Vs strong base, weak acid Vs strong base, weak acid Vs weak base by conductometry.
4) Titration of mixture of strong acid and weak acid with a strong base by conductivity.
5) Determination of dissociation constant of acetic acid by conductometry.
6) Verify the Lambert-Beer law and determine the molar extinction coefficient: Copper sulphate pentahydrate or Potassium dichromate.
7) Measurement of optical rotation and study the mutarotation of glucose.
8) Titration of HCl with NaOH using potentiometer.
9) Determination of solubility and solubility product of sparingly soluble salt (PbSO₄, BaSO₄) conductometrically.
10) Determination of standard electrode potential of zinc and copper.
11) To determine the dipole moment of given liquid.
12) Determination the pK value of acid-base indicator (methyl red) by spectrophotometrically.

Practical II
Physical Chemistry Practical
Time: 6-8 Hrs. (One day examination) Marks: 50
1) Exercise-1 (Non-instrumental) - 15 Marks
2) Exercise-2 (Instrumental) - 15 marks
3) Record - 05 Marks
4) Viva-voce - 05 Marks
5) Internal Assessment - 10 Marks
Total Marks = 50 Marks
Semester II

2SA-1 : Biochemistry

Unit I
Bimolecules, Amino Acids and Proteins:

Unit II

Unit III
Biotechnological Application of Enzymes : Large scale production and purification of enzymes, techniques and method of immobilization of enzymes, effect of immobilization on enzyme activity, Application of immobilized enzymes use of enzymes as targets for drug design. Clinical uses of enzymes, enzyme therapy, enzymes and recombinant DNA technology.

Unit IV

Unit V
Membranes and Membrane Transport : Membrane structure, phoso and glycolipids, membrane proteins, Sodium potassium pump, Calcium and Sugar transport, Inophorous antibiotics.

Books Recommended :

   Chapters: 2, 3, 4, 6, 7, 8, 11, 12, 13, 24, 25, 26, 27, 33 and 36.
   Chapter: 1, 2, 3, 4, 5, 6, 7, 9, 12, 13, 14, 15, 16, 18, 19, 27, 28, 29, 30 and 34.

2SA-2 : Organic synthesis

Unit I

Unit II

Unit III

Unit IV

Unit V (A)
Application of cycloadditions in organic synthesis : Selection rules for cycloaddition ([2+2],[3+2],[4+2],[6+4]). The Dienes, Heterdienes, Dienophiles and 1,3-Dipoles. Lewis Acid Catlysis, Modern methods to affect cycloadditions (use of high pressure, aqueous medium, ultrasound etc.).
Asymmetric synthesis: Cram’s rule and its variations, Chiral auxillaries, Chiral Lewis acid catalysis. Asymmetric Reductions. Chiral reagents (Grignards reagent, Organocuprates, organo irons).

Paper VII

2SA-3 : Biophysical Chemistry

Unit I Water and Biophysical Interactions: Structure and Interactions, Water as a solvent, proton mobility. Intermolecular interactions effecting conformation of biomolecules; non-covalent interactions e.g., ionic bonds, dipole-dipole interactions, hydrophobic interactions, hydrogen bonds, dispersion forces etc.

Unit II Bioenergetics and Statistical Mechanics in Biopolymers: Standard free energy change in biochemical reactions, exergonic, endergonic. Hydrolysis of ATP, synthesis of ATP from ADP. Chain configuration of macromolecules, statistical distribution end to end dimensions, calculation of average dimensions for various chain structures. Polypeptides and proteins structures, Introduction to protein folding problem.

Unit III Thermodynamics of Biopolymer Solutions: Thermodynamics of biopolymer solutions, osmotic pressure, membrane equilibrium, muscular contraction and energy generation in mechanochemical system.


Unit V Experimental Techniques for the Determination of Size, Shape and Molecular Mass of Biopolymers:  
   i) Viscosity: Measurement, relation to geometry and correlation with hydrodynamic properties.  
   iii) Ultra centrifugation: Svedberg equation, sedimentation equilibrium, density gradient sedimentation.  
   v) Osmotic Pressure: Second virial coefficient, molecular mass and geometry from O.P. data, Donnan membrane effect, Drug absorption.

2SA-4 : General Pharmacology

Unit I Introduction of Human Physiology in relation to drug action, Sources and nature of drugs, routes of administration, factors influencing doses and drug actions.

Unit II Pharmacodynamics: Mechanism of drug action and sites of drug action including membrane and receptor concepts.

Unit III Central nervous system: General anaesthetics, methods of giving anaesthesia, stages of anaesthesia, narcotic analgesics, sedatives & hypnotics, barbiturate poisoning and treatment.


Semester II

2SA-5 Laboratory III

Inorganic Chemistry Practical

Exercise I: - Classical
A) Neutralization titration: - Determination of acidity, Determination of free carbon dioxide, Determination of alkalinity.  
B) Complexometric titration: - Determination of temporary and permanent hardness, Determination of total calcium and magnesium hardness.  
C) Precipitation titration: - Determination of chloride.  
D) Redox titration: - Determination of ferrous ions. Determination of copper.

Exercise II: - Synthesis
Preparation of inorganic compounds and their characterization by elemental analysis, M.W. determination, decomposition temperature and molar conductance studies (minimum 4)
1) \([\text{Vo} (\text{acac})_2]\)  
2) \(\text{Cis K}[\text{Cr(C}_2\text{O}_4)_2(\text{H}_2\text{O})_2]\)  
3) \(\text{Na}[\text{Cr(NH}_3)_2(\text{SCN})_4]\)  
4) \(\text{Mn} (\text{acac})_2\)
Exercise III: - Estimation

A) Quantitative Analysis of mixture of two cations.
Quantitative analysis of binary mixture of cations involving their chemical separation and separate analysis of one cation by gravimetric and volumetric or colorimetric.
Certain model examples are given as follow:
1) Copper (II) and Nickel (II)
2) Copper (II) and Zinc (II)
3) Nickel (II) and Zinc (II)
4) Copper (II) and Iron (II)

B) Analysis of Limestone, Dolomite and Bauxite.

Laboratory III
Inorganic Chemistry Practical

Time: 6-8 Hrs. (One day examination) Marks: 50
1) Exercise-1: Classical - 10 Marks
2) Exercise-2: Synthesis - 10 Marks
3) Exercise-3: Estimation - 10 Marks
4) Record - 05 Marks
5) Viva-voce - 05 Marks
6) Internal Assessment - 10 Marks

Total Marks = 50 Marks

Semester II
2SA-6 : Laboratory IV
Inorganic and Analytical Chemistry Practical

Practical worked 9 Hrs. per week Marks: 50
Quantitative Inorganic Analysis

1) Detection and determination of Ascorbic acid from biological sample.
2) Determination of Phosphates from plant samples by spectrophotometer.
4) Determination of Calcium from given drug sample by complexometry.
Laboratory IV
Inorganic and Analytical Chemistry Practical

The Principal examination will be based on Inorganic Chemistry
Time: 6-8 Hrs. (One day examination) Marks: 50
1) Exercise-1 (Based on Instrumental) - 15 Marks
2) Exercise-2 (Based on Separation method) - 15 marks
3) Record - 05 Marks
4) Viva-voce - 05 Marks
5) Internal Assessment - 10 Marks

Total Marks = 50 Marks

Semester III
3SA-1 : Modern Pharmaceutical Analytical Technique I

Unit I UV-VISIBLE SPECTROSCOPY:

Unit II (A) Flame emission spectroscopy and atomic absorption spectroscopy:
Principle, instrumentation, interferences and applications in Pharmacy.
(B) SPECTROFLUORIMETRY:
Theory, instrumentation, advantages, relationship of chemical structure to fluorescence spectra, solvent effect, effect of acids and bases on fluorescence spectra, concentration effects, factors affecting fluorescence intensity, comparison of fluorescence and UV-Visible absorption methods and applications in Pharmacy.

Unit III: INFRARED SPECTROPHOTOMETRY:
Introduction, basic principles, vibrational frequency and factors influencing vibrational frequency, instrumentation and sampling techniques, interpretation of spectra, applications in Pharmacy, FT-IR-theory and applications, Attenuated Total Reflectance (ATR).

Unit IV: NUCLEAR MAGNETIC RESONANCE SPECTROSCOPY:
Fundamental Principles and Theory, Instrumentation, solvents, chemical shift, and factors affecting chemical shift, spin-spin coupling, coupling constant, and factors influencing the value of coupling constant, spin-spin decoupling, proton exchange reactions, FT-NMR, 2D - NMR, NMDR, NOE, NOESY, COSY and applications in Pharmacy, interpretation of spectra, C13 NMR-Introduction, Natural abundance, C13 NMR Spectra and its structural applications.

Unit V: MASS SPECTROSCOPY:
Basic principles and instrumentation, ion formation and types, fragmentation processes and fragmentation pattern, Chemical ionization mass spectroscopy (CIMS), Field Ionization Mass Spectrometry (FIMS), Fast Atom Bombardment MS (FAB MS), Matrix Assisted laser desorption / ionization MS (MALDI-MS), GC-MS, interpretation of spectra and applications in Pharmacy.

3SA-2: Medicinal Chemistry I

Unit I Introduction to Pharmaceuticals, Historical Development, Classification of Drugs, Nomenclature of Pharmaceuticals, Drug metabolism reactions. 2. Structure, stereochemistry, nomenclature, mode of action, specific clinical applications and structure activity relationships of following classes of drugs and synthesis / commercial routes to specified drugs.

Unit II: QUANTITATIVE ANALYSIS OF STRUCTURE ACTIVITY RELATIONSHIP
a) History and development of QSAR.
b) Drug receptor interactions.
c) Physicochemical parameters.
d) Hansch analysis, Fee Wilson analysis, relationship between them.
e) Statistical methods – regression analysis, partial
least square analysis (PLS) and other multivariate statistical methods.
f) 3D QSAR approaches.

Unit II A) MOLECULAR MODELING IN DRUG DESIGN
Molecular mechanics, quantum mechanisms, known receptor sites, calculation of affinity, unknown receptors – pharmacophore models. Searching for similarity, molecular comparison, finding common pattern.

B) ANALOG DESIGN FROM LEAD MOLECULE.
Introduction, Bioisosteric replacement, rigid analogs, alteration of chain branching, changes in ring size, ring position isomers, design of stereo isomers and geometric isomers, fragments of a lead molecule, variation in inter atomic distance.

Unit IV PRODRUG DESIGN.
Introduction, chemical bond, gastro intestinal absorption, parenteral administration, distribution, transdermal absorption, pharmacokinetic and biopharmaceutical aspects, rationale of prodrug design and practical considerations.

Unit V Medicinal Chemistry of following group of drugs
a) Antiviral agents and agents under development of HIV infection.
b) Antineoplastic agents.
c) Antihypertensive agents.
d) Prostaglandins, leukotrienes and other eicosanoids.

3SA-3 : Advanced Organic Chemistry I
Unit I Techniques in drug development and synthesis will be dealt at advanced level. These include a deep knowledge of the following topics: 8 Hours
a) Chemical bonding (localized, delocalized and Bonding weaker than covalent)
b) Reaction intermediates (carbocations, carbanions, free radicals, carbenes and nitrenes)
c) Various types of mechanisms and methods of determining them.
d) Acids and Bases.
e) Effect of structure on Reactivity.

Unit II Detailed knowledge to be imparted in the following topics:
a) Substitution reactions (aliphatic nucleophilic, aromatic electrophilic, aliphatic electrophilic, aromatic nucleophilic and free radical).

3SA-4 : Natural Products of Medicinal Interest
Unit I Alkaloids- General introduction and classification, isolation and purification methods, general methods employed for determining the structure of alkaloids, constitution of morphine, reserpine and quinine.

Unit II Steroids- General introduction, stereochemistry, nomenclature and structure elucidation of steroids (cholesterol), sapogenin (diosgenin) and cardiac glycosides.

Unit IIIA) Flavonoids - Detailed chemical account of rutin and quercetin. 8 Hours.
B) Triterpenoids – A general chemical treatment and structural elucidation of terpenoids.

Unit IV A) \( \beta \) - LACTUM ANTIBIOTICS.
Mechanism of action, penicillins, cephalosporins, nocardicins and monobactums, carbapenems and penems, \( \alpha \)-lactamase inhibitors and other\( \alpha \)-lactum agents.

B) NON \( \beta \) - LACTUM ANTIBIOTICS.
Amino glycosides, macrolides, linomycins and polypeptide antibiotics.

Unit V AWARENESS OF THE ACTIVE CONSTITUENT OF CERTAIN CRUDE DRUGS USED IN INDIGENOUS SYSTEM. 6 Hours.
b. Liver dysfunction – phyllanthus niruri.
c. Antitumor – curcuma longa Linn.

Semester III
3SA-5 : Laboratory V
Organic Chemistry Practical

Unit I: - Organic Synthesis
Typical preparations from which the single and two stage preparations can be chosen are
1) Toluene- p-nitrotoluene- p-nitrobenzoic acid- p-aminobenzoic acid.
2) Benzene- Acetophenone-Acetophenone oxime-Acetanilide.
3) Benzaldehyde-Benzoin-Benzil-Benzilic acid.
4) Nitrobenzene-m-di-nitrobenzene-m-nitroaniline-m-nitrophenol.
5) Phthalic acid-Phthalic anhydride-Phthalimide-Anthranilic acid.
6) Anthranilic acid-Phenylglycine-orthocarboxylic acid-indigo.
8) Aniline-Acetanilide-p-nitroacetanilide- p-nitroaniline.
9) Benzophenone- Benzophenone oxime-Benzenanilide.
10) Aniline-Phenyl thiourea-2-amino benzothiazole.
11) Phthalic anhydride-O-benzoyl benzoic acid-anthraquinone.
12) Chlorobenzene-triphenyl carbonil-trityl chloride.

Unit II: - Extraction
Extraction and analysis of following natural products
a) Eugenol from Cinnaman leaf oil or cloves.
b) Piperine from black pepper.
c) Cucumarin from turmeric.
d) Pectins from organe peels.
e) Carrotenne from Carrots.
f) Alkaloid from Cinchone bark.
g) Diosgenin from Diascoria tubers.
h) Caffeine from tea powder.
i) Casein from milk.
j) Lactose from milk.
k) Nicotine from Tobacco.
l) Lycopene from Tomatoes.

Laboratory V
Organic Chemistry Practical
Time: 6-8 Hrs. (One day examination) Marks: 50

Distribution of marks
1) Unit-I - 15 Marks
2) Unit-II - 15 marks
3) Record - 05 Marks
4) Viva-voce - 05 Marks
5) Internal Assessment - 10 Marks

Total Marks = 50 Marks

Semester III
3SA-6 : Laboratory VI
Advanced Medicinal Chemistry Practical

Unit I: - Synthesis, Purification and Identification of some of the following drugs
a) Sulfanilamide
b) Uracil
c) Phenytin
d) Ibuprofen
e) p-aminosalicylic acid
f) Paraacetamol
g) Dapson
h) Benzoic acid
i) Hydrazine
Sulfadiazine

Unit II: Screening for the following activities
a) Analgesic activity
b) Anti Inflammatory activity
c) Acute toxicity studies
d) Antibacterial and Antifungal activity
e) Free radical scavenging and anti-oxidant activity.

Unit III: Spectral Interpretation
Structure elucidation of organic compounds on the basis of spectral data. (UV, IR, $^1$H NMR and Mass). (Minimum 12 compounds are to be analyzed during regular practical).

Advanced Medicinal Chemistry Practical

Time: 6-8 Hrs. (One day examination)  Marks: 50

Distribution of marks
1) Unit-I - 10 Marks
2) Unit-II - 10 marks
3) Unit-III - 10 marks
4) Record - 05 Marks
5) Viva-voce - 05 Marks
6) Internal Assessment - 10 Marks

Total Marks = 50 Marks

Semester IV

Unit I: STEROCHEMISTRY AND DRUG ACTION
Realization that stereoselectivity is a pre-requisite for evolution. Role of chirality in selective and specific therapeutic agents. Case studies, Enantio selectivity in drug adsorption, metabolism, distribution and elimination.

Unit II: A STUDY OF THE MANUFACTURE OF THE FOLLOWING DRUGS
a) Paracetamol. b) Diphenhydramine. c) Indomethacin.
d) Sulphamethoxazole. e) Pheniramine maleate.

Unit III: Antibacterials
Penicillines, Cephalosporins, Tetracyclines, Aminoglycosides, Chloramphenicol, Macrolides, Lincomycins, Polypeptides antibiotics, Polyene antibiotics.


Unit IV A) Antimalarial
Antimalarial: Cinchona alkaloids, 4-Aminoquinolines, 8-Aminoquinolines, 9- Aminoacridines, Biguanides, Pyramidines and Sulfones, Mefloquine, Sulfonamides. Commercial synthetic routes to: Chloroquine, pamaquine, primaquine, proguanil,


Commercial synthetic routes to: Metronidazole, Ronidazole, Fluindazole, Idoquionol, Nifurfitmax, Benzimidazole, Tryparsamide.

Unit V Antifungal
Fatty acids and their derivatives (Propionic acid, zinc propionate, sodium caprylate, zinc caprylate, undecylenic acid, Zinc undecylenate, Triacetin), Salicylanilids, Salicylic acid, Tolnaftate, pchloromethoxylenol, Acriscin, Fluconazole, Itraconazole, Haloprogin, Clotrimazone, Econazole, Miconazole, Ketoconazole, Fluycosine, Griseofulvin, Polyene antibiotics (Nystatin, Amphotericin-B), Chlorophenesin, Dithranol. Commercial
synthetic routes to: Miconazole, Clotrimazole, Econoazole, Fluconazole, Griseofulvin, Ketoconazole, Naftidpine, Tolnaftate, Flucytosin.

**4SA2 : Advanced Organic Chemistry II**

**Unit-I : Strategy in Organic Synthesis**

Introduction, target selection, disconnection approach, functional group interconversion, synths, reagents, retrosynthesis, chemoselectivity, regioselectivity, linear synthesis and concergent synthesis. One group disconnection, two group disconnections, strategic bonds, disconnection of strategic bonds in carboxylic and heterocyclic rings, bio mimetic approach, retro mass spectral fragmentation- case studies of (+) Disparlure, retronecine and longfoline.

**Unit-II: Chiral drug synthesis**

Introduction to Chiral drugs, importance of stereochemistry in drug action, concepts of eutomer, distomer and eudesmic ratio, stereospecific and stereoselective synthesis, Synthesis of Chiral drugs like Ibuprofen, Propranolol, ramipril, levofloxacine.

**Unit-III: Modern synthesis method**

A) Green synthesis: Introduction, Green reagents, green catalysts, ionic solvents, phase transfer catalysis in green synthesis, application of phase transfer catalyst in green synthesis of Heterocyclic compounds, Williamson's synthesis, Witting reaction.

B) Microwave assisted synthesis: Introduction, Microwave reaction in water (Hoffmann elimination, hydrolysis and oxidation), Microwave reaction in organic solvents, solid state reactions, Advantages of Microwave technique.

**Unit IV: Photochemical reaction and catalysis**

Photochemical Reactions:

- Basic theory, orbital symmetry rules and their applications.
- Catalysis:
  - Introduction, phase transfer catalysis in anhydride, epoxide, ester, nitril, sulphide formation, ester hydrolysis and reduction reaction.

**Unit V: Pericyclic reactions**

Mechanism, Types of pericyclic reactions – cyclo addition, electrocyclic reaction, sigmatrophic rearrangement.

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**4SA3 : Drug Development And Analysis**

**Unit I A) Introduction History and Objective of drug designing:**

- Approaches to lead discovery. Drug discovery without a lead to de Novo drug designing.

**B) Extra-thermodynamic parameters:**

- Electronic, Steric and Hydrophobic substituents constant.
- Structural and theoretical parameters. Bioisostreism.
- Hansch analysis, Free and Wilson method

**Unit II Drug designing**

- Molecular orbital calculations and chemical reactivity.

**Unit III Drug Receptor - Interaction:**

- Historical, Receptor theories and forces involved in drug receptor interaction.

**Unit IV Prodrug Approach:**

- Basic concept, Common promotoites.

**Unit V Computer Aided Drug Designing**

- Computer requirement hardware, software, Data base and information retrieval techniques. Graphical description of chemical structure.
- Molecular interactions and interactive graphics. Modelling

**Paper XVI**

**4SA-4 : Concept of Industrial Management and Intellectual Property Rights**

**UNIT – I: Concepts of Industrial Management**

**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**


**Semester IV**

**4SA5 : Laboratory 5**

**Advanced Medicinal Chemistry Practical**

**Unit I: - Pharmaceutical Chemistry**
Preparation, evaluation and packing of liquid oral like solution, suspension and emulsions, ointments, eye drops, eye ointments etc.
Experiments to illustrate- Preparation, Stabilization, Physical and Biological evaluation of pharmaceutical products like powder, capsule, tablets and surgical dressing etc.
Formulation of oral S.R. products and their evaluation by invitro dissolution profile.

**Unit II: - Organic Estimation**
1) Estimation of Nitrogen.
2) Estimation of Sulphur.
3) Volumetric analysis of Ibuprofen in tablets.
4) Analysis of ascorbic acid in given tablets.
5) Spectrophotometric determination of paraacetamol in given tablets.
6) Analysis of ampicilline trihydrate.
7) Analysis of citric acid.
8) Determination of Vitamin B₁ in given tablets.
9) Determination of B₂ in given tablets.
10) Determination of Tetracycline in given capsule.
11) Determination of Phenobarbitone in given cough syrup.
12) Determination of Chloremphenicol in given capsule.
13) To perform I.P. monograph of tablets.
14) To perform I.P. monograph of hard gelatin capsules.

**4SA6 : Advanced Medicinal Chemistry Practical**

Time: 9-12 Hrs. (Two days examination)  Marks: 50

Distribution of marks

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Total Marks = 50 Marks

**M.Sc. Pharmaceutical Chemistry**

**Semester IV**

**4SA6 : Project Work**

The students will develop utilities such as analytical spectra, simulation programmes that will supplement laboratory exercises in their subject of specialization. For this variety of small research project designed by the teacher based on interest of the students and capabilities should be worked out.

The project will be evaluated by external and internal examiners.

**Study Tour:** Educational / Industrial Tour is compulsory for M.Sc. Chemistry.

1) Semester I / II: - Visit to local industry.
2) Semester III / IV: - Educational tour to visit the Industry / Research laboratory.

**4SA6 : Project Work**

Distribution of marks

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Total Marks = 50 Marks

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M.Sc. Part-I & Part-II (Semester I to IV) Examinations in Pharmaceutical Chemistry  
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