Telephone No. 2419677/2419361
Fax: 0821-2419363/2419301

e-mail : registrar@uni-mysore.ac.in
www.uni-mysore.ac.in

UNIVERSITY OF MYSORE

Estd. 1916

VishwavidyanilayaKaryasoudha
Crawford Hall, Mysuru- 570 005

No.AC2(S)/55/2024-25

Dated: 20.07.2024

Notification

Sub:-Syllabus and Scheme of Examinations of Chemistry (UG) programme (I &II Semester) from the Academic year 2024-25.

Ref:-1.Decision of Board of Studies in Chemistry (CB) meeting held on 08-06-2024.
2. Decision of the Faculty of Science & Technology meeting held on 19-06-2024.
3. Decision of the Academic Council meeting held on 28-06-2024.

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The Board of Studies in Chemistry (CB) which met on 08-06-2024 has resolved to recommend & approved the Syllabus and Scheme of examinations of Chemistry (UG) programme (I & II Semester) with effect from the Academic year 2024-25.

The Faculty of Science & Technology and Academic Council at their meetings held on 19-06-2024 and 28-06-2024 respectively has also approved the above said Syllabus and Scheme of examinations hence it is hereby notified.

The Syllabus and Scheme of Examinations content may be downloaded from the University Website i.e., www.uni-mysore.ac.in.

Registrar

Registrar
University of Mysore
Mysore

To;

1. All the Principal of affiliated Colleges of University of Mysore, Mysore.
2. The Registrar (Evaluation), University of Mysore, Mysuru.
3. The Chairman, BOS/DOS in Chemistry, Manasagangothri, Mysore.
4. The Dean, Faculty of Science & Technology, DOS in Mathematics, MGM.
5. The Director, Distance Education Programme, Moulya Bhavan, Manasagangotri, Mysuru.
6. The Director, PMEB, Manasagangothri, Mysore.
7. Director, College Development Council , Manasagangothri, Mysore.
8. The Deputy Registrar/Assistant Registrar/Superintendent, Administrative Branch and Examination Branch, University of Mysore, Mysuru.
9. The PA to Vice-Chancellor/ Registrar/ Registrar (Evaluation), University of Mysore, Mysuru.
10. Office Copy.

UNIVERSITY  **OF MYSORE**

SYLLABUS (CBCS Scheme)

CHEMISTRY

FOR B.Sc. DEGREE PROGRAMME

2024-25 (Batch Onwards)

B.Sc. CHEMISTRY SYLLABUS

FIRST SEMESTER

Paper: Chemistry-I **Code: CHDSC-1**

Contact Hours/ Week	Credits	Scheme of Evaluation: Max. Marks: 100		
		Continuous Internal Assessment		Semester End Examination (SEE)
		C_1	C_2	C_3
03	03	10 Marks	10 Marks	80 Marks

Unit-I **Inorganic Chemistry** **[15 Hours]**

Atomic Structure: de Broglie matter waves -dual nature of electron. Heisenberg's uncertainty principle and its significance. Schrodinger wave equation-explanation of the terms involved (no derivation). Significance of ψ and ψ^2. Atomic orbitals, shapes of s, p and d orbitals. Quantum numbers and its significance. (n+l) rule, Aufbau Principle, Pauli's exclusion principle and Hund's rule of maximum multiplicity, electronic configuration of elements (up to Z = 30). Explanation for the stability of completely-filled and half-filled orbitals based on the concepts of pairing energy, promotional energy and symmetric charge distribution. Effective nuclear charge, screening effect-based on Slater's rules (problems to be solved). [**07 Hours**]

Periodic properties: Classification of elements in to s, p, d, and f blocks. Atomic radii**,** covalent, ionic and van der Waal's (explanation with examples). Additive nature of covalent radii. Variation of covalent radii down a group and across a period - explanation for the observed trends, isoelectronic ions, variation of ionic radii in isoelectronic ions. Determination of ionic radii by Pauling's method. Comparison of the size of atoms with corresponding anions and cations.

Ionization enthalpy: Explanation, successive ionization enthalpy, factors affecting ionization enthalpy, applications of ionization enthalpy. Variation down a group and across a period, explanation for the observed trends.

Electron gain enthalpy: Definition, successive electron gain enthalpy, variation of electron gain enthalpy across a period and down a group, explanation for the observed trends.

Electronegativity: Explanation, Variation of electronegativity in a group and in a period-explanation for the observed trends. Factors determining electro negativity (charge on the atom and hybridization). Pauling, Mulliken and Allred-Rochow scale of electronegativity (problems to be solved). Applications of electronegativity. [**08 Hours**]

Unit-II **Organic Chemistry** **[15 Hours]**

Basic Concepts: Arrow notations and their significance, bond cleavage, types of reagents - electrophiles and nucleophiles. Reaction intermediates - generation, stabilities, and reactions involving carbocations, carbanions, carbon free radicals, nitrenes and carbenes.

Electronic displacement effects: Inductive effect, electromeric effect, resonance, hyperconjugation and their significance. Strengths of organic acids and bases: Comparative study with emphasis on factors effecting pK values. Relative strength of carboxylic acids (formic acid,

acetic acid, chloroacetic acid, trichloroacetic acid, propionic acid, benzoic acid, *o*-nitrobenzoic acid, *m*-nitrobenzoic acid, *p*-nitrobenzoic acid, *o*-toluic acid, *m*-toluic acid and *p*-toluic acid. Relative strength of organic bases (methylamine, ethylamine, dimethylamine, trimethylamine, aniline, diphenylamine, triphenylamine, *o*-nitroaniline, *m*-nitroaniline, *p*-nitroaniline, *o*-toluidine, *m*-toluidine, and *p*-toluidine. [**07 Hours**]

Alkanes: Preparation (Corey-House, Wurtz method), Mechanism of free radical substitution of methane.

Alkenes: Preparation (Wittig's reaction), Reactions of ethylene and propene (reduction, hydroboration, epoxidation, oxidation with $KMnO_4$ and OsO_4 and ozonolysis). Mechanism of addition of HBr to ethylene and propene (Markovnikoff rule, and peroxide effect).

Dienes: Definition, types with examples. Conjugated dienes: 1,3 butadiene – preparation, 1,2 and 1,4-addition reactions with HX and X_2, Diel's Alder reaction with an example.

Alkynes: Methods of preparation (Dehydrohalogenation), reactions (with HCN, H_2, HX, and H_2O). Acidic character of terminal alkynes.

Alkyl halides: Elimination reactions (Mechanism of E1, E2, and E1cb reactions). Saytzeff and Hoffmann's elimination. Substitution reactions (S_N1 and S_N2 reactions with energy profile diagram). Effect of nature of alkyl groups, leaving groups, nucleophiles, and solvents on substitution reactions. [**08 hours**]

Unit-III **Physical Chemistry** **[15 Hours]**

Gaseous State: Elementary aspects of kinetic theory of gases, ideal and real gases (No derivation).

Molecular Velocities: Distribution of molecular velocities and molecular energies (graphical representation-derivation not required) and their importance. Effect of temperature on distribution of molecular velocities using distribution curve. Energy distribution as a function of temperature. Types of Molecular Velocities- Most probable, average, and root mean square velocities definition and equation (no derivation) and their relationship. Law of equiportion of energy.

Behavior of real gases: Deviation from ideal gas behavior, compressibility factor (Z) and its variation with pressure. Causes of deviation from ideal behavior. [**04 Hours**]

Critical Phenomenon: Andrews experiments on CO_2. Critical constants: - critical temperature (T_c), critical pressure (P_c) and critical volume (V_c) – definitions. Experimental determination of T_C and P_C using Cagniard-de-laTours apparatus. Determination of critical volume (Vc) by Cailletet and Mathias method. Relationship of vander- Waals constant (a and b) with critical constants Tc, Pc and Vc (derived using isotherm of CO_2), Law of corresponding state and reduced equation state. Numerical problems on Tc, Pc and Vc vander Waals constant (a and b). [**04 Hours**]

Liquification of gases: Inter molecular forces, Vander-waal's forces of attraction, brief account of dipole-dipole, dipole-induced dipole, induced dipole-induced dipole interactions (London forces). Principle underlying liquefaction of gases - Joule Thomson effect, Joule Thomson experiments, show that joule Thomson effect is an iso-enthalpic process ($\Delta H=0$), Joule-Thomson coefficient, inversion temperature definition and its relation between Vander Waal's constants a and b. numerical problems. [**04 Hours**]

Adsorption: Introduction, principle involved, sorption, absorption, and adsorption (definition, examples and differences). Types of adsorptions - Physical and Chemical adsorption ((definition, examples and differences). Adsorption of gases on solids- Factors which influence the adsorption on solids, adsorption isotherms, mathematical expression for Frieundlich and Langmuir adsorption isotherms (to be derived), mention application of adsorption. [**03 Hours**]

Paper: Chemistry Practicals-I **Code: CHDSCP-1**

Contact Hours/ Week	Credits	Scheme of Evaluation: Max. Marks: 50		
		Continuous Internal Assessment		Semester End Examination (SEE)
		C_1	C_2	C_3
04	02	05 Marks	05 Marks	40 Marks

LIST OF EXPERIMENTS

Part A: Volumetric Analysis

1. Preparation of standard sodium carbonate solution, standardization of hydrochloric acid solution, and estimation of sodium hydroxide present in the given solution.
2. Preparation of standard oxalic acid solution, standardization of sodium hydroxide solution, and estimation of sulphuric acid present in the given solution.
3. Preparation of standard potassium biphthalate solution, standardization of sodium hydroxide solution, and estimation of oxalic acid present in the given solution.
4. Preparation of standard oxalic acid solution, standardization of potassium permanganate solution, and estimation of ferrous ammonium sulphate present in the given solution.
5. Preparation of standard ferrous ammonium sulphate solution, standardization of potassium permanganate solution, and estimation of hydrogen peroxide present in the solution.
6. Preparation of standard potassium dichromate solution, and estimation of ferrous and ferric iron in the given solution mixture.
7. Preparation of standard potassium dichromate solution, and estimation of ferrous ammonium sulphate present in the given solution (potassium ferrocyanide as an external indicator).
8. Preparation of standard sodium carbonate solution, standardization of hydrochloric acid solution, and estimation of sodium hydroxide and sodium carbonate in a mixture (or caustic soda) by double indicator method.

Part B

1. Demonstration of laboratory practices [safety, glassware/chemicals handling, chemical nature understanding, chemical/glassware waste management, error analysis], calibration of laboratory glassware [pipettes and burettes].
2. Practical concept of Molarity, Molality, Normality, Weight %. Preparation of standard solutions, normal solutions, dilution of stock solutions (0.1M) to different concentrations.
3. Separation of pigments in leaves/flowers by thin layer chromatography (Demonstration).

4. Separation of *o*- and *p*-nitroanilines in a mixture by column chromatography (Demonstration).
5. Estimation of calcium content in chalk as calcium oxalate using decinormal potassium permanganate solution.
6. Estimation of ammonium chloride using 0.05N sodium hydroxide and 0.1N hydrochloric acid solutions (back titration).
7. Estimation of sulphuric acid and oxalic acid in the given mixture using standard sodium hydroxide and standard potassium permanganate solutions.
8. Estimation of carbonate and bicarbonate in the given mixture by double indicator method.

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SECOND SEMESTER

Paper: Chemistry-II **Code: CHDSC-2**

Contact Hours/ Week	Credits	Scheme of Evaluation: Max. Marks: 100		
		Continuous Internal Assessment		Semester End Examination (SEE)
		C_1	C_2	C_3
03	03	10 Marks	10 Marks	80 Marks

Unit-I **Inorganic Chemistry** **[15 Hours]**

Chemical bonding-I: Ionic bond: General characteristics of ionic compounds, radius ratio and crystal coordination number, limitations of radius ratio rule. Lattice energy and Born-Haber cycle, setting up of Born-Haber cycle, numerical calculations of Lattice energy and electron affinity based on Born-Haber cycle for 1:1 ionic solids, Theoretical calculation of lattice energy by Born-Lande equation (no derivation). Role of lattice energy and hydration energy in solubility of ionic solids. Polarization of ions, Fajan's rules. [**05 Hours**]

Covalent bond: Factors favoring the formation of covalent bond (ionization energy, electron affinity, electronegativity, nuclear charge, inter nuclear distance and number of valence electrons). Valence bond approach– explanation with examples (H_2, F_2, HF, O_2 and N_2) to illustrate valence bond approach. Sigma and Pi bonds – explanation by taking H_2, O_2 and N_2 as examples. Bond length, bond order, bond energy and their significance, polarity of covalent bonds, polar and non-polar molecules, Dipole moment and polarity of molecules to be explained by taking HCl, CO_2, CCl_4 and H_2O as examples. [**04 Hours**]

Chemical bonding-II: Hybridization-directional property and geometry of sp, sp^2, sp^3, sp^3d and sp^3d^2 hybrid orbitals taking $BeCl_2$, C_2H_2 BF_3, C_2H_4, $SiCl_4$, CH_4 PCl_5 and SF_6 as examples. VSEPR theory- postulates with SO_2, NH_3, H_2O, SF_4, ClF_3 and ICl^{2-} as examples.

Molecular Orbital Theory: An elementary account of MOT, linear combination of atomic orbitals (no mathematical approach). Bonding and antibonding molecular orbitals, conditions for the combination, energy levels of molecular orbitals. Molecular orbital structures and bond orders

of species like H_2, He_2, He_2^+, N_2, O_2, F_2, HF, LiH, NO and CO. Prediction of magnetic properties of these species. [**06 Hours**]

Unit-II Organic Chemistry [15 Hours]

Cycloalkanes: Nomenclature of cycloalkanes, Synthesis of cycloalkanes (From calcium salts of dicarboxylic acids). Reactions of cycloalkanes (with Cl_2, H_2, and HBr). Sachse-Mohr theory of strainless rings. Conformation of cyclohexanes and their stabilities (mono and disubstituted). Conformational analysis of ethane and butane and their energy profile diagrams.

Aromatic hydrocarbons: Concept of aromaticity, Huckel rule with respect to benzenoids, (benzene, naphthalene, anthracene and phenanthracene), heterocycles (pyrrole, furan, thiphene, pyridine, quinoline, isoquinoline, indole), and non-benzenoid compounds (cyclopentadiene, cyclopentadienyl anion, cycloheptadienyl cation). Annulenes (10 to 18 carbon atoms) and their aromaticity. [**07 Hours**]

Reaction of aromatic compounds

Electrophilic substitution: Mechanisms of nitration, sulphonation, halogenation, Friedel-Crafts alkylation, and acylation reactions of benzene. Electronic interpretation of orientating influence of electron donating groups (-CH_3, -Cl, -NH_2 and -OH groups) and electron withdrawing groups (-NO_2, -CHO, -COOH and –SO_3H groups) on further electrophilic substitution reactions. **Nucleophilic substitution**: Benzyne mechanism. **Oxidation:** Toluene to benzaldehyde and benzoic acid, naphthalene to benzoquinone, anthracene to anthraquinone. **Reduction:** Benzene to cyclohexane, β-naphthol to tetrahydro-β-naphthol. Naphthalene to cis and trans decalin, anthracene to 9,10-dihydroanthracene and perhydroanthracene, phenanthracene to 9,10-dihydrophenanthracene, and Birch reduction. [**08 Hours**]

Unit-III Physical Chemistry [15 Hours]

Liquid State - Surface tension - definition and its explanation, determination of surface tension using stalagmometer, effect of temperature and solute on surface tension. Viscosity- definition, coefficient of viscosity, determination of viscosity using Ostwald viscometer, effect of temperature, size, weight, shape of molecules and inter molecular forces. [**03 Hours**]

Solid state: Introduction- amorphous and Crystaline solids and their differences. Laws of crystallography: (i) Law of constancy of interfacial angles (ii) Law of rotational indices - Weiss and Miller indices, unit cell, Lattice point, Lattice planes in cubic crystals. Laws of symmetry- Symmetry elements – plane, axis and center of symmetry, element of symmetry in cubic crystal. Crystal system, Bravias Lattices – types cubic lattices and identification of lattice planes. X-ray diffraction by crystals - Braggs law, derivation of Braggs equation, determination of structure of single crystal by rotating crystal method, and powder method. Defects in solids. Numerical problems. [**06 Hours**]

Distribution law: Nernst distribution law - Statement and its derivation, distribution constant, factors affecting distribution constant, validity of distribution law, limitations of distribution law, verification of distribution law taking distribution of I_2 in H_2O and CCl_4. Modification of distribution law when molecules undergo association and dissociation. Application of distribution

law in solvent extraction process and Parke's process (de-silverisation of lead). Numerical problems.

Catalysis: Definition, general characteristics, action of catalytic promoters and inhibitors. Homogeneous catalysis (definition and examples), Heterogeneous catalysis- definition and examples, mechanism of heterogeneous catalysis based on adsorption theory. Enzyme catalysis- definition and example, lock and key mechanism of enzyme catalyzed reaction. Mechalis-Menten equation (to be derived), Mechalis-Menten constant and its significance. [**06 Hours**]

Paper: Chemistry Practicals-II **Code: CHDSCP-2**

Contact Hours/ Week	Credits	Scheme of Evaluation: Max. Marks: 50		
		Continuous Internal Assessment		Semester End Examination (SEE)
		C_1	C_2	C_3
04	02	05 Marks	05 Marks	40 Marks

LIST OF EXPERIMENTS

Part A: Qualitative analysis of organic compounds

The following classes of organic compounds (at least one compound from each class) be given for systematic analysis.

Carbohydrates: Glucose, sucrose; Amides: Urea, thiourea; Amines: Aniline, *N*-Methylaniline, *N*,*N*-Dimethylaniline, *p*-toluidine; Carboxylic acids: Benzoic acid, cinnamic acid; Phenols: phenol, *p*-cresol, β-napthlol; Aldehydes: Benzaldehyde; Ketones: Benzophenone, acetophenone; Hydrocarbons: Naphthalene, biphenyl; Halogenated hydrocarbons: Chlorobenzene, dichlorobenzene; Nitro compounds: Nitrobenzene, *m*-dinitrobenzene; Anilides: Acetanilide; Bifunctional compounds: Salicylic acid. Nitro aniline.

Part B: Organic preparations:

1. Preparation of acetanilide from aniline (Acetylation).
2. Preparation of benzoic acid from benzaldehyde (Oxidation).
3. Preparation of osazone from glucose (Condensation).
4. Preparation of *p*-cresyl benzoate from *p*-cresol (Esterification).
5. Preparation of *p*-bromo acetanilide from acetanilide (Bromination).
6. Preparation of benzoic acid from ethyl benzoate (Hydrolysis).
7. Preparation 2,4-dinitrophenylhydrazone of benzaldehyde (Condensation).

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5. Shriver, D.F. & Atkins, P.W. Inorganic Chemistry, Oxford University Press.
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10. Vogel's Qualitative Chemical Analysis, J. Bassett, G. H. Jeffery and J. Mendham, ELBS (1986).
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QUESTION PAPER: THEORY EXAMINATION

(Applicable to **DSC-1** and **DSC-2**)

Time: 03 Hours **Max. Marks: 80**

Instructions: Draw a neat labelled diagrams wherever necessary.

PART-A

Answer all of the following 8 X 1 = 08

1 a)
b)
c)
d)
e)
f)
g)
h)

PART-B: Inorganic Chemistry

Answer any three of the following 3 X 8 = 24

2
3
4
5

PART-C: Organic Chemistry

Answer any three of the following 3 X 8 = 24

6
7
8
9

PART-D: Physical Chemistry

Answer any three of the following 3 X 8 = 24

10
11
12
13

The sub-questions in Q2-Q13 shall be of (3+3+2) or (5+3) or (4+4) Marks

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SCHEME OF VALUATION
DSCP-1: CHEMISTRY-1 (PRACTICALS):

Time: 03 Hours **Max. Marks: 40**

Note: Duly certified practical record shall be submitted at the examination for evaluation.

Distribution of Marks

Record	5 Marks
Part A	25 Marks
Part B	10 Marks

Part A

Experiments (**1, 2, 3, 4, 5**)	Preparation of standard solution and calculation of its normality		04 Marks
	Titration values		
	Discrepancy	Standardization	Estimation
	± 0.2 cm^3	08 Marks	10 Marks
	± 0.3 cm^3	06 Marks	08 Marks
	± 0.4 cm^3	04 Marks	06 Marks
	Any other value	02 Mark	03 Marks
	Calculation	Normality of link solution = 01 Mark Normality of given solution = 01 Mark Weight/dm^3 or 250cm^3 = 01 Mark	

Experiments **6, 7**	Preparation of standard solution and calculation of its normality		03 Marks
	Titration values		
	Discrepancy	First titration	Second titration
	± 0.2 cm^3	09 Marks	09 Marks
	± 0.3 cm^3	07 Marks	07 Marks
	± 0.4 cm^3	05 Marks	05 Marks
	Any other value	02 Marks	02 Marks
	Calculation	02 Marks	02 Marks

Experiment (**8**)	Preparation of standard solution and calculation of its normality			03 Marks
	Titration values			
	Discrepancy	Standardization	First titration	Second titration
	± 0.2 cm^3	03 Marks	07 Marks	07 Marks
	± 0.3 cm^3	02 Marks	05 Marks	05 Marks
	Any other value	01 Mark	02 Marks	02 Marks
	Calculation	Normality of link solution = 01 Mark Normality of given solution = 01+ 01 Mark Weight/dm^3 or 250cm^3 = 01+ 01 Mark		

Part B

Procedure writing from the experiments listed in part B	04 Marks
Three questions/problems be given on the concept of laboratory practices, calibration, error analysis, molarity, molality, normality, weight %, preparation of standard solutions, normal solutions, dilution of stock solutions (0.1M) to different concentrations.	3 X 2 = 06 Marks

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DSCP-2: CHEMISTRY-2 (PRACTICALS)

Time: 03 Hours **Max. Marks: 40**

Note: Duly certified practical record shall be submitted at the examination for evaluation.

Distribution of Marks

Record	5 Marks
Part A	25 Marks
Part B	10 Marks

Part A: Organic Analysis		**Part B: Organic preparations**	
Preliminary Examinations	04 Marks	Equation	02 Marks
Physical Constant	02 Marks	Preparation	05 Marks
Elemental Analysis including procedure for preparation of sodium fusion extract	04 Marks	Yield	01 Mark
Solubility (Complete chart)	04 Marks	Recrystallization	01 Mark
Functional group analysis (minimum of two tests)	06 Marks	Melting point	01 Mark
Naming and structure	03 Marks		
Solid Derivative	02 Marks		
Total	**25 Marks**	**Total**	**10 Marks**

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