HIMACHAL PRADESH UNIVERSITY
SHIMLA – 171005

SYLLABUS AND SCHEME
OF
EXAMINATION IN THE SUBJECT OF
CHEMISTRY

FOR
B. Sc. PHYSICAL SCIENCES
UNDER
CHOICE BASED CREDIT SYSTEM
2016 – 2017 ONWARDS
## OUT LINES OF SYLLABI AND COURSES
### IN THE SUBJECT OF CHEMISTRY FOR B. Sc. Physical Sciences (2016-2017 onwards)

<table>
<thead>
<tr>
<th>Semester</th>
<th>Course Code</th>
<th>Course Name</th>
<th>Credit(s)</th>
<th>Total Credits</th>
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<tr>
<td>I (Odd)</td>
<td>Ability Enhancement Compulsory Course - I</td>
<td>English/Hindi(Communication) /Environmental Science</td>
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<td>Atomic Structure, Bonding, General Organic Chemistry and Hydrocarbons</td>
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<td><strong>Skill Enhancement Course IV</strong> (Chemistry (CHEM SEC 603 or 604)/Maths/Physics)</td>
<td>Chemistry (Chemical Tech. &amp; Society and Bus. Skills for Chemistry or Pesticide Chemistry &amp; Pharmaceutical Chemistry) /Physics SEC II/ Mathematics SEC II</td>
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Total Credits 132
Comprehensive Continuance Assessment (CCA) and End-semester Examination (ESE) Scheme in Chemistry of Three years

B.Sc. Physical Sciences

Scheme of Examination for every course except Skill enhancement course*

English shall be the medium of instructions and Examinations. Examinations shall be conducted at the end of each semester as per the academic calendar notified by H.P. University Shimla-5.

Each course of 6 credits will carry 100 marks (theory + practical) and will have following components:

1. **Theory**
   
   Comprehensive Continuous Assessment  
   
   i) Assignment/Quiz/Seminar/model/ Mid-Term Examination 15 marks  
   
   a) Attendance/Mid-Term Examination 05 marks  
   
   ii) End-Semester Examination 50 marks  

II. **Practical** 30 marks

   Practical examination will have following components:
   
   i) Performing the two practical exercises assigned by the examiner in terms of requirement of chemicals/apparatus/ theory/ reaction (if any) involved, procedure/ scheme/ observations/calculations and results. 20 marks  
   
   ii) viva-voce examination 5 marks  
   
   ii) Practical note book and regularity during practical classes 5 Marks

{Theory Paper (CCA + End semester Examination) + Practical [20 +50 +30] =100 marks}  

* Each Skill Enhancement course will be of 4 credits and scheme of examination for these courses is as under:

{CCA + End semester Examination [20 + 80] =100 marks}

**Criterion for marks on the basis of Class-room attendance (0 - 5 marks)**

under component CCA/ IA be defined as follows:

a) Attendance 75 -- 80% = 3 marks  
   
   b) Attendance 81 – 90 % = 4 marks  
   
   c) Attendance 91% and above = 5 marks  
   
   d) Candidates securing 75% Attendance after condonation will not be entitled to get any mark.
Core Courses (CC)

One in Each Semester
($1^{st}$, $2^{nd}$, $3^{rd}$ and $4^{th}$)

(Credits: 06 each)
SEMESTER-I

CHEM CC 101

ATOMIC STRUCTURE, BONDING, GENERAL ORGANIC CHEMISTRY & ALIPHATIC HYDROCARBONS

Max. Marks: 50
Credits: 4

Time Allowed: 3 Hours

Note for Examiners and Students:

1. The question paper will consist of five sections A, B, C, D and E. Section E will be compulsory. Examiner will set nine questions in all, selecting two questions from section A, B, C, and D of 10 marks each and may contain more than one part. Section E will be of 10 marks and consists of objective type questions (MCQ/true and false / fill in the blanks etc.) of one mark each covering the entire paper.

2. The candidate will be required to attempt five questions in all i.e. selecting one question from each section including the compulsory question. The duration of the examination will be 3 hours.

SECTION - A

Atomic Structure


SECTION - B

Chemical Bonding and Molecular Structure

Ionic Bonding: General characteristics of ionic bonding. Energy considerations in ionic bonding, lattice energy and solvation energy and their importance in the context of stability and solubility of ionic compounds. Statement of Born-Landé equation for calculation of lattice energy, Born-Haber cycle and its applications, polarizing power and polarizability. Fajan’s rules, ionic character in covalent compounds, bond moment, dipole moment and percentage ionic character.

Covalent bonding- VB Approach: Shapes of some inorganic molecules and ions on the basis of VSEPR and hybridization with suitable examples of linear, trigonal planar, square planar, tetrahedral, trigonal bipyramidal and octahedral arrangements. Concept of resonance and resonating structures in various inorganic and organic compounds. MO Approach: Rules for the LCAO method, bonding and antibonding MOs and their characteristics for s-s, s-p and p-p combinations of atomic orbitals, nonbonding combination of orbitals, MO treatment of homonuclear diatomic molecules up to Ne (including idea of s-p mixing) and heteronuclear diatomic molecules such as CO, NO and NO+. Comparison of VB and MO approaches. (16 Hours)
SECTION - C

Fundamentals of Organic Chemistry


Strength of organic acids and bases: Comparative study with emphasis on factors affecting pK values. Aromaticity: Benzenoids and Hückel’s rule. (8 Hours)

Stereochemistry

Conformations with respect to ethane, butane and cyclohexane. Interconversion of Wedge Formula, Newman, Sawhorse and Fischer projections. Concept of chirality (upto two carbon atoms). Configuration: Geometrical and Optical isomerism; Enantiomerism, Diastereomerism and Meso compounds). Threo and erythro; D and L; cis - trans nomenclature; CIP Rules: R/ S (for upto 2 chiral carbon atoms) and E / Z Nomenclature (for upto two C=C systems). (10 Hours)

SECTION – D

Aliphatic Hydrocarbons

Functional group approach for the following reactions (preparations & reactions) to be studied in context to their structure.


Alkenes: (Upto 5 Carbons) Preparation: Elimination reactions: Dehydration of alkenes and dehydrohalogenation of alkyl halides (Saytzeff’s rule); cis alkenes (Partial catalytic hydrogenation) and trans alkenes (Birch reduction). Reactions: cis-addition (alk. KMnO₄) and trans-addition (bromine), Addition of HX (Markownikoff’s and anti-Markownikoff’s addition), Hydration, Ozonolysis, oxymercuration-demercuration, Hydroboration-oxidation.

Alkynes: (Upto 5 Carbons) Preparation: Acetylene from CaC₂ and conversion into higher alkynes; by dehalogenation of tetra halides and dehydrohalogenation of vicinal-di halides.

Reactions: Formation of metal acetylides, addition of bromine and alkaline KMnO₄, ozonolysis and oxidation with hot alkaline KMnO₄. (12 Hours)

Reference Books:


LAB COURSE

CHEM CC 101 P

ATOMIC STRUCTURE, BONDING, GENERAL ORGANIC CHEMISTRY & ALIPHATIC HYDROCARBONS LAB

TIME ALLOWED: 03 HOURS
Max Marks: 30 Credits – 2

I. Inorganic Chemistry - Volumetric Analysis

1. Estimation of sodium carbonate and sodium hydrogen carbonate present in a mixture.
2. Estimation of oxalic acid by titrating it with KMnO₄.
3. Estimation of water of crystallization in Mohr’s salt by titrating with KMnO₄.
4. Estimation of Fe (II) ions by titrating it with K₂Cr₂O₇ using internal indicator.
5. Estimation of Cu (II) ions iodometrically using Na₂S₂O₃.

II. Organic Chemistry

1. Detection of extra elements (N, S, Cl, Br, I) in organic compounds (containing up to two extra elements)
2. Separation of mixtures by Chromatography: Measure of Rₐ value of a mixture of o-nitroaniline and p-nitroaniline.

Reference Books:
SEMMETER II

CHEM CC 202

CHEMICAL ENERGETICS, EQUILIBRIA & FUNCTIONAL ORGANIC CHEMISTRY

Max. Marks: 50
Credits: 4

Time Allowed: 3 Hours

Note for Examiners and Students:

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SECTION - A

Chemical Energetics:


SECTION - B

Chemical Equilibrium:

Free energy change in a chemical reaction. Thermodynamic derivation of the law of chemical equilibrium. Distinction between ΔG and ΔGo, Le Chatelier’s principle. Relationships between Kp, Kc and Kx for reactions involving ideal gases. (6 Hours)

Ionic Equilibria:

Strong, moderate and weak electrolytes, degree of ionization, factors affecting degree of ionization, ionization constant and ionic product of water. Ionization of weak acids and bases, pH scale, common ion effect. Salt hydrolysis - calculation of hydrolysis constant, degree of hydrolysis and pH for different salts. Buffer solutions. Solubility and solubility product of sparingly soluble salts – applications of solubility product principle. (10 Hours)
SECTION - C

Functional group approach for the following reactions (preparations & reactions) to be studied in context to their structure.

Aromatic hydrocarbons

Preparation (Case benzene): from phenol, by decarboxylation, from acetylene, from benzene sulphonic acid.


Alkyl Halides (Upto 5 Carbons) Types of Nucleophilic Substitution (SN₁, SN₂ and SNi) reactions.

Preparation: from alkenes and alcohols.

Reactions: hydrolysis, nitrite & nitro formation, nitrile & isonitrile formation, Williamson’s ether synthesis.

Aryl Halides Preparation: (Chloro, bromo and iodo-benzene case): from phenol, Sandmeyer & Gattermann reactions.

Reactions (Chlorobenzene): Aromatic nucleophilic substitution (replacement by –OH group) and effect of nitro substituent. Benzene Mechanism: KNH₂/NH₃ (or NaNH₂/NH₃).

Reactivity and Relative strength of C-Halogen bond in alkyl, allyl, benzyl, vinyl and aryl halides. (17 Hours)

SECTION - D

Alcohols, Phenols and Ethers (Upto 5 Carbons)

Alcohols: Preparation: Preparation of 1°, 2° and 3° alcohols: using Grignard reagent, Ester hydrolysis, Reduction of aldehydes, ketones, carboxylic acid and esters.


Ethers (aliphatic and aromatic): Cleavage of ethers with HI.

Aldehydes and ketones (aliphatic and aromatic): (Formaldehyde, acetaldehyde, acetone and benzaldehyde)

Preparation: From acid chlorides and from nitriles.


Reference Books:


LAB COURSE

CHEM CC 202 P

TIME ALLOWED: 03 HOURS
Max Marks: 30
Credits – 2

I. Thermochemistry

1. Determination of heat capacity of calorimeter for different volumes.
2. Determination of enthalpy of neutralization of hydrochloric acid with sodium hydroxide.
3. Determination of enthalpy of ionization of acetic acid.
4. Determination of integral enthalpy of solution of salts (KNO₃, NH₄Cl).
5. Determination of enthalpy of hydration of copper sulphate.

II. Ionic Equilibria: pH measurements

a) Measurement of pH of different solutions like aerated drinks, fruit juices, shampoos and soaps (use dilute solutions of soaps and shampoos to prevent damage to the glass electrode) using pH-meter.

b) Preparation of buffer solutions: (i) Sodium acetate-acetic acid (ii) Ammonium chloride-ammonium hydroxide Measurement of the pH of buffer solutions and comparison of the values with theoretical values.

III. Organic Chemistry

1. Purification of organic compounds by crystallization (from water and alcohol) and distillation.
2. Criteria of Purity: Determination of melting and boiling points.
3. Preparations of organic compounds – Iodoform and Glucosazone

Reference Books

Note for Examiners and Students:

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2. The candidate will be required to attempt five questions in all i.e. selecting one question from each section including the compulsory question. The duration of the examination will be 3 hours.

SECTION - A

Solutions


Phase Equilibrium

Phases, components and degrees of freedom of a system, criteria of phase equilibrium. Gibbs Phase Rule and its thermodynamic derivation. Derivation of Clausius – Clapeyron equation and its importance in phase equilibria. Phase diagrams of one-component systems (water and sulphur) and two component systems involving eutectics, congruent and incongruent melting points (lead-silver, NaCl-H₂O and Mg-Zn only).

SECTION - B

Conductance

Conductivity, equivalent and molar conductivity and their variation with dilution for weak and strong electrolytes. Kohlrausch law of independent migration of ions.

Transference number and its experimental determination using Hittorf and Moving boundary methods. Ionic mobility. Applications of conductance measurements: determination of degree of ionization of weak electrolyte, solubility and solubility products of sparingly soluble salts, ionic product of water, hydrolysis constant of a salt. Conductometric titrations (only acid base).
Electrochemistry


Calculation of equilibrium constant from EMF data. Concentration cells with transference and without transference. Liquid junction potential and salt bridge. pH determination using hydrogen electrode and quinhydrone electrode. Potentiometric titrations - qualitative treatment (acid-base and oxidation-reduction only).

(15 Hours)

SECTION – C

Functional group approach for the following reactions (preparations & reactions) to be studied in context to their structure.


**Carboxylic acid derivatives (aliphatic):** (Upto 5 carbons) - Preparation: Acid chlorides, Anhydrides, Esters and Amides from acids and their inter conversion.

**Reactions:** Comparative study of nucleophilicity of acyl derivatives. Reformatsky Reaction, Perkin condensation.

**Amines and Diazonium Salts**


(15 Hours)

SECTION - D

**Amino Acids, Peptides and Proteins**

**Preparation of Amino Acids:** Strecker synthesis using Gabriel’s phthalimide synthesis. Zwitter ion, Isoelectric point and Electrophoresis. **Reactions of Amino acids:** ester of –COOH group, acetylation of –NH2 group, complexation with Cu2+ ions, ninhydrin test. Overview of Primary, Secondary, Tertiary and Quaternary Structure of proteins.

**Carbohydrates:** Classification, and General Properties, Glucose and Fructose (open chain and cyclic structure), Determination of configuration of monosaccharides, absolute configuration of Glucose and Fructose, Mutarotation, ascending and descending in monosaccharide. Structure of disaccharides (sucrose, maltose, lactose) and polysaccharides (starch and cellulose) excluding their structure elucidation.

(15 Hours)

**Reference Books:**

LAB COURSE
CHEM CC 303 P

TIME ALLOWED: 03 HOURS
Max Marks: 30

Credits – 2

I. **Distribution Law**
Study of the equilibrium of one of the following reactions by the distribution method:

\[
\text{I}_2(aq) + I^-(aq) \rightleftharpoons I_3^-(aq) \\
\text{Cu}^{2+}(aq) + x\text{NH}_2(aq) \rightleftharpoons [\text{Cu(NH}_3)_x]^{2+}
\]

II. **Conductance**
1. Determination of cell constant
2. Determination of equiv. conductance, degree of dissociation & dissociation constant of a weak acid.
3. Perform the following conductometric titrations:
   i) Strong acid vs. strong base
   ii) Weak acid vs. strong base

III. **Potentiometry** - Perform the following potentiometric titrations:
1. Strong acid vs. strong base
2. Weak acid vs. strong base
3. Potassium dichromate vs. Mohr's salt

IV. **Organic Chemistry**
1. Systematic Qualitative Organic Analysis of Organic Compounds possessing monofunctional groups (-COOH, phenolic, aldehydic, ketonic, amide, nitro, amines) and preparation of one derivative.
2. Any Two of the following:
   i) Separation of amino acids by paper chromatography
   ii) Determination of the concentration of glycine solution by formylation method.
   iii) Titration curve of glycine
   iv) Action of salivary amylase on starch
   v) Effect of temperature on the action of salivary amylase on starch.
   vi) Differentiation between a reducing and a non reducing sugar.

**Reference Books:**
SEMESTER IV

CHEM CC 404

COORDINATION CHEMISTRY, STATES OF MATTER & CHEMICAL KINETICS

Max. Marks: 50
Credits: 4

Time Allowed: 3 Hours

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SECTION - A

Transition Elements (3d series)

General group trends with special reference to electronic configuration, variable valency, colour, magnetic and catalytic properties, ability to form complexes and stability of various oxidation states (Latimer diagrams) for Mn, Fe and Cu.

Lanthanides and actinides: Electronic configurations, oxidation states, colour, magnetic properties, lanthanide contraction, separation of lanthanides and actinides (ion exchange method only).

Coordination Chemistry

Valence Bond Theory (VBT): Inner and outer orbital complexes of Cr, Fe, Co, Ni and Cu (coordination numbers 4 and 6). Structural and stereoisomerism in complexes with coordination numbers 4 and 6. Drawbacks of VBT. IUPAC nomenclature of coordination compounds.

(16 Hours)

SECTION - B

Crystal Field Theory


(14 Hours)

SECTION - C

Kinetic Theory of Gases

Postulates of Kinetic Theory of Gases and derivation of the kinetic gas equation.
Deviation of real gases from ideal behaviour, compressibility factor, causes of deviation. van der Waals equation of state for real gases. Boyle temperature (derivation not required). Critical phenomena, critical constants and their calculation from van der Waals equation. Andrews isotherms of CO₂.

Maxwell Boltzmann distribution laws of molecular velocities and molecular energies (graphic representation – derivation not required) and their importance.

Temperature dependence of these distributions. Most probable, average and root mean square velocities (no derivation). Collision cross section, collision number, collision frequency, collision diameter and mean free path of molecules. Viscosity of gases and effect of temperature and pressure on coefficient of viscosity (qualitative treatment only).

**Liquids**

Surface tension and its determination using stalagmometer. Viscosity of a liquid and determination of coefficient of viscosity using Ostwald viscometer. Effect of temperature on surface tension and coefficient of viscosity of a liquid (qualitative treatment only).

**SECTION - D**

**Solids**


**Chemical Kinetics**


Theories of Reaction Rates: Collision theory and Activated Complex theory of bimolecular reactions. Comparison of the two theories (qualitative treatment only).

**Reference Books:**

1. Inorganic Mixture Analysis - Semi-micro qualitative analysis of inorganic mixture using H₂S of mixtures - not more than four ionic species (two anions and two cations and excluding insoluble salts) out of the following:

Cations: \(\text{NH}_4^+, \text{Pb}^{2+}, \text{Ag}^+, \text{Bi}^{3+}, \text{Cu}^{2+}, \text{Cd}^{2+}, \text{Sn}^{2+}, \text{Fe}^{3+}, \text{Al}^{3+}, \text{Co}^{2+}, \text{Cr}^{3+}, \text{Ni}^{2+}, \text{Mn}^{2+}, \text{Zn}^{2+}, \text{Ba}^{2+}, \text{Sr}^{2+}, \text{Ca}^{2+}, \text{K}^+\)

Anions: \(\text{CO}_3^{2-}, \text{S}^{2-}, \text{SO}_3^{2-}, \text{S}_2\text{O}_3^{2-}, \text{NO}_2^-, \text{CH}_3\text{COO}^-, \text{Cl}^-, \text{Br}^-, \text{I}^-, \text{NO}_3^-, \text{PO}_4^{3-}, \text{BO}_3^{3-}, \text{C}_2\text{O}_4^{2-}\)

(Spot tests should be carried out wherever feasible)

2. Gravimetry

Estimate the amount of nickel present in a given solution as bis(dimethylglyoximato) nickel(II) or aluminium as oximate in a given solution gravimetrically.

3. Colorimetry

Draw calibration curve (absorbance at \(\lambda_{\text{max}}\) vs. concentration) for various concentrations of a given coloured compound (\(\text{KMnO}_4/\text{CuSO}_4\)) and estimate the concentration of the same in a given solution.

4. Complexometric titrations

a) Estimation of (i) \(\text{Mg}^{2+}\) or (ii) \(\text{Zn}^{2+}\) by complexometric titrations using EDTA.

b) Estimation of total hardness of a given sample of water by complexometric titration.

5. Surface tension measurement (use of organic solvents excluded).

a) Determination of the surface tension of a liquid or a dilute solution using a stalagmometer.

b) Study of the variation of surface tension of a detergent solution with concentration.


a) Determination of the relative and absolute viscosity of a liquid or dilute solution using an Ostwald’s viscometer.

b) Study of the variation of viscosity of an aqueous solution with concentration of solute.

7. Chemical Kinetics

Study the kinetics of the following reactions.

a) Initial rate method: Iodide-persulphate reaction

b) Integrated rate method:

i) Acid hydrolysis of methyl acetate with hydrochloric acid.

ii) Saponification of ethyl acetate.

iii) Compare the strengths of HCl and H₂SO₄ by studying kinetics of hydrolysis of methyl acetate

Reference Books:


Skill Enhancement Courses

(4 Courses)

At least one from Each Discipline

One Each in Semesters

(3rd, 4th, 5th and 6th)

(Credit: 04 each)
SEMESTER - III

CHEM SEC 301

BASIC ANALYTICAL CHEMISTRY

Max. Marks: 80
Credits: 4

Time allowed: 03 Hours

Note for Examiners and Students:

1. The question paper will consist of five sections A, B, C, D and E. Section E will be compulsory. Examiner will set nine questions in all, selecting two questions from section A, B, C, and D of 15 marks each and may contain more than one part. Section E will be of 20 marks and consists of 10 objective type questions (in MCQ/true and false / fill in the blanks) of one mark each and 5 short answer questions of two marks each covering the entire paper.

2. The candidate will be required to attempt five questions in all i.e. selecting one question from each section including the compulsory question. The duration of the examination will be 3 hours.

SECTION - A

Introduction: Introduction to Analytical Chemistry and its interdisciplinary nature. Concept of sampling. Importance of accuracy, precision and sources of error in analytical measurements. Presentation of experimental data and results, from the point of view of significant figures.

Analysis of soil: Composition of soil, Concept of pH and pH measurement, Complexometric titrations, Chelation, Chelating agents, use of indicators

a. Determination of pH of soil samples. b. Estimation of Calcium and Magnesium ions as Calcium carbonate by complexometric titration.

SECTION - B

Analysis of water: Definition of pure water, sources responsible for contaminating water, water sampling methods, water purification methods.

a. Determination of pH, acidity and alkalinity of a water sample. b. Determination of dissolved oxygen (DO) of a water sample.

Analysis of food products: Nutritional value of foods, idea about food processing and food preservations and adulteration.

a. Identification of adulterants in some common food items like coffee powder, asafoetida, chilli powder, turmeric powder, coriander powder and pulses, etc. b. Analysis of preservatives and colouring matter.

SECTION - C

Chromatography: Definition, general introduction on principles of chromatography, paper chromatography, TLC etc. a. Paper chromatographic separation of mixture of metal ion (Fe$^{3+}$ and Al$^{3+}$). b. To compare paint samples by TLC method. Ion-exchange: Column, ion-exchange chromatography etc. Determination of ion exchange capacity of anion / cation exchange resin (using batch procedure if use of column is not feasible).

(15 Hours)
SECTION - D

Analysis of cosmetics: Major and minor constituents and their function

a. Analysis of deodorants and antiperspirants, Al, Zn, boric acid, chloride, sulphate. b. Determination of constituents of talcum powder: Magnesium oxide, Calcium oxide, Zinc oxide and Calcium carbonate by complexometric titration. **Suggested Applications (Any one):**

a. To study the use of phenolphthalein in trap cases. b. To analyze arson accelerants. c. To carry out analysis of gasoline.

**Suggested Instrumental demonstrations:**

a. Estimation of macro nutrients: Potassium, Calcium, Magnesium in soil samples by flame photometry.

b. Spectrophotometric determination of Iron in Vitamin / Dietary Tablets.

c. Spectrophotometric Identification and Determination of Caffeine and Benzoic Acid in Soft Drink (15 Hours)

**Reference Books:**

SEMMESTER – III
CHEM SEC 302
FUEL CHEMISTRY
&
CHEMISTRY OF COSMETICS & PERFUMES

Max. Marks: 80
Credits: 4

Time allowed: 03 Hours

Note for Examiners and Students:

1. The question paper will consist of five sections A, B, C, D and E. Section E will be compulsory. Examiner will set nine questions in all, selecting two questions from section A, B, C, and D of 15 marks each and may contain more than one part. Section E will be of 20 marks and consists of 10 objective type questions (in MCQ/true and false / fill in the blanks) of one mark each and 5 short answer questions of two marks each covering the entire paper.

2. The candidate will be required to attempt five questions in all i.e. selecting one question from each section including the compulsory question. The duration of the examination will be 3 hours.

SECTION-A

Review of energy sources (renewable and non-renewable). Classification of fuels and their calorific value.
Coal: Uses of coal (fuel and nonfuel) in various industries, its composition, carbonization of coal. Coal gas, producer gas and water gas—composition and uses. Fractionation of coal tar, uses of coal tar bases chemicals, requisites of a good metallurgical coke, Coal gasification (Hydro gasification and Catalytic gasification), Coal liquefaction and Solvent Refining.

Petroleum and Petrochemical Industry: Composition of crude petroleum, Refining and different types of petroleum products and their applications. (18 Hours)

SECTION-B

Fractional Distillation (Principle and process), Cracking (Thermal and catalytic cracking), Reforming Petroleum and non-petroleum fuels (LPG, CNG, LNG, bio-gas, fuels derived from biomass), fuel from waste, synthetic fuels (gaseous and liquids), clean fuels. Petrochemicals: Vinyl acetate, Propylene oxide, Isoprene, Butadiene, Toluene and its derivatives Xylene.

Lubricants: Classification of lubricants, lubricating oils (conducting and non-conducting) Solid and semisolid lubricants, synthetic lubricants. Properties of lubricants (viscosity index, cloud point, pore point) and their determination. (18 Hours)

SECTION-C

A general study including preparation and uses of the following: Hair dye, hair spray, shampoo, suntan lotions, face powder, lipsticks, talcum powder, nail enamel, creams (cold, vanishing and shaving creams), antiperspirants and artificial flavours. (12 Hours)

SECTION-D

Essential oils and their importance in cosmetic industries with reference to Eugenol, Geraniol, sandalwood oil, eucalyptus, rose oil, 2-phenyl ethyl alcohol, Jasmone, Civetone, Muscone. (12 Hours)
Reference Books:


SEMESTER – VI

CHEM SEC 603

CHEMICAL TECHNOLOGY & SOCIETY
and
BUSINESS SKILLS FOR CHEMISTRY

Max. Marks: 80
Credits: 4

Time allowed: 03 Hours

Note for Examiners and Students:

1. The question paper will consist of five sections A, B, C, D and E. Section E will be compulsory. Examiner will set nine questions in all, selecting two questions from section A, B, C, and D of 15 marks each and may contain more than one part. Section E will be of 20 marks and consists of 10 objective type questions (in MCQ/true and false / fill in the blanks) of one mark each and 5 short answer questions of two marks each covering the entire paper.

2. The candidate will be required to attempt five questions in all i.e. selecting one question from each section including the compulsory question. The duration of the examination will be 3 hours.

SECTION-A

Chemical Technology

Basic principles of distillation, solvent extraction, solid-liquid leaching and liquid-liquid extraction, separation by absorption and adsorption. An introduction into the scope of different types of equipment needed in chemical technology, including reactors, distillation columns, extruders, pumps, mills, emulgators. Scaling up operations in chemical industry. Introduction to clean technology. (18 Hours)

SECTION-B

Society

Exploration of societal and technological issues from a chemical perspective. Chemical and scientific literacy as a means to better understand topics like air and water (and the trace materials found in them that are referred to as pollutants); energy from natural sources (i.e. solar and renewable forms), from fossil fuels and from nuclear fission; materials like plastics and polymers and their natural analogues, proteins and nucleic acids, and molecular reactivity and interconversions from simple examples like combustion to complex instances like genetic engineering and the manufacture of drugs. (18 Hours)
Section - C

Business Basics
Key business concepts: Business plans, market need, project management and routes to market.

Chemistry in Industry
Current challenges and opportunities for the chemistry-using industries, role of chemistry in India and global economies. (12 Hours)

Section - D

Making money - Financial aspects of business with case studies

Intellectual property - Concept of intellectual property, patents. (12 Hours)

Reference Books:
1. www.rsc.org
2. John W. Hill, Terry W. McCreary & Doris K. Kolb, Chemistry for changing times 13th Ed.

SEMESTER VI

CHEM SEC 604

PESTICIDE CHEMISTRY
&

PHARMACEUTICAL CHEMISTRY

Max. Marks: 80
Time allowed: 03 Hours
Credits: 4

Note for Examiners and Students:

1. The question paper will consist of five sections A, B, C, D and E. Section E will be compulsory. Examiner will set nine questions in all, selecting two questions from section A, B, C, and D of 15 marks each and may contain more than one part. Section E will be of 20 marks and consists of 10 objective type questions (in MCQ/true and false / fill in the blanks) of one mark each and 5 short answer questions of two marks each covering the entire paper.

2. The candidate will be required to attempt five questions in all i.e. selecting one question from each section including the compulsory question. The duration of the examination will be 3 hours.

SECTION-A

General introduction to pesticides (natural and synthetic), benefits and adverse effects, changing concepts of pesticides, structure activity relationship. (12 Hours)

SECTION-B

Synthesis and technical manufacture and uses of representative pesticides in the following classes: Organochlorines (DDT, Gammexene,); Organophosphates (Malathion, Parathion ); Carbamates (Carbofuran and carbaryl); Quinones (Chloranil), Anilides (Alachlor and Butachlor). (15 Hours)
SECTION - C

Drugs & Pharmaceuticals Drug discovery, design and development; Basic Retrosynthetic approach. Synthesis of the representative drugs of the following classes: analgesics agents, antipyretic agents, anti-inflammatory agents (Aspirin, paracetamol, Ibuprofen); antibiotics (Chloramphenicol); antibacterial and antifungal agents (Sulphonamides; Sulphanethoxazol, Sulphacetamide, Trimethoprim); antiviral agents (Acyclovir), Central Nervous System agents (Phenobarbital, Diazepam), Cardiovascular (Glyceryl trinitrate), antilaprosy (Dapsone), HIV-AIDS related drugs (AZT- Zidovudine). (18 Hours)

SECTION - D

Fermentation Aerobic and anaerobic fermentation. Production of (i) Ethyl alcohol and citric acid, (ii) Antibiotics; Penicillin, Cephalosporin, Chloromycetin and Streptomycin, (iii) Lysine, Glutamic acid, Vitamin B2, Vitamin B12 and Vitamin C. (15 Hours)

Reference Books:

1. G.L. Patrick: Introduction to Medicinal Chemistry, Oxford University Press, UK
Discipline Specific Electives (DSE) Courses

(two papers: one each in 5th and 6th semesters)

from

Each Discipline

(Chemistry, Physics and Mathematics)

(Credits: Theory-04/Practical-02)
SEMMESTER - V
CHEM DSE 501
POLYMER CHEMISTRY

Max. Marks: 50
Credits: 4

Time Allowed: 3 Hours

Note for Examiners and Students:

1. The question paper will consist of five sections A, B, C, D and E. Section E will be compulsory. Examiner will set nine questions in all, selecting two questions from section A, B, C, and D of 10 marks each and may contain more than one part. Section E will be of 10 marks and consists of objective type questions (MCQ/true and false / fill in the blanks etc.) of one mark each covering the entire paper.

2. The candidate will be required to attempt five questions in all i.e. selecting one question from each section including the compulsory question. The duration of the examination will be 3 hours.

SECTION - A

Introduction and history of polymeric materials:

Different schemes of classification of polymers, Polymer nomenclature, Molecular forces and chemical bonding in polymers, Texture of Polymers. Functionality and its importance: Criteria for synthetic polymer formation, classification of polymerization processes, Relationships between functionality, extent of reaction and degree of polymerization. Bifunctional systems, Poly-functional systems. (15 Hours)

SECTION - B

Kinetics of Polymerization:

Mechanism and kinetics of step growth, radical chain growth, ionic chain (both cationic and anionic) and coordination polymerizations, Mechanism and kinetics of copolymerization, polymerization techniques. Crystallization and crystallinity:

Determination of crystalline melting point and degree of crystallinity, Morphology of crystalline polymers, Factors affecting crystalline melting point. Nature and structure of polymers-Structure Property relationships. (15 Hours)

SECTION - C

Determination of molecular weight of polymers (Mn, Mw, etc) by end group analysis, viscometry, light scattering and osmotic pressure methods. Molecular weight distribution and its significance. Polydispersity index.

Glass transition temperature (Tg) and determination of Tg, Free volume theory, WLF equation, Factors affecting glass transition temperature (Tg).
**Polymer Solution** – Criteria for polymer solubility, Solubility parameter, Thermodynamics of polymer solutions, entropy, enthalpy, and free energy change of mixing of polymers solutions, Flory- Huggins theory, Lower and Upper critical solution temperatures. (16 Hours)

**SECTION - D**

Properties of Polymers (Physical, thermal, Flow & Mechanical Properties).

Brief introduction to preparation, structure, properties and application of the following polymers: polyolefins, polystyrene and styrene copolymers, poly(vinyl chloride) and related polymers, poly(vinyl acetate) and related polymers, acrylic polymers, fluoro polymers, polyamides and related polymers. Phenol formaldehyde resins (Bakelite, Novalac), polyurethanes, silicone polymers, polydienes, Polycarbonates, Conducting Polymers, [polyacetylene, polyaniline, poly(p-phenylene sulphide polypyrrole, polythiophene)]. (14 Hours)

**Reference Books:**


**LAB COURSE**

**CHEM DSE 501 P**

**TIME ALLOWED: 03 HOURS**

Max Marks: 30  
Credits - 2

**I. Polymer synthesis**

1. Free radical solution polymerization of styrene (St) / Methyl Methacrylate (MMA) / Methyl Acrylate (MA) / Acrylic acid (AA).
   a. Purification of monomer
   b. Polymerization using benzooyl peroxide (BPO) / 2,2’-azo-bis-isobutylonitrile (AIBN)

2. Preparation of nylon 66

3. Redox polymerization of acrylamide

4. Precipitation polymerization of acrylonitrile

5. Preparation of urea-formaldehyde resin
6. Preparations of novalac resin/resold resin.

7. Microscale Emulsion Polymerization of Poly(methylacrylate).

II. Polymer characterization

1. Determination of molecular weight by viscometry:
   
   (a) Polyacrylamide-aq.NaNO₂ solution
   
   (b) (Poly vinyl propyldine (PVP) in water

2. Determination of the viscosity-average molecular weight of poly(vinyl alcohol) (PVOH) and the fraction of “head-to-head” monomer linkages in the polymer.

3. Determination of molecular weight by end group analysis: Polyethylene glycol (PEG) (OH group).


*At least 7 experiments to be carried out.

Reference Books:

SEMESTER - V
CHEM DSE 502
INDUSTRIAL CHEMICALS AND ENVIRONMENT

Max. Marks: 50
Credits: 4
Time Allowed: 3 Hours

Note for Examiners and Students:

1. The question paper will consist of five sections A, B, C, D and E. Section E will be compulsory. Examiner will set nine questions in all, selecting two questions from section A, B, C, and D of 10 marks each and may contain more than one part. Section E will be of 10 marks and consists of objective type questions (MCQ/true and false / fill in the blanks etc.) of one mark each covering the entire paper.

2. The candidate will be required to attempt five questions in all i.e. selecting one question from each section including the compulsory question. The duration of the examination will be 3 hours.

SECTION – A

Industrial Gases and Inorganic Chemicals

Industrial Gases: Large scale production, uses, storage and hazards in handling of the following gases: oxygen, nitrogen, argon, neon, helium, hydrogen, acetylene, carbon monoxide, chlorine, fluorine, sulphur dioxide and phosgene.

Inorganic Chemicals: Manufacture, application, analysis and hazards in handling the following chemicals: hydrochloric acid, nitric acid, sulphuric acid, caustic soda, common salt, borax, bleaching powder, sodium thiosulphate, hydrogen peroxide, potash alum, chrome alum, potassium dichromate and potassium permanganate. (14 Hours)

SECTION - B

Industrial Metallurgy - General Principles of Metallurgy

Chief modes of occurrence of metals based on standard electrode potentials. Ellingham diagrams for reduction of metal oxides using carbon as reducing agent.

Hydrometallurgy, Methods of purification of metals (Al, Pb, Ti, Fe, Cu, Ni, Zn): electrolytic, oxidative refining, Kroll process, Parting process, van Arkel-de Boer process and Mond’s process. Preparation of metals (ferrous and nonferrous) and ultrapure metals for semiconductor technology.


Effects of air pollution on living organisms and vegetation. Greenhouse effect and Global warming. Ozone depletion by oxides of nitrogen, chlorofluorocarbons and Halogens, removal of sulphur from coal. Control of particulates. (16 Hours)
SECTION - C

Water Pollution: Hydrological cycle, water resources, aquatic ecosystems, Sources and nature of water pollutants, Techniques for measuring water pollution, Impacts of water pollution on hydrological and ecosystems. Water purification methods. Effluent treatment plants (primary, secondary and tertiary treatment). Industrial effluents from the following industries and their treatment: electroplating, textile, tannery, dairy, petroleum and petrochemicals, agro, fertilizer, etc. Sludge disposal. Industrial waste management, incineration of waste. Water treatment and purification (reverse osmosis, electro dialysis, ion exchange). Water quality parameters for waste water, industrial water and domestic water. (16 Hours)

SECTION - D

Energy & Environment

Sources of energy: Coal, petrol and natural gas. Nuclear Fusion / Fission, Solar energy, Hydrogen, geothermal, Tidal and Hydel, etc.

Nuclear Pollution: Disposal of nuclear waste, nuclear disaster and its management.

Biocatalysis: Introduction to biocatalysis: Importance in “Green Chemistry” and Chemical Industry. (14 Hours)

Reference Books:


LAB COURSE
CHEM DSE 502 P

TIME ALLOWED: 03 HOURS
Max Marks: 30

Credits – 2

1. Determination of dissolved oxygen in water.
2. Determination of Chemical Oxygen Demand (COD)
3. Determination of Biological Oxygen Demand (BOD)
4. Percentage of available chlorine in bleaching powder.
5. Measurement of chloride, sulphate and salinity of water samples by simple titration method (AgNO₃ and potassium chromate).
6. Estimation of total alkalinity of water samples (CO$_3^{2-}$, HCO$_3^-$) using double titration method.


8. Study of some of the common bio-indicators of pollution.


10. Preparation of borax/ boric acid.

Reference Books:


SEMESTER - V
CHEM DSE 503
QUANTUM CHEMISTRY, SPECTROSCOPY & PHOTOCHEMISTRY

Max. Marks: 50
Credits: 4

Time Allowed: 3 Hours

Note for Examiners and Students:

1. The question paper will consist of five sections A, B, C, D and E. Section E will be compulsory. Examiner will set nine questions in all, selecting two questions from section A, B, C, and D of 10 marks each and may contain more than one part. Section E will be of 10 marks and consists of objective type questions (MCQ/true and false / fill in the blanks etc.) of one mark each covering the entire paper.

2. The candidate will be required to attempt five questions in all i.e. selecting one question from each section including the compulsory question. The duration of the examination will be 3 hours.

SECTION – A

Quantum Chemistry

Postulates of quantum mechanics, quantum mechanical operators, Schrödinger equation and its application to free particle and “particle-in-a-box” (rigorous treatment), quantization of energy levels, zero-point energy and Heisenberg Uncertainty principle; wave functions, probability distribution functions, nodal properties, Extension to two and three dimensional boxes, separation of variables, degeneracy. Qualitative treatment of simple harmonic oscillator model of vibrational motion: Setting up of Schrödinger equation and discussion of solution and wave functions. Vibrational energy of diatomic molecules and zero-point energy.

Angular momentum: Commutation rules, quantization of square of total angular momentum and z-component.
Rigid rotator model of rotation of diatomic molecule. Schrödinger equation, transformation to spherical polar coordinates. Separation of variables. Spherical harmonics. Discussion of solution. (16 Hours)

SECTION – B

Molecular Spectroscopy

Interaction of electromagnetic radiation with molecules and various types of spectra; Born Oppenheimer approximation. Rotation spectroscopy: Selection rules, intensities of spectral lines, determination of bond lengths of diatomic and linear triatomic molecules, isotopic substitution. Vibrational spectroscopy: Classical equation of vibration, computation of force constant, amplitude of diatomic molecular vibrations, anharmonicity, Morse potential, dissociation energies, fundamental frequencies, overtones, hot bands, degrees of freedom for polyatomic molecules, modes of vibration, concept of group frequencies. Vibration-rotation spectroscopy: diatomic vibrating rotator, P, Q, R branches. (16 Hours)

SECTION - C

Raman spectroscopy

Qualitative treatment of Rotational Raman effect; Effect of nuclear spin, Vibrational Raman spectra, Stokes and anti-Stokes lines; their intensity difference, rule of mutual exclusion.

Electronic spectroscopy

Franck-Condon principle, electronic transitions, singlet and triplet states, fluorescence and phosphorescence, dissociation and pre-association, calculation of electronic transitions of polyenes using free electron model.

Nuclear Magnetic Resonance (NMR) spectroscopy: Principles of NMR spectroscopy, Larmor precession, chemical shift and low resolution spectra, different scales, spin-spin coupling and high resolution spectra, interpretation of PMR spectra of organic molecules. Electron Spin Resonance (ESR) spectroscopy: It’s principle and hyperfine structure, ESR of simple radicals. (16 Hours)

SECTION - D

Photochemistry

Characteristics of electromagnetic radiation, Lambert-Beer’s law and its limitations, physical significance of absorption coefficients. Laws of photochemistry, quantum yield, examples of low and high quantum yields, photochemical equilibrium and the differential rate of photochemical reactions, photosensitised reactions, quenching. Role of photochemical reactions in biochemical processes, photostationary states, chemiluminescence. (12 Hours)

Reference Books:

LAB COURSE

CHEM DSE 503 P

TIME ALLOWED: 03 HOURS
Max Marks: 30

Credits - 2

I. Verify Lambert-Beer’s law and determine the concentration of CuSO$_4$/ KMnO$_4$/ K$_2$Cr$_2$O$_7$ in a solution of unknown concentration

II. Determine the concentrations of KMnO$_4$ and K$_2$Cr$_2$O$_7$ in a mixture.

III. Study the kinetics of iodination of propanone in acidic medium.

IV. Determine the amount of iron present in a sample using 1,10-phenanthroline.

V. Determine the dissociation constant of an indicator (phenolphthalein).

VI. Study the kinetics of interaction of crystal violet/ phenolphthalein with sodium hydroxide.

VII. Analyse the given vibration-rotation spectrum of HCl(g)

Reference Books

SEMESTER - VI

CHEM DSE 604

CHEMISTRY OF MAIN GROUP ELEMENTS, THEORIES OF ACIDS AND BASES

Max. Marks: 50 Time Allowed: 3 Hours
Credits: 4

Note for Examiners and Students:

1. The question paper will consist of five sections A, B, C, D and E. Section E will be compulsory. Examiner will set nine questions in all, selecting two questions from section A, B, C, and D of 10 marks each and may contain more than one part. Section E will be of 10 marks and consists of objective type questions (MCQ/true and false / fill in the blanks etc.) of one mark each covering the entire paper.

2. The candidate will be required to attempt five questions in all i.e. selecting one question from each section including the compulsory question. The duration of the examination will be 3 hours.

SECTION - A

Acids and Bases

Arrhenius, Bronsted and Lowry, Lewis, Lux flood and solvent system concepts of acids and bases. Classification of acids and bases as hard and soft. Pearson’s HSAB concept, application of HSAB principle. Relative strength of acids and bases and effect of substituents and solvent on their strength. (12 Hours)

SECTION - B

Hydrogen


S-Block Elements

Periodicity of elements with respect to electronic configuration, atomic and ionic size, ionization enthalpy, electron gain enthalpy, electronegativity (Pauling Scale). General characteristics of s-block elements like density, melting points, flame colouration and reducing character, solvation and complexation tendencies and solutions of metals in liquid ammonia. (16 Hours)

SECTION – C

P- Block Elements

Comparative studies including diagonal relationship of group 13 and 14 elements. Borohydrides, Hydrides, oxide and oxy-acids and halides of boron, borax, Borazine, allotropic forms of carbon, fullerenes, carbides of calcium and silicon, silanes, structure of silicate minerals and silicones. Hydrides, oxides, oxoacids and halides of nitrogen. Allotropic forms of phosphorous. Hydrides, halides, oxides and oxyacids of phosphorous. Basic properties of halogens and inter halogen compounds, pseudohalogens and poly halides. (20 Hours)
SECTION – D

Noble Gases

Occurrence of noble gases, History of discovery of noble gases and isolation of noble gases form air. Preparation properties and structure of important compounds of noble gases-flourides, oxides, oxyfluorides of xenon (valence bond structure only). Krypton difloride and clathrate compounds of noble gases. (12 Hours)

Books Recommended:
2. Inorganic Chemistry by T. Moeller.
5. Theoretical Inorganic Chemisty by Day & Selbin.

LAB COURSE

CHEM DSE 604 P

TIME ALLOWED: 03 HOURS
Max Marks: 30

1. Iodometric estimation of potassium dichromate and copper estimate.
2. Iodimetric estimation of antimony in tartaremetic.
3. Estimation of amount of available chlorine in bleaching powder and household bleachers.
4. Estimation of iodine in iodized salts
5. Iodimetric estimation of ascorbic acid in fruit juices.
8. Inorganic preparation of
   i) Potash alum
   ii) Chrome alum
   iii) tetraamminecopper(II) sulphate
   iv) potassium trioxalatoferrate(III)
   v) hexaammine nickel(II) chloride
SEMESTER - VI
CHEM DSE 605
ORGANOMETALLICS, BIOINORGANIC CHEMISTRY, POLYNUCLEAR HYDROCARBONS AND UV, IR SPECTROSCOPY

Max. Marks: 50
Credits: 4

Time Allowed: 3 Hours

Note for Examiners and Students:

1. The question paper will consist of five sections A, B, C, D and E. Section E will be compulsory. Examiner will set nine questions in all, selecting two questions from section A, B, C, and D of 10 marks each and may contain more than one part. Section E will be of 10 marks and consists of objective type questions (MCQ/true and false / fill in the blanks etc.) of one mark each covering the entire paper.

2. The candidate will be required to attempt five questions in all i.e. selecting one question from each section including the compulsory question. The duration of the examination will be 3 hours.

SECTION - A

Chemistry of elements of 3d metals

Oxidation states displayed by Cr, Fe, Co, Ni and Co.

A study of the following compounds (including preparation and important properties); Peroxo compounds of Cr, K₂Cr₂O₇, KMnO₄, K₃[Fe(CN)₆], sodium nitroprusside, [Co(NH₃)₆]Cl₃, Na₃[Co(NO₂)₆].

Organometallic Compounds

Definition and Classification with appropriate examples based on nature of metal-carbon bond (ionic, s, p and multicentre bonds). Structures of methyl lithium, Zeiss salt and ferrocene. EAN rule as applied to carbonyls. Preparation, structure, bonding and properties of mononuclear and polynuclear carbonyls of 3d metals. p-acceptor behaviour of carbon monoxide. Synergic effects (VB approach)- (MO diagram of CO can be referred to for synergic effect to IR frequencies).

SECTION - B

Bio-Inorganic Chemistry

A brief introduction to bio-inorganic chemistry. Role of metal ions present in biological systems with special reference to Na+, K+ and Mg2+ ions: Na/K pump; Role of Mg2+ ions in energy production and chlorophyll. Role of Ca2+ in blood clotting, stabilization of protein structures and structural role (bones).

SECTION – C

SECTION - D

Application of Spectroscopy to Simple Organic Molecules

Application of visible, ultraviolet and Infrared spectroscopy in organic molecules. Electromagnetic radiations, electronic transitions, $\lambda_{\text{max}}$ & $\epsilon_{\text{max}}$. chromophore, auxochrome, bathochromic and hypsochromic shifts. Application of electronic spectroscopy and Woodward rules for calculating $\lambda_{\text{max}}$ of conjugated dienes and $\alpha, \beta$ – unsaturated compounds.

Infrared radiation and types of molecular vibrations, functional group and fingerprint region. IR spectra of alkanes, alkenes and simple alcohols (inter and intramolecular hydrogen bonding), aldehydes, ketones, carboxylic acids and their derivatives (effect of substitution on $\geq$C=O stretching absorptions). (18 Hours)

Reference Books:

3. J.D. Lee: A New Concise Inorganic Chemistry, E.L.B.S.

LAB COURSE

CHEM DSE 605 P

TIME ALLOWED: 03 HOURS
Max Marks: 30

Credits – 2

1. Separation of mixtures by chromatography: Measure the Rf value in each case. (Combination of two ions to be given) Paper chromatographic separation of Fe$^{3+}$, Al$^{3+}$ and Cr$^{3+}$ or Paper chromatographic separation of Ni$^{2+}$, Co$^{2+}$, Mn$^{2+}$ and Zn$^{2+}$

2. Preparation of any two of the following complexes and measurement of their conductivity:

(i) tetraamminecarbonatocobalt (III) nitrate
(ii) tetraamminecopper (II) sulphate
(iii) potassium trioxalatoferrate (III) trihydrate

Compare the conductance of the complexes with that of M/1000 solution of NaCl, MgCl$_2$ and LiCl$_3$.

1. Systematic Qualitative Organic Analysis of Organic Compounds possessing monofunctional groups (-COOH, phenolic, aldehydic, ketonic, amide, nitro, amines) and preparation of one derivative.

Reference Books:

1. A.I. Vogel: Qualitative Inorganic Analysis, Prentice Hall, 7th Edn.
SEMESTER -VI
CHEM DSE 606
MOLECULES OF LIFE

Max. Marks: 50
Credits: 4

Time Allowed: 3 Hours

Note for Examiners and Students:

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2. The candidate will be required to attempt five questions in all i.e. selecting one question from each section including the compulsory question. The duration of the examination will be 3 hours.

SECTION – A

Carbohydrates

Classification of carbohydrates, reducing and non-reducing sugars, General Properties of Glucose and Fructose, their open chain structure. Epimers, mutarotation and anomers. Determination of configuration of Glucose (Fischer proof). Cyclic structure of glucose. Haworth projections. Cyclic structure of fructose. Linkage between monosaccharides, structure of disaccharides (sucrose, maltose, lactose) and polysaccharides (starch and cellulose) excluding their structure elucidation.

Lipids


(18 Hours)

SECTION – B

Amino Acids, Peptides and Proteins

Classification of Amino Acids, Zwitterion structure and Isoelectric point. Overview of Primary, Secondary, Tertiary and Quaternary structure of proteins. Determination of primary structure of peptides, determination of N-terminal amino acid (by DNFB and Edman method) and C-terminal amino acid (by thiohydantoin and with carboxypeptidase enzyme). Synthesis of simple peptides (upto dipeptides) by N-protection (tbutyloxycarbonyl and phthaloyl) & C-activating groups and Merrifield solid phase synthesis.

(14 Hours)

SECTION - C

Enzymes and correlation with drug action

Mechanism of enzyme action, factors affecting enzyme action, Coenzymes and cofactors and their role in biological reactions, Specificity of enzyme action( Including stereospecificity), Enzyme inhibitors and their importance, phenomenon of inhibition(Competitive and Non- competitive inhibition including allostERIC
inhibition). Drug action-receptor theory. Structure–activity relationships of drug molecules, binding role of –OH group, -NH2 group, double bond and aromatic ring. (13 Hours)

SECTION - D

Nucleic Acids

Components of Nucleic acids: Adenine, guanine, thymine and Cytosine (Structure only), other components of nucleic acids, Nucleosides and nucleotides (nomenclature), Structure of polynucleotides; Structure of DNA (Watson-Crick model) and RNA (types of RNA), Genetic Code, Biological roles of DNA and RNA: Replication, Transcription and Translation.

Concept of Energy in Biosystems


Recommended Texts:

LAB COURSE

CHEM DSE606 P

TIME ALLOWED: 03 HOURS

Max Marks: 30

1. Separation of amino acids by paper chromatography

2. To determine the concentration of glycine solution by formylation method.

3. Study of titration curve of glycine

4. Action of salivary amylase on starch

5. Effect of temperature on the action of salivary amylase on starch.

6. To determine the saponification value of an oil/fat.

7. To determine the iodine value of an oil/fat

8. Differentiate between a reducing/ nonreducing sugar.

9. Extraction of DNA from onion/cauliflower

Recommended Texts: