The following persons were the members of the committee for the proposed syllabi and courses of reading for M Sc (Industrial Chemistry) w.e.f. 2014-15

Prof. V K Rattan  
(Ex-Chairman and Dean)  
University Institute of Chemical Engineering and Technology  
Panjab University, CHANDIGARH

Dr Neera Raghav  
Professor, Department of Chemistry, Kurukshetra University, Kurukshetra

Dr Rakesh Pahwa  
Department of Pharmaceutical Sciences, Kurukshetra University, Kurukshetra

Dr Rameshwar Dass  
Associate Professor, Department of Industrial Chemistry,  
Guru Nanak Khalsa College, Yamuna Nagar

Expert advice of the following persons has been incorporated in the proposed syllabi

Dr Devinder Kumar  
Professor, Department of Chemistry, G J University, HISSAR

Dr M S Khanna  
Associate Director, Daichi Sankyo India (Ranbaxy) Laboratories

Mr. Sandeep Kanwar  
Senior Research Scientist, Jubilant Organosys Limited, NOIDA, U P

Dr. Bharat Varu  
Group Leader, Jubilant Organosys Limited, NOIDA, U P

Dr. Sandeep Sharma  
Director, BA/BE Studies, Jubilant Clinsys Limited, NOIDA, U P

Dr. Bhupinder Singh  
Project leader, Jubilant Clinsys Limited, NOIDA, U P

Dr. Ashish Dwivedi  
Research Scientist, Jubilant Clinsys Limited, NOIDA, U P

Dr. Ajay Soni  
Daichi Sankyo India (Ranbaxy) Laboratories, Gurgaon
SYLLABUS AND COURSES OF READING FOR M.Sc. (INDUSTRIAL CHEMISTRY) w.e.f. 2014-15

SCHEME OF EXAMINATION

M.Sc. (Previous)

FIRST SEMESTER

<table>
<thead>
<tr>
<th>Paper No.</th>
<th>Nomenclature of the paper</th>
<th>No. of teaching hrs per week</th>
<th>Time allowed for exam (hrs)</th>
<th>Max. Marks</th>
<th>Internal Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>IC-101</td>
<td>Analytical Methods – I</td>
<td>04</td>
<td>03</td>
<td>70</td>
<td>20</td>
</tr>
<tr>
<td>IC-102</td>
<td>Biophysical Chemistry</td>
<td>04</td>
<td>03</td>
<td>70</td>
<td>20</td>
</tr>
<tr>
<td>IC-103</td>
<td>Chemistry of Life</td>
<td>04</td>
<td>03</td>
<td>70</td>
<td>20</td>
</tr>
<tr>
<td>IC-104</td>
<td>Organic Chemistry – I</td>
<td>04</td>
<td>03</td>
<td>70</td>
<td>20</td>
</tr>
</tbody>
</table>

SECOND SEMESTER

<table>
<thead>
<tr>
<th>Paper No.</th>
<th>Nomenclature of the paper</th>
<th>No. of teaching hrs per week</th>
<th>Time allowed for exam (hrs)</th>
<th>Max. Marks</th>
<th>Internal Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>IC-201</td>
<td>Analytical Methods – II</td>
<td>04</td>
<td>03</td>
<td>70</td>
<td>20</td>
</tr>
<tr>
<td>IC-202</td>
<td>Bioinorganic Chemistry</td>
<td>04</td>
<td>03</td>
<td>70</td>
<td>20</td>
</tr>
<tr>
<td>IC-203</td>
<td>Organic Chemistry – II</td>
<td>04</td>
<td>03</td>
<td>70</td>
<td>20</td>
</tr>
<tr>
<td>IC-204</td>
<td>Organic Chemistry – III</td>
<td>04</td>
<td>03</td>
<td>70</td>
<td>20</td>
</tr>
</tbody>
</table>

Practicals

<table>
<thead>
<tr>
<th>Paper No.</th>
<th>Nomenclature of the paper</th>
<th>No. of teaching hrs per week</th>
<th>Time allowed for exam (hrs)</th>
<th>Max. Marks</th>
<th>Internal Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>IC-205</td>
<td>Analytical Laboratory</td>
<td>09</td>
<td>06</td>
<td>100</td>
<td>30</td>
</tr>
<tr>
<td>IC-206</td>
<td>Organic Laboratory</td>
<td>09</td>
<td>06</td>
<td>100</td>
<td>30</td>
</tr>
</tbody>
</table>

Note: For evaluating laboratory work in paper IC-205 & IC-206, 20% marks are reserved for laboratory record which will include assessment based upon daily performance, attendance and his/her conduct.
M.Sc. (Final)

THIRD SEMESTER

<table>
<thead>
<tr>
<th>Paper No.</th>
<th>Nomenclature of the paper</th>
<th>No. of teaching hrs per week</th>
<th>Time allowed for exam (hrs)</th>
<th>Max. Marks</th>
<th>Internal Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Theory</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IC-301</td>
<td>Organic Chemistry - IV</td>
<td>04</td>
<td>03</td>
<td>70</td>
<td>20</td>
</tr>
<tr>
<td>IC-302</td>
<td>Pharmaceutical Technology and Management - I</td>
<td>04</td>
<td>03</td>
<td>70</td>
<td>20</td>
</tr>
<tr>
<td>IC-303</td>
<td>Pharmaceutical Technology and Management - II</td>
<td>04</td>
<td>03</td>
<td>70</td>
<td>20</td>
</tr>
<tr>
<td>IC-304</td>
<td>Pharmaceutical Chemistry - I</td>
<td>04</td>
<td>03</td>
<td>70</td>
<td>20</td>
</tr>
</tbody>
</table>

FOURTH SEMESTER

<table>
<thead>
<tr>
<th>Paper No.</th>
<th>Nomenclature of the paper</th>
<th>No. of teaching hrs per week</th>
<th>Time allowed for exam (hrs)</th>
<th>Max. Marks</th>
<th>Internal Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>IC-401</td>
<td>Chemical Engineering</td>
<td>04</td>
<td>03</td>
<td>70</td>
<td>20</td>
</tr>
<tr>
<td>IC-402</td>
<td>Pharmaceutical Chemistry – II</td>
<td>04</td>
<td>03</td>
<td>70</td>
<td>20</td>
</tr>
<tr>
<td>IC-403</td>
<td>Pharmaceutical Chemistry – III</td>
<td>04</td>
<td>03</td>
<td>70</td>
<td>20</td>
</tr>
<tr>
<td>IC-404</td>
<td>Pharmaceutical Chemistry – IV</td>
<td>04</td>
<td>03</td>
<td>70</td>
<td>20</td>
</tr>
</tbody>
</table>

Practicals

<table>
<thead>
<tr>
<th>Paper No.</th>
<th>Nomenclature of the paper</th>
<th>No. of teaching hrs per week</th>
<th>Time allowed for exam (hrs)</th>
<th>Max. Marks</th>
<th>Internal Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>IC-405</td>
<td>Pharmaceutical Chemistry Laboratory</td>
<td>10</td>
<td>09</td>
<td>100</td>
<td>30</td>
</tr>
<tr>
<td>IC-406</td>
<td>Pharmaceutical Technology and Quality Laboratory</td>
<td>10</td>
<td>09</td>
<td>100</td>
<td>30</td>
</tr>
<tr>
<td>IC-407</td>
<td>Seminar</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: For evaluating laboratory work in paper IC-405 & IC-406, 20% marks are reserved for laboratory record which will include assessment based upon daily performance, attendance and his/her conduct.

IC-408 – Project Report: Every candidate after final examinations will be required to go for eight week training in reputed industry and after completion of the training the candidate will submit project report. Grades will be awarded by the examiners after viva-voce.
M.Sc. (PREVIOUS) INDUSTRIAL CHEMISTRY SYLLABUS
w.e.f. 2014-15

FIRST SEMESTER

ANALYTICAL METHODS – I

Paper IC - 101

Max. Marks – 70
Time Allowed – 3 Hrs.

Note: Eight questions will be set, four from each of the sections A & B. The candidates are required to attempt five questions in all selecting at least two questions from each section. All questions carry equal marks.

SECTION – A

Spectrophotometry: Types of electronic transitions, theory of spectrophotometry, Laws of absorption, deviation from Beer’s law, instrumentation for absorption measurements, criteria for satisfactory colorimetric analysis, choice of solvent, applications of spectrophotometry to qualitative and quantitative analysis, spectrophotometric titrations, study of composition of complex, determination of instability constant, an introduction to derivative spectrophotometry.

Turbidimetry/Nephelometry: Principle and instrumentation for nephelometry and turbidimetry, effect of concentration, particle size and wavelength on intensity of scattered light, applications to analysis, turbidimetric titrations, determination of molecular weight of a polymer.

Buffer Solution: pH and its importance, buffer solutions, measurement of pH.

Flame photometry: Introduction, principle and instrumentation of flame photometry, experimental techniques – standard addition method and internal standard method, interferences in flame photometry and applications.

Solvent Extraction: Distribution law, batch and continuous extractions, synergistic extraction, ion-association complexes, soxhlet extraction, Extraction of drug from the biological matrix – Solid Phase Extraction

SECTION – B

Chromatography: Classification, theories of chromatographic methods, principles and methods of chromatographic separation by paper, TLC, preparative TLC, HPTLC, column, HPLC, gas chromatography and ion-exchange chromatography. Instrumentation of HPLC and GC, types of columns and detectors for GC, Applications of chromatographic methods, an introduction to LC-MS technique.
**Polarography:** Principle and instrumentation, concept and expressions of diffusion current, half-wave potential, residual current, DME, current-potential curve and reversible reactions, qualitative and quantitative applications of polarography, types and advantages of amperometric titrations.

**Thermal analysis:** Introduction to thermal analysis, Differential Thermal Analysis (DTA), Thermogravimetry (TG) and Differential Thermogravimetry (DTG), static and dynamic thermogravimetry; Instrumentation and applications, Introduction to Differential Calorimetry (DSC), types and its applications.

**BOOKS RECOMMENDED**

**BIOPHYSICAL CHEMISTRY**

**Paper IC – 102**

Max.Marks – 70+20
Time Allowed – 3 Hrs.

Note: Eight questions will be set, four from each of the sections A & B. The candidates are required to attempt five questions in all selecting at least two questions from each section. All questions carry equal marks.

**SECTION – A**

Concept of viscosity and viscosity coefficient, concept of diffusion & diffusion constant, Fick’s first and second law of diffusion (derivation excluded), encounter pairs, diffusion controlled reactions in liquid

Osmosis and osmotic pressure, Relation between osmotic pressure and lowering of vapour pressure of an ideal solution, concept of reverse osmosis.

Nernst heat theorem, third law of thermodynamics, experimental verification, concept of free energy, entropy, determination of absolute entropies, entropy change in chemical reactions, Boltzman entropy equation, residual entropy.

Concept of fugacity, determination of fugacity of a gas, fugacity of liquid components in a liquid solution, physical significance of fugacity. Concept of activity, activity coefficient, relation
between fugacity and activity. Ionic strength, its physical & biological significance. 

Partial molar properties, concept of chemical potential Gibbs – Duhem equation, variation of chemical potential with temperature and pressure, chemical potential in a system of ideal gases.

Formulation of equilibrium law, equilibrium constant and its dependence on temperature and pressure, factors affecting the state of equilibrium – Le Chatelier’s principle.

SECTION – B

Polymorphism of drugs: Definition of polymorphism, polymorphs, pseudopolymorphs, polymorphism of drugs and its importance, detection and identification of polymorphs, physical and chemical properties of polymorphs.

Introduction to reaction rate, reaction order, specific rate constant, temperature coefficient of a reaction, activation energy and energy barrier, factors affecting reaction rate, integrated rate laws for first, second and third order reactions, kinetics of complex reactions – reversible, parallel and consecutive first order reactions, relaxation, principle of relaxation and relaxation time for one step reversible reactions. Influence of strength on the rate of ionic reactions – primary salt effect, secondary - salt effect and significance of salt effect.

Adsorption, physical adsorption, chemical adsorption, concept of sorption, factors affecting adsorption, adsorption isotherms and their derivation – Freundlich, Langmuir, BET isotherms, an introduction to Temkin (Slygin-Frumkin) isotherm (derivation excluded), Gibb’s adsorption isotherms and thermodynamics of gas - solid adsorption.

Catalysis and its types, autocatalysis, catalytic promoters, catalytic poisons, general characteristics of catalytic reactions, Heterogeneous catalysis – Mechanism of surface reactions, Homogenous catalysis, comparison between homogenous and heterogeneous catalysis, theory of catalysis – Adsorption and activated complex formation theories;

BOOKS RECOMMENDED
6. Physical Chemistry by F. A. Albery
CHEMISTRY OF LIFE

Note: Eight questions will be set, four from each of the sections A & B. The candidates are required to attempt five questions in all selecting at least two questions from each section. All questions carry equal marks.

SECTION – A

Living Matter: History of cell, brief idea of structural organization of prokaryotic, eukaryotic and plant cells, cell wall and membrane, nucleus, ribosomes, storage granules, mitochondrion, golgi complex, endoplasmic reticulum, lysosome, microbody, chloroplast, vacuole.

Molecular components of cell: Bio molecules, chemical and biological evolution, level of organization.

Regulation of cell functions: Genetic level, hormones, secondary messenger. (10)


Proteins: Classification, Level of organization and biological functions. (10)

Enzymes: History, nomenclature, classification, general characteristics, difference between inorganic catalyst and enzyme, Theories of enzyme action, Enzyme kinetics (Michael’s Menton equation and its modification). Mechanism of action-factors contributing the catalytic efficiency.

Enzyme Inhibition: Reversible and irreversible. (10)

SECTION – B

Molecular basis of Life

Nucleic Acids: Nucleosides, Nucleotides, Biological importance of nucleotides and pentose sugar structure and properties of uracil, thymine, guanine, cytosine, adenine. Structures of different forms of RNA, DNA (Watson and Crick Model), concept of gene, Nucleic acid metabolism – central dogma, features of genetic code, A brief introduction of replication, transcription and translation. (6)


Carbohydrate metabolism: Glycolysis & Kreb’s cycle. (15)

Lipids: Fatty acids, essential fatty acids, structure and function of triacylglycerols, glycerophospho-lipids, cholesterol, sphingolipids, bile acids, prostaglandins, lipoproteins – composition and function, role in atherosclerosis properties of lipid aggregates – micelles, bilayers, liposomes and their possible biological functions, lipid metabolism - oxidation of fatty
acids and its significance.

BOOKS RECOMMENDED
- Cell and Molecular Biology by D. Robertis.
- Molecular Biology of Cell by Albertis.
- Biochemistry by Lehninger, Kalyani Publishers.
- Biochemistry by Voet and Voet.
- Biochemistry by U. Stayanarayana and U. Chakrapani, Books and Allied (P) Ltd
- Biochemistry by Stryer.
- Outline of Biochemistry, Conn and Stumpf Biochemistry by J.H. Well.
- Biochemistry by Zubey.
- Peptide synthesis, Bondensky & Bondensky.
- Fundamental of biochemistry by J L Jain, Sunjay Jain and Nitin Jain, S Chand & Co Ltd.

ORGANIC CHEMISTRY - I

Paper IC - 104  Max.Marks . – 70+20
Time Allowed – 3 Hrs.

Note: Eight questions will be set, four from each of the sections A & B. The candidates are required to attempt five questions in all selecting at least two questions from each section. All questions carry equal marks.

SECTION – A


Reactive Intermediates: Formation, structure, stability and reactions of carbocations, carbanions, free radicals, carbenes (singlet and triplet), nitrenes and arynes.

Nucleophilic Substitution Reactions: Mechanism and stereochemistry of aliphatic nucleophilic substitution reactions, competition between nucleophilicity and basicity, ambident nucleophiles, concept of hard and soft acids and bases, leaving group effects, solvents effects.

Elimination Reactions: E1, E1CB, and E2 mechanism, orientation effects in elimination reactions, Saytzeff and Hoffman eliminations, sterochemistry of E2 reactions, dehydration of alcohols, pyrolytic eliminations.
SECTION – B

Aromatic Electrophilic Substitution Reactions: Theoretical treatment of nitration, sulphonation and halogenation reactions, structure-activity relationship in monosubstituted benzene rings and orientation in other ring systems, partial rate factor. 

Nucleophilic aromatic substitution reactions: Bimolecular, diazonium salt and addition – elimination. (6)

Addition to C-C Multiple Bonds: General Mechanistic considerations; addition of hydrogen halides, water, halogens and haloacids to alkenes and alkynes. Hydroboration and oxymercuration of alkenes. (4)

Stereochemistry: Symmetry elements, stereoisomerism, chirality and chiral molecules, projection formulae of chiral molecules, interconversion of Fischer, Newman, Sawhorse and flying wedge formulae, relative and absolute configuration, DL, EZ, RS, threo and erythro nomenclature, enantiomerism and diastereoisomerisms of simple cyclic and acyclic systems, optical purity. Methods of racemisation and resolution of racemic mixtures. (10)

Conformational analysis of n-butane, cyclohexane, mono and disubstituted cyclohexanes. Topicity of ligands and faces, their nomenclature and prostereoisomerism, stereogenecity, chirogenicity, prochiral centre. Elementary idea of principle categories of asymmetric synthesis, Cram’s rule and its modification, Prelog’s rule.

Stereochemistry of Decalins (10)

BOOKS RECOMMENDED

- Reaction mechanism in organic chemistry, S.M. Mukherji, S. P. Singh, MacMillion India, New Delhi.
- Stereochemistry, V.M. Potapov- Mir Publisher Moscow.
SECOND SEMESTER

ANALYTICAL METHODS – II

Paper IC - 201

Max.Marks . – 70+20
Time Allowed – 3 Hrs.

Note: Eight questions will be set, four from each of the sections A & B. The candidates are required to attempt five questions in all selecting at least two questions from each section. All questions carry equal marks.

SECTION – A

Ultraviolet (UV) Spectroscopy: Introduction, Origin of UV band spectrum, types of electronic transition, selection rules, presentation of UV spectra, solvents effects on UV absorption, chromophores and auxochromes, effect of conjugation, conformation and geometry on UV absorption of polyenes, Woodword Fieser rules for dienes, -axial haloketone rule, Woodwords rule for enones, unsaturated aldehydes, the UV spectra of benzenoids, polynuclear aromatic hydrocarbons and heterocycles. (8)

Infrared (IR) Spectroscopy: Introduction, principles of IR spectroscopy, sample handling, various modes of vibrations, presentation of spectra, functional group and finger print region, combination and overtones, Fermi resonance, bond properties and absorption trends, factors influencing vibration frequencies, interpretation of IR spectra, introduction of FT-IR spectroscopy. (7)

Nuclear Magnetic Resonance (NMR) Spectroscopy: Principles of NMR spectroscopy, nuclear spin states, nuclear magnetic moments, absorption of energy, chemical shift and its measurements, shielding and deshielding of protons, anisotropy, chemical shift and chemical equivalence, integrals, spin-spin splitting, N+1 rule, mechanism of coupling and coupling constants, presentation of spectra, magnetic equivalence, allylic coupling, exchangeable protons, Interpretation of NMR spectra of simple organic compounds, effect of enantiotopic, diastereotopic protons, Karplus curves- Variation of coupling constant with dihedral angles. Techniques of simplifying NMR spectra, double resonance, shift reagents and deuteration, elementary idea of $^{13}$C NMR, Introduction to FT-NMR spectroscopy. (15)

SECTION – B

Mass Spectrometry: Electron impact line diagram of mass spectrometer, mass spectrum, metastable ion, nitrogen rule, molecular weight determination, molecular formula from isotopic ratio data, isotopic profile of halogen compounds, factors effecting reaction pathways, fragmentation patterns – simple cleavage, retro – Diels Alder, hydrogen transfer, Rearrangement – like scrambling, ortho effect, McLafferty rearrangement. Fragmentation pattern of
hydrocarbons, alcohols, phenols, ethers, aldehydes, ketones, esters, carboxylic acids, amines, nitro, amides, nitriles. An elementary idea of chemical ionization and negative ion mass spectrometry. A brief introduction to LC-MS technique.

Simple structural problems based upon UV, IR, NMR and Mass spectrometry.

**BOOKS RECOMMENDED:**
1. Introduction to spectroscopy by D.L. Pavia et. al. Saunders Golden Sunburst Series 1996.

**BIOINORGANIC CHEMISTRY**

Paper IC - 202

Max. Marks – 70

Time Allowed – 3 Hrs.

Note: Eight questions will be set, four from each of the sections A & B. The candidates are required to attempt five questions in all selecting at least two questions from each section. All questions carry equal marks.

**SECTION – A**

**Chemical Toxicology:** Toxic chemicals in environment, their impact on enzymes, biochemical effects of As, Cd, Pb, Hg, CO, NOx, SO2, O3, carcinogens, and cyanide.

**Homogenous catalysis:** Hydrogenation, hydroformylation, carbonylation, polymerization and isomerization of alkene, Wacker process.

**Organometallics:** Synthesis, structure and nature of bonding of organometallic compounds formed with electron donor organic legends namely: olefinic, acetylenic, allylic, butadiene and cyclopentadiene.

**Medical Applications of Radioisotopes:** Therapeutic and diagnostic applications of radioisotopes, application to assessment of volume of blood in a patient, study of blood circulation, bone fracture healing, thyroid and parathyroid imaging, cardiovascular studies, tumor localization.
SECTION – B

Metal ions and chelating agents in medicines: Trace metal ions, metal ions and chelates in chemotherapy, synthetic metal chelates as antimicrobial agents, role of gold and its compounds in chemotherapy, role of lithium in mental health, metal complexes as anti-tumour agents, binding of \( \text{cis-Pt(NH}_3\text{)}_2\text{Cl}_2 \) to DNA, toxicity and new drugs, metal ion toxicity and chelation therapy, drugs that appear to involve interaction with metal ions, non-metals as trace elements.

Storage and transport of iron: Transferrin, ferritin, absorption and exchange of iron, iron transport in microbiology.

Oxygen carriers: Reactions of dioxygen, model compounds for oxygen carriers, natural oxygen carriers and porphyrin model compounds.

BOOKS RECOMMENDED

ORGANIC CHEMISTRY - II

Paper IC - 203  Max.Marks . – 70
Time Allowed – 3 Hrs.

Note: Eight questions will be set, four from each of the sections A & B. The candidates are required to attempt five questions in all selecting at least two questions from each section. All questions carry equal marks.

SECTION – A

Pharmacognosy: Introduction, classification of crude drugs, cultivation, collection, processing and utilisation of medicinal and aromatic compounds

Terpenoids: Classification, isolation, general methods of structure elucidation including spectral techniques. Structure determination, synthesis and medicinal importance of geraniol, terpeneol, pinene and camphor. Biogenetic isoprene rule and biogenesis of terpenoids.
**Steroids:** Isolation and nomenclature of steroids, structure, synthesis (Woodward) and stereochemistry of cholesterol, Methods for the following conversions:
(i) Cholesterol Testosterone
(ii) Cholesterol Progesterone

Synthesis and medicinal uses of cortisone and Betamethasone

**Carotenoids:** Structure, synthesis and biogenesis of carotene, Vitamin-A and Lycopene

**Flavonoids:** Occurrence, extraction, general methods of structure elucidation including spectral techniques, isolation, structural determination and synthesis of cyanin, Diadzein, Quercetin, flavon, flavonal, chrysin mechanism of Baker-Vankateraman rearrangement and Algar-Flynn-Oyamada reaction, biosynthesis of flavonoids-acetate and shikimic acid pathways.

**SECTION – B**

**Tannins:** Occurrence, classification and medicinal uses of tannins.

**Vitamins:** Occurrence, Identification, deficiency disease and biological role of Vitamin A, B$_1$, B$_2$, B$_{12}$, B$_6$, C, D, E Niacin, Biotin, Panthothenic acid and folic acid.

**Heterocyclic compounds:** Systematic (Hantzsch–Widman) Nomenclature for monocyclic and fused ring systems.
*Methods of synthesis and reactions including mechanism of the following:* Pyrazole, Imidazole, oxazoles, thiazoles, their aromatic and basic characters. Adenine, Guanine, Uracil, Thymine, Cytosine.

**Alkaloids:** Definition, physiological action, occurrence, isolation, general methods of structure elucidation, classification, role of alkaloids in plants. *Structure, stereochemistry, synthesis, biosynthesis and medicinal uses of the following:* Ephedrine, Nicotine, Morphpine and Reserpine.

**BOOKS RECOMMENDED**
- An Introduction to the Chemistry of Heterocyclic Compounds by R.M. Acheson.
- Heterocyclic Chemistry by L.A. Papquette.
- Reagents for Organic Synthesis by N.Fieser and L.F. Fieser, Vol. 1 to 15 and other recent volumes, John Wiley and Sons
- Principle of organic synthesis, R O C Norman and J M Coxon, CRC press
Note: Eight questions will be set, four from each of the sections A & B. The candidates are required to attempt five questions in all selecting at least two questions from each section. All questions carry equal marks.

SECTION – A

Organic Synthesis: The Synthon Approach - an introduction to synthons and synthetic equivalents, functional group, interconversions and functional group addition, general principles of the synthon approach, the importance of events in organic synthesis, chemoselectivity, regioselectivity, regiospecificity, stereoselectivity and stereospecificity. One group and two group C-X disconnections, reversal of polarity.

Protective groups: Principles of protection of alcoholic, amino, carbonyl and carboxylic acids.

Catalysis: Phase transfer catalysis, crown ethers, cryptates, cyclodextrins, cyclodextrin based enzyme models, ionophores.

SECTION – B

Oxidation: Introduction, different oxidative processes, Hydrocarbons – alkenes, aromatic rings, saturated C–H groups (activated and unactivated), Alcohols, diols, aldehydes, ketones, ketals and carboxylic acids, amines, hydrazines and sulphides.


Addition to Carbon-Heteroatom Multiple Bonds: General Consideration; Reactivity of carbonyl compounds towards nucleophilic addition reactions. Mechanism of addition-elimination reactions, hydration and addition of alcohols to aldehydes and ketones; Mechanism of esterification and ester hydrolysis. A detailed study including mechanism of the
following reactions in organic synthesis: Benzoin condensation, Aldol condensation, Wittig reaction, Perkin condensation, Knoevenagel condensation, Mannic reaction, Cannizzaro reaction, Arndt – Eistert synthesis, Darzens synthesis, Stroke enamine synthesis, Shapiro reaction, Sharpless asymmetric oxidation, Beckmann, Hofmann, Curtius, Lossen, Schmidt rearrangements.

BOOKS RECOMMENDED
- Reaction mechanism in organic chemistry, S.M. Mukherji, S. P. Singh, MacMillion India, New Delhi.
- Principle of organic synthesis, R O C Norman and J M Coxon, CRC press

ANALYTICAL LABORATORY

Paper IC – 205
Max. Marks–100
Time allowed–6 hrs.
(Two Sessions)

1. One experiment based on any one of the following techniques:
   a) Spectrophotometry
   b) Conductometric titrations
   c) Flame Photometry
   d) Polarimetry
   e) pH metry
   f) Nephelometry
   g) Refractrometry

   : 70 marks

1. Viva Voce
   : 10 marks
2. Laboratory Record
   : 20 marks

Total : 100 marks

Note: For evaluating laboratory work 20% marks are reserved for laboratory record which will include assessment based upon daily performance, attendance and his / her
conduit.
ORGANIC LABORATORY

Paper IC – 206
Max. Marks–100
Time allowed–6 hrs.
(Two Sessions)

1. Purification of organic compounds involving fractional crystallization, fractional distillation, steam distillation, sublimation, extraction.
   Preparation of organic compounds involving two stages. : 35 Marks

2. One of the following experiments:
   • Estimation of Phenol and Aniline by KBr/KBrO₃ method.
   • Estimation of Amino group.
   • Estimation of Hydroxyl group.
   • Estimation of Carbonyl group.
   • Estimation of Reducing and non-reducing sugars.
   • Estimation of a drug in mixture using simple titration. : 35 marks

3. Viva Voce : 10 marks
4. Laboratory Record : 20 marks

Total : 100 marks

Note: For evaluating laboratory work 20% marks are reserved for laboratory record which will include assessment based upon daily performance, attendance and his / her conduct.
M.Sc. (FINAL) INDUSTRIAL CHEMISTRY
SYLLABUS w.e.f. 2015-16

THIRD SEMESTER

ORGANIC CHEMISTRY – IV

Paper IC-301

Max. Marks : 70
Time Allowed: 3hrs

Note: Eight questions will be set, four from each of the sections A & B. The candidates are required to attempt five questions in all selecting at least two questions from each section. All questions carry equal marks.

SECTION – A


(30)

SECTION – B

Organic Photochemistry: Excitation and excited states, Jablonski diagram, energy transfer, photosensitization, quenching, quantum efficiency and quantum yield, Photochemistry of carbonyl compounds (Norrish type I and type II changes), photochemistry of olefins and 1,3-butadienes (cis-trans isomerization, dimerization and cycloadditions), di-π methane rearrangement, enone and dienone rearrangements, Photo-Fries reaction, photolysis of nitric esters and Barton reaction. Photochemistry of arenes.

(17)


(13)
BOOKS RECOMMENDED
2. R.E. Lehr & A.P. Merchand, "Problem solving approach to orbital symmetry".
3. S.M. Mukherji "Pericyclic Reactions" McMillan India
7. Marrison and Byod, "Organic Chemistry"

PHARMACEUTICAL TECHNOLOGY AND MANAGEMENT - I
Paper IC-302 Max. Marks : 70
Time Allowed: 3hrs

Note: Eight questions will be set, four from each of the sections A & B. The candidates are required to attempt five questions in all selecting at least two questions from each section. All questions carry equal marks.

SECTION – A

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, standardization and evaluation of tablets as per official standards.

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.

SECTION – B


Liquid Dosage Forms: Type of LDF, advantages and disadvantages, and large scale

Semi-solid dosage forms: A brief description, preparation of ointments, creams, jellies and suppositories.

Aerosol Dosage forms: Advantages, formulation and standardization.

BOOKS RECOMMENDED
2. Cooper and Gunn's Tutorial Pharmacy.
5. ISO Reports
6. Indian Pharmacopoeia, Govt. of India, Ministry of Health and Family Welfare.
9. Sharma P.P., GMP, Vallabh Prakashan

REFERENCE BOOK

PHARMACEUTICAL TECHNOLOGY AND MANAGEMENT – II

Paper IC-303 Max. Marks : 70
Time Allowed: 3hrs

Note: Eight questions will be set, four from each of the sections A & B. The candidates are required to attempt five questions in all selecting at least two questions from each section. All questions carry equal marks.

SECTION – A

Sterile operations: Microbial aspects of sterilization for bacterial spores, moulds & yeasts, factors effecting growth, phases of bacterial growth, preparation of culture media.

Formulation of injections: The route of administration, volume of injection, vehicle, isomotic pressure of solutions, the need for a preservative, units for formulae, pH, stability of medicaments, wt/ml of solution, presentation of suspensions.
**Sterilisation by Heat:** Dry heat, moist heat (Steaming and autoclaving) saturated, superheated steam and other methods of sterilization by moist heat. Sterilization of vaccines, pasteurization, tyndallisation, and operation of steam steriliser and their applications. Testing of the stability of sterilisers.

(3)

**Aseptic Techniques:** Source of contamination, the design of an asepsis laboratory, cleaning methods, clothing, asepsis room ventilation, aseptic methods, investigation of efficiency of air sterilisation method and other aspects of asepsis room ventilation, simple exercise in aseptic techniques.

(3)

**Sterility Testing:** Sampling, culture media, precautions against accidental contamination, testing procedure, control tests, inactivation of antibacterial samples by dilution, neutralization and separation methods, filtration techniques in sterility testing, tests on aqueous solutions, aqueous suspensions, powders, water – miscible semisolid preparations, oils and ointments, ligrates, and sutures, surgical dressings, paraffin gauze dressings, equipment and miscellaneous tests. Gaseous and radiation sterilisation, sterilisation of equipment and other articles.

(3)

**Fermentation Technology:** Screening techniques, stock cultures, fermentation media, detection and assay of fermentation products. A detailed study of the process technology of the following microbial metabolites: organic acids (citric acid and lactic acid), antibiotics (caphalosporin, erythromycin and rifampicin).

(4)

**SECTION – B**

**Pharmaceutical Management:** Principles of Pharmaceutical material management: Scope, problems, cost of item, vendor development procedures of order, procurement of pharmaceutical substances and packaging material, schedule M requirements of Drug and cosmetics Act, issue of material from ware house to production floor and documentation system.

(6)

Quality control and Quality Assurance: Brief description of GMP, cGMP, GLP, ISO-9000 process validation and TQM Concept.

(2)

**Industrial Control:** Patent law, intellectual property rights (IPR), GATT & WTO.

(2)

**Impurity and Stability:** Test procedures and acceptance criteria for new drug substances and new drug products: Introduction, general concepts, guidelines – definition justification, description, identification assay, impurities; specific tests – physicochemical properties, particle size, solid state forms, tests for optically active drugs, water content, inorganic impurities, microbial limits; New drug products – Dissolution, disintegration, hardness friability, uniformity of dosage units, water contents, microbial limits; Oral liquids – uniformity of dosage units, pH, microbial limits, antimicrobial preservative content, anti-oxidant preservative content, extractables, alcohol content, dissolution particle size distribution, redispersibility, rheological properties, specific gravity, reconstitution time; Parenteral products – uniformity of dosage units, pH, sterility, endotoxins, pyrogens, particulate matter, water content, antimicrobial preservative content, antioxidant perservative content, extractables, functionality testing of delivery systems.
osmolarity, particle size distribution, redispersibility and reconstitution time. Decision trees for acceptance criteria – New drug substance, degradation product, particle size.

**Stability testing of new drug substances and products:** Drug substance – criteria, storage conditions, long term testing accelerated testing, frequency, evaluation, labelling; Drug product – Selection of batches criteria, specification, conditions of storage and testing.

**BOOKS RECOMMENDED**
2. Cooper and Gunn's Tutorial Pharmacy.  
5. ISO Reports  
6. Indian Pharmacopoeia, Govt. of India, Ministry of Health and Family Welfare.  
9. Sharma P.P., GMP, Vallabh Prakashan  

**REFERENCE BOOK**

**PHARMACEUTICALS CHEMISTRY –I**

**Paper IC-304**

**Max. Marks : 70**

**Time Allowed: 3hrs**

**Note:** Eight questions will be set, four from each of the sections A & B. The candidates are required to attempt five questions in all selecting at least two questions from each section. All questions carry equal marks.

**SECTION – A**

**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 preclinical 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 drug: Introduction, procedure followed in drug design, the search for lead compounds, molecular modification of lead compounds, prodrugs and soft drugs; Prodrug: introduction, prodrug formation of compounds containing various chemical groups, multiple prodrug formation. Soft drugs: design of soft drugs, structure – activity relationship (SAR), factors affecting bioactivity, isosterism, bioisosterism, spatial considerations, biological properties of simple functional groups, theories of drug activity, occupancy theory, quantitative structure – activity relationship (QSAR): History and development of QSAR, drug receptor
interactions, the additivity of group contributions, physico-chemical parameters, lipophilicity parameter, measurement of partition coefficient and related lipophilicity parameters, lipophilicity contributions and calculation of partition co-efficients, polarisibility, electronic parameter, ionization constants, steric parameters, chelation parameters, surface activity parameter, redox potential, quantitative models, Hansch analysis, Free – Wilson analysis, their application relationship between Hansch and free Wilson analysis (the mixed approach), The drug development process, preclinical and clinical trials, regulatory review during the conduct of trials.

(25)

SECTION – B

Design of enzyme inhibitors: 9-Alkylpurines, 6-mercaptopurines, and allepurines, active – site directed irreversible enzyme inhibition with special reference to chymotrypsin, suicide enzyme inactivators.

(6)

Introduction to molecular modeling using computers, uses of molecular modeling, manual use, further computer programming.

(6)

Structure-based drug design: Process of structure based drug design, deactivation of certain drugs, determination of the active site, design of inhibitors.

(6)

Poisoning: Principles of toxicology and treatment of poisoning, LD$_{50}$, and ED$_{50}$ introduction, dose – response relationship, risk, and spectrum of undesired effects, descriptive toxicity tests in animals, prevention of further absorption of poisoning, enhanced elimination of poison, antagonism or chemical inactivation of an absorbed poison.

(12)

BOOKS RECOMMENDED
1. Burger's medicinal chemistry and drug discovery vol I (Ch. 9 and 14) ; Edn. M.E. Wolff, John Wiley.
4. Burglers Introduction to medicinal chemistry "Alexo Gringauz, Wiley – VCH.
5. D. Lednicer and L.A. Mitscher, i.e. the organic chemistry of Drug Synthesis "Vol I to Vol I to V, John Wiley.
FOURTH SEMESTER

CHEMICAL ENGINEERING

Paper IC-401  
Max. Marks : 70  
Time Allowed: 3hrs

Note: Eight questions will be set, four from each of the sections A & B. The candidates are required to attempt five questions in all selecting at least two questions from each section. All questions carry equal marks.

SECTION – A

Fluid Flow: Introduction, Newtonian and non-Newtonian fluids, viscosity, effect of temperature on viscosity, kinematic viscosity, laminar and turbulent flows, Reynolds number, pumps, types of pumps, principle and working of reciprocating pumps, rotary gear pumps, cavitation and net positive suction head.

Filtration: Introduction, filter media, factors affecting choice of filter media and operating conditions, filter aids, factors affecting rate of filtration, classification of filters, candle filter-description, components, selection criteria, operational sequence and maintenance of candles, washing of filter cakes, centrifuges, batch top driven centrifuge, batch under driven centrifuge, disk type centrifuge.

Properties and Handling of particulate solids: Characterization of solid particles, screen analysis-standard screen series, concept of comminution, advantages and disadvantages of comminution, criterion for comminution, characteristics of comminuted products, energy and power requirements in comminution.

Chemical process development: Process design development, types of design process development, plant location, plant layout, plant operation and control, material handling.

Safety and loss prevention: Health and safety hazards, intrinsic and extrinsic safety, The hazards: toxicity, preventive aspect of the use of hazardous substances, flammability, explosions, sources of ignition, pressure, temperature deviations, noise, theoretical aspect of Dow Fire and Explosion Index, hazard and operability studies, hazard analysis.

Reactors: Introduction to reactor design, aim of reactor design, factors affecting choice of reactor design, performance equation of ideal batch reactor - concept of space time and space velocity; performance equation of steady state mixed flow reactor and steady state plug flow reactor, multiple reactor system - plug flow reactor in series or in parallel, reactor of different types in series, general rules for best arrangement of set of ideal reactors, recycle reactor, autocatalytic reactor.
SECTION – B


Drying: Introduction, rate of drying and drying curves, constant rate period, critical moisture content, falling rate period, equilibrium moisture, free moisture, bound and unbound moisture, drying equipments – tray dryers, drum dryers, rotary dryers, spray dryers, flash dryers.


BOOKS RECOMMENDED


REFERENCE BOOKS

1. Coulson & Richardson, "Chemical Engineering" vol. 1, 2 and 6.
PHARMACEUTICAL CHEMISTRY - II

Paper IC-402

Max. Marks : 70

Time Allowed: 3hrs

Note: Eight questions will be set, four from each of the sections A & B. The candidates are required to attempt five questions in all selecting at least two questions from each section. All questions carry equal marks.

Synthesis, dosage and clinical application of the drugs mentioned in Section A & B.

SECTION – A

Antineoplastic agent: Mechloretamine, melphalan, chlorambucil, busulfan, carmustine, uracil mustards, fluorouracil, 6-mercaptopurine, thioguanine, paclitaxel (synthesis of paclitaxel excluded) (3)

Analgesics: Acetaminophen, phenacetin, aspirin, oxyphenylbutazone. (3)

Antiinflammatory agent: Indomethacin, ibuprofen, diclofenac, naproxen, mfenamic acid. (2)

Antiparasitic drugs: Antimalarials chloroquine, depsone, primaquine. (2)

Anthelmintic: Quinacrine, thiabendazole, mebendazole. (2)

Antibacterials: Sulphonamides sulphanilamide, sulphacetamide. Furazolidone, nilidixic acid, ciprofloxacin, norfloxacin. (3)

Antitubercular agent: Aminosalicylic acid, isoniazid. (1)

Antifungal agent: Benzoic and salicylic acid, econazole. (1)

Anticholinergic agents: Dicyclomine cyclopentalate. (1)

Antiarrhythmics: Quinidine, verapamil (1)

Antihypertensive drug: Guanithidine, methyldopa, atenolol, oxyprenolol. (2)

Antihistaminic agent: Chlorpheniramine, cemetidine, ranitidine. (1)

Antidiabetic agents: Tolbutamide, glipizide, chlorpropamide. (1)

Diuretics: Triametrene, amiloride, chlorothiazide, bumetanide. (3)

Drugs against HIV: An introduction to AIDS, durgs against HIV, how HIV infects the system,
structure and mode of action of important drugs against HIV (AZT, ddI, dCdC, d4T & 3TC), synthesis of AZT only.

SECTION – B

PSYCHOACTIVE DRUGS

Antianxiety agent: Meprobamate, diazepam, oxazepam, alprozolam, busprione.

Anticonvulsants: Phenytoin, ethosuximide, trimethadione.

Antifertility agent: Norethynodore, norprogesterol, mestranol, 17-α-ethynyl estradiol, tamoxifen.

Sedatives and hypnotics: Barbiturates, thiopental sodium, glutethimide.

Antibiotics: Preparation, synthesis and therapeutic uses of Penicillin G, Penicillin V, Ampicillin, amoxycillin, cefazolin, cefaclor, cefotanine, cefepine, griseofulvin, chloramphenicol.

BOOKS RECOMMENDED

2. Burger's medicinal chemistry and drug discovery vol I (Ch. 9 and 14) ; Edn. M.E. Wolff, John Wiley.
3. Burglers Introduction to medicinal chemistry "Alexo Gringauz, Wiley – VCH.
4. D. Lednicer and L.A. Mitscher, i.e. the organic chemistry of Drug Synthesis "Vol I to Vol I to V, John Wiley.
5. Goodman and Gilman's Pharmacological Basis of Therapeutics, McGraw Hill.

PHARMACEUTICAL CHEMISTRY – III
(The Pharmacological basis of Therapeutics)

Paper IC-403
Max. Marks : 70
Time Allowed: 3hrs

Note: Eight questions will be set, four from each of the sections A & B. The candidates are required to attempt five questions in all selecting at least two questions from each section. All questions carry equal marks.

SECTION – A

BASIS OF DRUG ACTION

Pharmacokinetics: Introduction to 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 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.

**Drug metabolism:** Definition and concept types of metabolic reaction effecting xenobiotic metabolism, biological factors effecting drug metabolism, biotransformations, metabolic reactions, conjugate reactions, significance of drug metabolim in medicinal chemistry.

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

**SECTION – B**

**Antineoplastic agents:** Introduction causative factors, cancer chemotherapy – special problems, drug resistance, drug discovery strategies, alkylating agents, antimetabolites, carcinolytic antibiotics, mitotic inhibitors, hormonal agents, miscellaneous carcinolytics.

**Analgesics and antiinflammatory agents:** Introduction, classification of pain, classification of analgesics, prostaglandins, non-steroidal antiinflammatory receptors, ligands, multiple opiate receptors.

**Antimicrobial drugs:** The antibiotics, cell wall biosynthesis, cell wall synthesis inhibitors, the β-lactam ring – the enchanting structure, and other bicylic β-lactams, monobactams, β-lactamase enzymes, β-lastamase inhibitors, antibiotics inhibiting protein synthesis. Brief introduction about cephalosporins, local antiinfective agents, the 4-quinolones, parasitic diseases, drugs used in the chemotherapy of protozoal infections – malaria, leishmaniasis, amoebiasis, giardiasis, trichomoniasis, antifungal agents, antiviral agents, urinary tract anti-infectives, antitubercular agents, anthelmintics.

**BOOKS RECOMMENDED**
1) Introduction to Medicinal Chemistry, Alex Gringauz, Wiley – VCH.

**REFERENCE BOOKS**
2. Goodman and Gilman's Pharmacological Basis of Therapeutics, McGraw – Hill.
PHARMACEUTICAL CHEMISTRY – IV
(The Pharmacological basis of Therapeutics)

Paper IC-404

Max. Marks : 70
Time Allowed: 3hrs

Note: Eight questions will be set, four from each of the sections A & B. The candidates are required to attempt five questions in all selecting at least two questions from each section. All questions carry equal marks.

SECTION – A

Drug effecting cholinergic mechanism: Introduction, aspects of cholinergic system, cholinergic drugs, anticholinesterase agents, antidote for AChE inhibitors, memory and Alzheimer's disease, cholinergic blocking agents, neuro muscular blocking agents.

(7)

Drugs affecting andrenergic mechanisms: Andrenergic concepts and synthesis catabolism, catecholaminergic receptors, indirect sympathomimetics α-receptors.

(7)

Drugs and cardiovascular diseases: Introduction, cardiovascular diseases, the drugs – inhibitors of peripheral sympathetic function, direct acting arteriolar dialators, ACE inhibitors, diuretics, cardiotonic agents, anti-arrhythmic agents, antianginal drugs – the coronary vasodilators, miscellaneous drugs, anticoagulants, anti-thrombotics, thrombolytics, cyclooxygenase inhibitors, plasminogen activators, hypolipidemic hypocholesterolemic drugs, drug and diabetes, sickle cell disease – anemia, thyroid functions and drugs affecting them.

(16)

SECTION – B

Psychoactive drugs – the chemotherapy of mind: Introduction, historical overview, neurotransmitters, CNS depressants — general anaesthetics, hypnotics & sedatives, antianxiety agents, the benzodiazepines, buspirone, antiepilepsy drugs, neurochemistry of mental disease, antipsychotic drugs – the neuroleptics, butyrophenones and drug development, anti-depressants, stereochemical aspects of psychotropic drugs.

(7)

Histamine antagonists and local anesthetics: Histamine antagonists, inhibition of mediator release, peptic ulcer disease, proton pump inhibitors (H +, K + - Atpase), prostaglandins, local anaesthetics & their mechanism of action.

(7)

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.

(16)

BOOKS RECOMMENDED
1) Introduction to Medicinal Chemistry, Alex Gringauz, Wiley – VCH.
3) Essentials of medical pharmacology by K D Tripathi, Jaypee Bros Medical Publishers (P) Ltd.

REFERENCE BOOKS
2. Goodman and Gilman's Pharmacological Basis of Therapeutics, McGraw – Hill.

PHARMACEUTICALS CHEMISTRY LABORATORY

Paper IC-405 Max. Marks : 100
(Two sessions)

PRACTICALS

1 Multistep preparation of organic compounds of medicinal interest and extraction of natural products. 30

2 Techniques of purification: Vacuum distillation, column chromatography, sublimation. Separation and identification of the components of a tablet using preparative TLC. 05

3 Separation and identification of components of binary organic mixture using chemical methods and special data. 35

4 Viva – voce 10

5 Lab. Record 20

Total marks 100

Note: For evaluating laboratory work 20% marks are reserved for laboratory record which will include assessment based upon daily performance, attendance and his/her conduct.
PRACTICALS

Section A

Preparation and evaluation of the following: Emulsion, simple syrup, aqueous iodine, strong iodine, calamine lotion, Boroglycerine, Tannic acid / glycerine, peppermint water, rose water, non-staining iodine ointment, stability studies of tablets, capsules, syrups.

Limit test in pharmaceutical preparations.

Section B

1. Study of specific rotation of ibuprofen and its determination in the unknown sample.
2. Volumetric determination of ibuprofen in the given tablet.
3. Volumetric determination of Asprin content in the soluble Asprin tablet.
4. Spectrophotometric determination of Paracetamol in the tablet.
5. Extractive spectrophotometric determination of Oxyphanylbutazone from tablet.
6. Determination of Ephaderine Hydrochloride in given syrup.
7. Determination of Tetracycline in the given capsule.
8. Spectroscopic determination of glucose in the given sample.
10. To perform I.P. monograph of hard gelatin capsule
11. Evaluation of injections
12. Determination of Chloramphenicol in the given capsule.

Distribution of marks

<table>
<thead>
<tr>
<th></th>
<th>Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>One experiment from Section A</td>
<td>35</td>
</tr>
<tr>
<td>One experiment from Section B</td>
<td>35</td>
</tr>
<tr>
<td>Viva-voce</td>
<td>10</td>
</tr>
<tr>
<td>Laboratory record</td>
<td>20</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

Note: For evaluating laboratory work 20% marks are reserved for laboratory record which will include assessment based upon daily performance, attendance and his/her conduct.
SEMINAR

Paper IC-407
Max. Marks : 40

Every candidate of M.Sc. (Final) class will deliver one seminar which will be evaluated in terms of topic, contents, presentation and interaction.

PROJECT REPORT

Paper IC-408
Max. Marks : Grades

IC-408 – Project Report: Every candidate after final examinations will be required to go for eight week training in reputed industry and after completion of the training the candidate will submit project report.
Viva – voce will be conducted by the external and internal examiners appointed by the University. *Grades will be awarded by the examiners after viva – voce.*