# JSS COLLEGE FOR WOMEN (Autonomous)

## Saraswathipuram, Mysuru- 570 009

# B.Sc. (Honors) Degree Programme in Chemistry
**(V AND VI SEMESTER)**

# NATIONAL EDUCATION POLICY
# (NEP) – 2020

**CHOICE BASED CREDIT SYSTEM(CBCS) WITH MULTIPLE ENTRY AND EXIT OPTIONS**

## (2021-22 onwards)

## V SEMESTER

## GME 260-5: Chemistry-V

**(L:T:P = 4:0:0) Contact Hours: 60 Credits: 4 Workload: 4Hours/Week**

**Unit-I: Inorganic Chemistry** **15 Hrs.**

**Coordination compounds**: Ligands, classification of ligands, and chelation, physical methods in the study of complexes–change in conductance, color and pH. Nomenclature ofco-ordination compounds, Inner metallic polynuclear and bridged complexes, Preparationof complexes-by simple addition reactions, substitution reactions and oxidation-reductionreactions. **05 Hrs.**

**Metal-Ligand equilibria in solution**: Stability of complexes- kinetic and thermodynamic stability of metal complexes, step-wise and overall formation constant and their relationship, trends in step-wise constant. Factors affecting the stability of metal complexeswith reference to the nature of the metal ion and ligand, chelate effect, macrocyclic effectand their thermodynamic origin. Determination of formation constant by pH metric, and spectrophotometric methods. **06 Hrs.**

**Isomerism in co-ordination complexes:** Structural isomerism- Ionization, Hydrate, linkage, Ligand isomerism. Stereoisomerism – Geometrical and optical isomerism exhibited by co-ordination compounds of co-ordination number 4 and 6. Geometries of complexes with coordination number 3 to 8. **04 Hrs.**

**Unit-II: Organic Chemistry** **15 Hrs.**

Aromaticity, Homo-aromaticity of azulene, tropone, tropolone, annulenes, benzenoids, meso-ionic compounds. Alternant and non-alternant hydrocarbons, Energy levels in odd and even-alternant hydrocarbons. **02 Hrs.**

**Stereochemistry:** Chirality in allenes, alkylidene cycloalkanes and spiranes (with a stereogenic axis). Cram's and Prelog's rules. Conformational analysis of substituted cycloalkanes (Methyl, iso-propyl, tert-butyl, dialkyl, dihalo, diols), and cycloheptane. Nomenclature and conformations of fused rings and bridged ring systems. Prochirality: Enantiotopic and diastereotopic atoms, groups and faces. **06 Hrs**.

**Vitamins:** Definition, classification. Structure elucidation of vitamin A, synthesis and biological importance of Vitamin A, and Vitamin C. Structural formulae and biological importance of thiamine, pyridoxine, folic acid, pantothenic acid, riboflavin, α-tocopherol, biotin, vitamin $K_1$ and vitamin $K_2$. **07 Hrs**.

**Unit-III: Physical Chemistry** **15 Hrs.**

**Photochemistry: Laws of photochemistry:** Grothus-Draper's law, Stark-Einstein law of photochemical equivalence. Quantum efficiency: definition, reasons for low quantum yield and high quantum yield with examples (formation of HBr and formation of HCl). Actinometers: Uranyl oxalate actinometer, Potassium ferrioxalate actinometer (Qualitative study). (Numerical problems).

**Photophysical processes:** Jabolonski diagram, photosensitization (mercury as an example), photoinhibition, fluorescence and phosphorescence, chemiluminescence and bioluminescence (explanation with examples), mechanism (qualitative).

**Radiation Chemistry**: Definition, primary and secondary stages in radiochemical reactions,ionic yield, energy yield, comparison with photochemistry. Units of radiation-rad, gray, Roentgen.

Dosimeters-Frick-dosimeter, ceric sulphate dosimeter (qualitative study)

theories of radiolysis – Lind's and EHT theories. Radiolysis of water (qualitative study) and acetic acid. **10 Hrs.**

**Phase equilibria:** Definition of the terms-phase, component and degree of freedom with examples. Statement of Gibb's phase rule and thermodynamic derivation. Applications: (a) one component system (water system); (b) reduced phase rule and reduced system, two component system (Silver-lead system, eutectic type), desilverization of lead and $FeCl_3$-$H_2O$ system (congruent melting point). Freezing mixtures: Definition and examples, explanationbased on KI-water system. **05 Hrs.**

**Unit-IV: Molecular Spectroscopy** **15 Hrs.**

Electromagnetic radiation: Regions of electromagnetic radiations (spectra), molecularenergy levels, absorption and emission spectra, Born- Oppenheimer approximation.

**Rotation spectroscopy:** Selection rules, expression for rotational spectra of diatomicmolecules for rigid rotator model, moment of inertia (expression to be derived) rotationalenergy rotational spectral lines, determination of bond lengths of diatomic molecules,isotopic substitution effect on rotational lines. **05 Hrs.**

**Vibrational spectroscopy:** Selection rules, classical equation of vibration, computation offorce constant, expression for vibrational energy levels and potential energy of simpleharmonic oscillator, zero-point energy, determination of force constant bond dissociationenergies, fundamental frequencies, overtones. The number of degrees of freedom ofvibrations polyatomic molecules, modes of vibration ($CO_2$and $H_2O$). **05 Hrs.**

**Raman spectroscopy**- Selection rules, origin of Raman spectrum, quantum mechanicaltheory, stokes and anti-stokes lines. Pure rotational Raman spectra of diatomic molecule (derivation ,and vibrational rotational Raman spectra for diatomicmolecule (explanation with equation) .

**Electronic spectra:** Concepts of potential energy curves for bonding and anti-bonding molecular orbitals, Franck-Condon principle. **05 Hrs.**

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## GMEP 260-5: Chemistry-V Practical

**(L:T:P = 0:0:2) Contact Hours: 60 Credits: 2 Workload: 4Hours/Week**

**PART-A: Organic Preparations (Multistep synthesis):**

1. Preparation of *p*-bromo aniline from acetanilide.
2. Preparation of anthranilic acid from phthalic acid.
3. Preparation of benzanilide from benzophenone.
4. Preparation of 2,4-dinitrophenylhydrazine from chlorobenzene.
5. Preparation of acridone from 2-chlorobenzoic acid.
6. Preparation of benzocaine from p-nitrobenzoic acid
7. Pechmann Reaction: Preparation of coumarin from resorcinol and ethyl acetoacetate.
8. Sandmeyer reaction: Preparation of 4-chlorotoluene from 4-toluidine.
9. Preparation of *p*-nitroacetanilide from acetanilide.

**PART-B: Organic Estimations:**

1. Estimation of glucose by colorimetric method.
2. Estimation of aspirin by colorimetric method.
3. Estimation of ascorbic acid by iodometric method.

4. Estimation of amino acids by formylation method.
5. Estimation of carboxylic acid.
6. Estimation of amino group.
7. Determination of saponification value of oil.

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# GME262-6: Chemistry-VI

**(L:T:P = 4:0:0) Contact Hours: 60 Credits: 4 Workload: 4Hours/Week**

**Unit-I: Inorganic Chemistry** **15 Hrs.**

**Modern concept of acids and bases**: Lux-Flood and Usanovich concepts, solvent systemand leveling effect. Hard-Soft Acids and Bases, Classification and Theoretical backgrounds.

**Non-aqueous solvents**: Classification of solvents, Properties of solvents (dielectricconstant, donor and acceptor properties) protic solvents (anhydrous $H_2SO_4$, HF and glacialacetic acid) aprotic solvents (liquid $SO_2$, $BrF_3$ and $N_2O_4$). Solutions of metals in liquidammonia, hydrated electron. Super acids and super bases. **07 Hrs.**

**Chemistry of main group elements**: Structure and bonding in boranes ($B_2H_6$, $B_4H_{10}$, $B_5H_9$), carboranes ($C_2B_{10}H_{12}$, $C_2B_9H_{13}$, $C_2B_6H_{12}$), Wades rules, borazines, phosphazines, S, N-compounds.

**M-M bond and metal atom clusters**: Halide clusters, bonding in $[ReCl_8]^{2-}$ . Metal carbonyl clusters- LNCC's and HNCC's. Electron counting in carbonyl clusters, Wades-Mingos and Lauher rule. **08 Hrs.**

**Unit-II: Organic Chemistry** **15 Hrs.**

**Carbohydrates:** Introduction. Monosaccharides-Elucidate open and ring structure of glucose, mutarotation, epimerization. Interconversion reactions (aldose to ketose, ketose to aldose, chain elongation-Killiani-Fischer method, and chain degradation-Ruff's method), Determination ring size of glucose (methylation). Determination conformational analysis of monosaccharides (glucose). Amino sugars: Structural formulae and conformations of α- and β- (glucosamine, galactosamine). Disaccharides- Structure elucidation of sucrose. Polysaccharides-partial structural formulae of starch and cellulose. Application of starch in titrimetric analysis. **08 Hrs.**

**Heterocyclic compounds:** Definition, classification and nomenclature.

Furan-synthesis (from pentasan), reactions (nitration, acylation). Thiophene-synthesis (from acetylene), reactions (sulphonation, chlorination). Pyrrole-synthesis (from furan), reactions (diazotization, Riemer-Tiemann). Pyridine-synthesis (from acetylene), reactions (bromination, with $NaNH_2$). Aromaticity and basicity of pyrrole and pyridine. Indole: Synthesis (Fischer), reactions ($Br_2$/HOAc, $CHCl_3$/NaOH). Quinoline: Synthesis (Skraup's method), reactions (nitration, with $NaNH_2$, with $KMnO_4$/NaOH). Pyrazole: Synthesis and reactions. **07 Hrs.**

**Unit-III: Physical Chemistry** **15 Hrs.**

**Quantum Mechanics**: Introduction, black body radiation, plank radiation law, photo electric effect, Compton effect, de Broglie concept and uncertainty principle.

Concepts of Operators: Laplacian, Hamiltonian, Linear and Hermitian operators. Commutative and non-commutative of operators. Eigen function and eigen values. Postulates of quantum mechanics. Solutions of Schrödinger wave equation for a free particle, particle in a one-dimensional box. **05 Hrs.**

**Colligative properties**: Definition and examples.

**Lowering of vapour pressure**: Raoult's law (to be derived), relationship between relative lowering of vapour pressure and molar mass (to be derived). Experimental determination of molar mass of the solute by Dynamic method (Numerical problems).

**Elevation in boiling point:** Definition, its relation to lowering of vapour pressure and molar mass (to be derived). Ebullioscopic constant of the solvent and its relation to the boiling point (only equation). Experimental determination of molar mass of the solute by

Walker–Lumsden method (Numerical problems).

**Depression in freezing point:** Definition, its relation to lowering of vapour pressure and molar mass (to be derived). Cryoscopic constant and its relation to melting point (only equation), Determination of molar mass of non-volatile solute by Rast method (Numerical problems).

**Semipermeable membrane**: Definition, types with examples. Preparation of artificial semipermeable membrane (copper ferrocyanide) by Morse-Frazer method.

**Osmotic pressure:** Definition of osmosis, reverse osmosis and osmotic pressure. Determination of osmotic pressure by Berkely-Hartley's method (Numerical problems). Applications of osmotic pressure (mention only).

**Osmotic laws and analogy with gas laws:** Relationship between molar mass and osmotic pressure (to be derived). Isotonic solutions, plasmolysis. Abnormal molecular mass, causes, vant Hoff's factor (Numerical problems). **10 Hrs.**

**Unit-IV: UV-Visible Spectroscopy** **15 Hrs.**

Introduction, measurement of absorption intensities, absorption maxima ($\lambda$max), instrumentation, types of electronic transitions, concept of chromophores and auxochromes. Absorption and intensity shifts (bathochromic, hypsochromic, hyperchromicand hypochromic). Types of absorption bands (K, R, B and E-bands). The effect of solvents temperature and conjugation on absorption. **05 Hrs.**

Woodward-Fieser rules for calculation of absorption maxima for: Conjugated dienes(aliphatic, alicyclic, exocyclic, homoannular, heteroannular, with and/or without extendedconjugation, and polyenes), α,β-Unsaturated carbonyl compounds (aldehydes, ketones,carboxylic acids, esters with and/or without extended conjugation) and Acyl benzenederivatives. Absorption in compounds with N-O bonds, quinones, α-diketones, α-ketoaldehydes, benzene and its derivatives. Absorption spectra of heterocyclic and condensedring systems (cata-condensed and peri-condensed). Effect of steric hindrance andcoplanarity (cis, trans isomers) on absorption. The electronic transitions in charge transfercomplexes, and keto-enol tautomers. **10 Hrs.**

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## GMEP 262-6: Chemistry-VI practical

**(L:T:P = 0:0:2) Contact Hours: 60 Credits: 2 Workload: 4Hours/Week**

**PART-A:**

1. Conductometric titration of weak acid ($CH_3COOH$/HCOOH) versus weak base (Ammonium hydroxide).
2. Conductometric titration of a mixture of HCl and $CH_3COOH$ versus NaOH.
3. Conductometric titration of strong acid (HCl) with salt ($CuSO_4$) versus NaOH.
4. Potentiometric titration of FAS versus $K_2Cr_2O_7$.
5. Potentiometric method of determination of dissociation constant of Formic acid.
6. Potentiometric titration of weak acid $CH_3COOH$ against a strong base NaOH using quinhydrone electrode and calculation of pKa and Ka of the weak acid.
7. Colorimetric estimation of $Fe^{2+}$ ions concentration in the given solution by titration of FAS versus $KMnO_4$.
8. Colorimetric estimation of $Fe^{2+}$ ions concentration using 1,10- phenanthroline.

**PART-B:**

1. Determination of the isoelectric point of an amino acid by pH metry.
2. Determination of pH of acetic acid with sodium acetate buffer by pH metry
3. Potentiometric determination of pH of a buffer by using quinhydrone electrode and comparison of the pH values obtained with glass electrode.
4. Colorimetric determination of dissociation constant of a given indicator.
5. Potentiometric titration of $AgNO_3$ versus KCl (demonstration).
6. Conductometric titration of weak acid ($CH_3COOH$) with salt ($CuSO_4$) versus NaOH.
7. Determination of pKa value of phosphoric acid by pH meter.

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## SEMESTER VI

## GMF 260-7: Chemistry-VII

**(L:T:P = 4:0:0) Contact Hours: 60 Credits: 4 Workload: 4Hours/Week**

**Unit-I: Inorganic Chemistry** **15 Hrs.**

**Metal-ligand bonding: Valence bond theory**: Salient features, formation and magnetic properties of octahedral complexes $[Fe(CN)_6]^{4-}$, $[Fe(CN_6)]^{3-}$, $[Co(CN)_6]^{3-}$, $[CoF_6]^{3-}$ $[Cr(H_2O)_6]^{3+}$ and $[Fe(H_2O)_6]^{2+}$. Formation and magnetic properties of tetrahedral and square planar complexes $[Ni(CO)4]$, $[Cu(NH_3)_4]^{2+}$, $[Ni(CN)_4]^{2-}$ and $[Pt(Cl_4)]^{2-}$, limitations of VBT. **04 Hrs.**

**Crystal field theory**: Salient features, splitting of d-orbitals in octahedral, tetrahedral, and square planar geometry. Applications - colors of transition metal complexes, magnetic properties of octahedral complex, CFSE and their uses. Factors affecting CFSE: Geometry of complexes, nature of the central metal ion, nature of ligand, and spectrochemical series. Limitations of CFT. Experimental evidence for metal-ligand covalent bonding in complexes, nephelauxetic effect. MO theory: tetrahedral and octahedral complexes (including p-bonding). **08 Hrs.**

**Magnetic properties of coordination compounds:** Introduction, magnetic susceptibilityand its determination- Gouy and Faraday method, the effects of temperature on μeff, ferromagnetism, anti-ferromagnetism and ferrimagnetism. **03 Hrs.**

**Unit-II: Organic Chemistry** **15 Hrs.**

Aromatic Electrophilic Substitution Reactions: Quantitative treatment of reactivity in substrates and electrophiles. Amination, sulfonylation, diazonium coupling, Vilsmeier-Haack reaction, Gatterman reaction, Gatterman-Koch reaction and Hoesch reaction.

Aromatic Nucleophilic substitution reactions: The Goldberg reaction, Bucherer reaction, Schiemann reaction, von Richter reaction, and Sommelet-Hauser reactions. **07 Hrs.**

**Addition Reactions:** Addition reactions of cyclopropane ring. Addition reactions of carbon-heteroatom multiple bonds: Mechanism of metal hydride reduction (NaH, LiH, $LiAlH_4$, $NaBH_4$), Grignard reagent ($CH_3MgBr$) and organolithium ($CH_3Li$) of saturated andunsaturated carbonyl compounds. Hydrolysis of nitriles with mechanism. Wittig, Mannichand Stobbe reactions.

**Elimination Reactions:** Effects of substrate structure, attacking base, the leaving group andthe medium on elimination reactions. Chugaev reaction. **08 Hrs.**

**Unit-III: Physical Chemistry** **15 Hrs.**

**Ionic equilibria:** Ionic equilibria in aqueous solutions, strong and weak electrolytes- definition and examples. Ostwald's dilution law (to be derived) and its limitations. Debye- Huckel theory of strong electrolytes (relaxation time, electrophoretic effect and viscous effect). Activity and activity coefficient–definition and their relation. Hydrolysis of salts- Derivation of hydrolysis constant and degree of hydrolysis of the salt of weak acid and weakbase (ammonium acetate as an example), effect of temperature on degree of hydrolysis. (Numerical problems). **05 Hrs**.

**Electrochemistry-II:** Electrolytic and Electro chemical cells (galvanic cells)-Daniel cell (construction, working and cell reaction). Reversible and irreversible cells, rules for representation of a cell, single electrode potential, Standard electrode potential, sign convention for electrode potential, Nernst equation for single electrode potential (Derivation).

**Reference electrodes:** Calomel electrode, Ag-AgCl electrode**.** Weston standard cell

(Construction, working, reaction and standard emf). Equilibrium constant and free energy of a cell reaction, Concentration cell with transport (example) concentration cell without transport, EMF of concentration cell (derivation). Liquid junction potential. Salt bridge. Application of concentration cell: Valency of ions and solubility product of sparingly solublesalt.
Applications of EMF measurements in (a) Determination of pH of a solution using - (i) quinhydrone electrode, (ii) glass electrode. (b) Potentiometric titration-principle and location of end point in (i) Oxidation - reduction reaction, (ii) Precipitation reaction, iii) acid-base reaction. **10 Hrs**.

**Unit-IV: Infrared Spectroscopy** **15 Hrs.**

Introduction, principle, modes of vibrations, vibrational frequency. Factors influencing vibration frequencies (coupled vibration, electronic effects, and bond angles). Finger print region and its significance. Effects of H-bonding, conjugation, resonance, and ring size on IR absorptions. **04 Hrs.**

IR absorption frequency positions in; Hydrocarbons (alkanes, alkenes, alkynes, cycloalkanes, aromatic), halogen compounds, alcohols and phenols, ethers, aldehydes and ketones (aliphatic, alicyclic, and aromatic), esters and lactones, carboxylic acids, acid halides, acid anhydrides, amides, lactams, amines, amino acids, nitro compounds, anilides, nitriles, thiols, thiophenols, sulphonic acids, sulphonamides, and hetero aromatic compounds. **07 Hrs.**

Coordination compounds: Changes in infrared spectra of donor molecules uponcoordination (*N,N*-dimethylacetamide, urea, DMSO, pyridine N-oxide, ammine, cyano, cyanato and thiocyanato complexes), mono and multinuclear carbonyl complexes, nitrosyls, and phosphine complexes. **04 Hrs.**

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## GMFP 260-7: Chemistry-VII Practical

**(L:T:P = 0:0:2) Contact Hours: 60 Credits: 2 Workload: 4Hours/Week**

**PART-A: Gravimetric and Volumetric Analysis**

1. Gravimetric determination of Fe in iron ore as $Fe_2O_3$.
2. Gravimetric estimation of calcium as calcium oxide.
3. Gravimetric estimation of aluminum as aluminum oxide.
4. Gravimetric estimation of magnesium as magnesium 8-hydroxy oxinate.
5. Gravimetric estimation of lead as lead chromate.
6. Gravimetric determination of Ni using DMG in Ni solution.
7. Gravimetric determination of Fe using $NH_4OH$ in Fe solution.
8. Gravimetric estimation of Cu using $NH_4SCN$ in Cu solution.
9. Gravimetric determination of Barium as Barium sulphate.
10. Volumetric estimation of Ca and Mg in dolomite solution.
11. Volumetric estimation of Fe in Fe solution.
12. Volumetric estimation of Zn in Cu and Zn solution.
13. Volumetric estimation of Ni in Ni and Zn solution.

**PART-B: Preparation of co-ordination complexes**

1. Preparation of hexamminenickel(III) chloride.
2. Preparation of chloropentaminecobalt(III)chloride.
3. Preparation of tris(oxalato)ferrate(III) and estimate the iron.
4. Preparation of hexamminecobalt(III)chloride(demonstration).
5. Preparation of mercury tetrathiocyantocobaltate(II) (demonstration).

# GMF262-8: Chemistry-VIII

**(L:T:P = 4:0:0) Contact Hours: 60 Credits: 4 Workload: 4Hours/Week**

**Unit-I: Inorganic Chemistry** **15 Hrs.**

**Paints:** Constituents and their functions, manufacture of lithopone and titanium dioxide.

**Propellants:** Definition, characteristics, classification and applications.

**Abrasives:** Definition, classification with examples, hardness, manufacture and applicationsof carborundum, alundum and tungsten carbide.

**Refractories:** Definition, properties, classification with examples. Different steps involvedin the manufacture of refractories. Applications of refractories. **05 Hrs.**

**Ceramics:** Introduction, types, manufacturing process, applications.

**Explosives:** Origin of explosive and classification. preparation and explosive propertiesof leadazide, PETN, cyclonite (RDX).

**Fertilizers:** Economic importance and synthesis of nitrogenous fertilizers- CAN, ammonium sulfate, ammonium nitrate and urea. Phosphate fertilizers- calcium dihydrogen phosphate, super phosphate. **05 Hrs.**

**Silicates:** Structure, classification - silicates with discrete anions, silicates containing chainanion, silicates with layer structure, silicones with three dimensional net-work and applications. **02 Hrs.**

**Nanotechnology:** Definition, uses and nature of nanotechnology. Nanomaterials: Definition, properties and applications. Carbon nanotubes: Definition, types, methods of preparation (mention), properties and industrial applications of carbon nanotubes, Nanowires: Definition, types, production of crystalline nanowires by vapour-liquid-solid synthesis method, application of nanowires. **03 Hrs.**

**Unit-II: Organic Chemistry** **15 Hrs.**

**Rearrangements:** Reaction and mechanism of Wagner-Meerwein, Fries, Beckmann, Hofmann, Benzil-benzilic acid, Favorskii, Dienone-phenol, and Benzidine rearrangement. Baeyer-Villiger oxidation, Arndt-Eistert reaction. **07 Hrs.**

**Amino acids and Peptides: Amino acids:** Synthesis (from α-halogen acids, Gabriel phthalimide, malonic ester), reactions (alkyl halides, nitrous acid, acid halide, $NH_3$, $LiAlH_4$). Classification and nomenclature of peptides. Sanger and Edman methods of sequencing. Cleavage of peptide bond by chemical and enzymatic methods. Peptide synthesis- Protection of amino group (Boc-) and carboxyl group as alkyl esters. Use of DCC, and HOBt in peptide bond formation reactions. Deprotection and racemization in peptide synthesis. Solution and solid phase techniques. Synthesis of oxytocin. Introduction to peptidomimetics. **08 Hrs.**

**Unit-III: Physical Chemistry** **15 Hrs.**

**Chemical Dynamics:** Arrhenius equation-characteristics, Significance of energy of activation, Temperature coefficient and its evaluation. Thermodynamical formulation of reaction rates (Thermodynamic parameters).

Reaction between ions in solutions - Influence of ionic strength on reaction rates - primary and secondary salt effects, Effect of dielectric constant (single sphere model).

**Complex reactions:** Kinetics of parallel reactions, consecutive reaction, reversible reactions (qualitative treatment). **07 Hrs.**

**Kinetics of homogeneous catalysis**- kinetics of acid-base catalyzed reactions-specific acid and specific base catalysis, general acid base catalysis. Enzyme catalyzed reactions, Mechanism (Lock and Key theory), Kinetics of enzyme catalyzed reactions - Henri- Michaelis- Menten mechanism, Significance of Michaelis-Menten constant, Lineweaver-

Burk plot. Effects of enzyme concentration, pH, Temperature, catalysts and Inhibitors on enzyme activity.

**Kinetics of fast reactions:** Introduction, Study of reactions by relaxation method (Temperature and pressure jump), flow method (continuous flow method and stopped flow method), Flash photolysis and Shock tube method. **08 Hrs.**

**Unit-IV: Nuclear Magnetic Resonance Spectroscopy 15 Hrs.**

**$^1$H NMR spectroscopy**: Introduction (including magnetic properties of nuclei, spin population), relaxation process (spin-spin, spin-lattice, quadrupole), number of signals. Instrumentation, chemical shifts, internal standards, shielding and deshielding effects.Factors affecting chemical shift (inductive, Van der Waals, anisotropic, H-bonding). Solventsused. Peak area and proton counting, splitting of the signals, spin-spin coupling, equivalentand non-equivalent protons. Chemical exchange (proton exchange reactions). Calculation ofatoms ratio from the height of signals. coupling constant (geminal, vicinal, long-rangecoupling). Restricted rotation. Double resonance (spin decoupling), nuclear overhausereffect. **09 Hrs.**

Structure determinations/interpretation of spectra of; ethane, propane, 1-bromopropane, 2-bromopropane, ethylene, propene, acetylene, propionamide, methylamine, dimethylamine, trimethylamine, ethyl acetate, methyl cyanide, ethylbenzene, o-cresol, p-cresol, benzoic acid, anisole, benzaldehyde, acetaldehyde, benzophenone, acetophenone, thiophenol. **06 Hrs.**

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## GMFP262-8: Chemistry-VIII Practical

**(L:T:P = 0:0:2) Contact Hours: 60 Credits: 2 Workload: 4Hours/Week**

**PART-A:**

1. Hydrolysis of methyl acetate in presence of two different concentrations of HCl and determination of the relative strength.
2. Determination of energy of activation for the reaction between $K_2S_2O_8$ versus KI (first order) in two different temperatures.
3. Determination of rate constant for the reaction between chloramine-T and indigocaramine dye in pH 10 buffer medium spectrophotometrically.
4. Conductometric determination of strength of HCl, $CH_3COOH$ and $CuSO_4$ versus NaOH.
5. Conductometric titration of sodium sulphate versus $BaCl_2$.
6. Conductometric determination second order rate constant for the saponification of ethyl acetate.
7. Determination of partial molar volume of NaCl-$H_2O$ system by apparent molar volume method.
8. Potentiometric titration of acid mixture ($CH_3COOH$ and $ClCH_2COOH$) versus NaOH.

**PART-B: Organic Preparations:**

1. Cannizarro reaction of benzaldehyde.
2. Friedel-Crafts reaction of benzene and acetyl chloride.
3. Oxidation of cyclohexanol.
4. Preparation of p-iodonitrobenzene
5. Preparation of *N*-phenyl-2,4-dinitroaniline.
6. Preparation of 2,4,6-tribromoaniline.
7. Preparation of 2,4-dichlorophenoxyacetic acid.

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**Recommended Books/References:**


1. Basic Inorganic Chemistry, F. A. Cotton, G. Wilkinson, P. L. Gaus; John Wiley, 6th Ed. (1999).
2. Advanced Inorganic Chemistry, F. A. Cotton, G. Wilkinson, 6th Ed.
3. Inorganic Chemistry, J. E. Huheey, E. A. Keiter and R. L. Keiter, Addison; Wesley, 4th Ed. (1993).
4. Inorganic Chemistry, D. F. Shriver, P. W. Atkins, C. H. Langford, Oxford University Press, 2nd Ed. 1994.,
5. Concise Inorganic Chemistry, J. D. Lee, 5th Ed. (1996).
6. Essentials of nuclear chemistry, H. J. Arniker, NAIL publishers, 4th Ed. (1995).
7. Vogel's Qualitative Chemical Analysis, J. Bassett, G. H. Jeffery and J. Mendham, ELBS (1986).
8. Advanced Organic Chemistry, Jerry March, John Wiley (2008).
9. Advanced Organic Chemistry, F A Carey and R J Sundberg, Plenum, (1990).
10. Organic Chemistry, R.T. Morrison and R.N. Boyd, Prentice-Hall, (1998).
11. Stereochemistry of Organic Compounds, D Nasipuri, New-Age International, (1999).
12. Stereochemistry of Carbon Compounds, E L Eliel, S H Wilen and L N Mander, John Wiley, (1994).
13. Stereochemistry, Potapov, MIR, Moscow, 1984.
14. Organic Chemistry, Vol. I and II, I L Finar, Longman, (1999).
15. Laboratory Manual of Organic Chemistry, B.B. Dey, M V Sitaraman, T R Govindachari, Allied Publishers, New Delhi, (1996).
16. Practical Organic Chemistry - Mann and Saunders, (1980).
17. Textbook of Practical Organic Chemistry- A. I. Vogel, (1996).
18. Textbook of Quantitative Organic Analysis- A. I. Vogel, (1996).
19. Comprehensive Practical Organic Chemistry, V. K. Ahluwalia, R. Aggarwal, Uni. Press, (2000).
20. Practical Organic Chemistry (Quantitative analysis), B. B. Dey, M. V. Sitaraman, T. R. Govindachari, Allied Publishers, New Delhi, (1992).
21. Physical Chemistry, P. W. Atkins, Julio de Paula, ELBS, 7th Ed., (2002).
22. Physical Chemistry: A Molecular Approach, McQuarie and Simon, Viva, New Delhi, (2001).
23. Introduction to Quantum Chemistry, A. K. Chandra, Tata McGraw Hill, (1988).
24. Quantum Chemistry, R. K. Prasad, New Age International, 2nd Ed. (2000).
25. Chemical Kinetics, K. J. Laidler, McGraw Hill. Inc. New York (1988).
26. Principles of Chemical Kinetics, House J. E. Wm C Brown Publisher, Boston, (1997).
27. Kinetics and Mechanism, A. A. Frost and R. G. Pearson, John-Wiley, New York, (1961).
28. Chemical Kinetic Methods, C. Kalidas, New Age International Publisher, New Delhi (1995)
29. Physical Chemistry, P. Atkins and J. D. Paula, 9th Ed., Oxford University Press (2010).
30. Biochemistry, Geoffrey Zubay, 2nd Ed., Macmillan Publishing Co. New York (1981).
31. Advanced Practical Physical Chemistry, J. B. Yadav, Goel Publications Meerut (1988)
32. Senior Practical Physical Chemistry by B. C. Kosla, Simla Printers New Delhi (1987)
33. Experimental Physical Chemistry by Daniel et al., McGraw Hill, New York (1962).
34. Experimental Physical Chemistry by Wilson, Newcombe & others, Pergamon Press, (1962)
35. Experimental Physical Chemistry by R. C. Behra and B Behra, Tata McGraw, New Delhi (1983)
36. Practicals in Physical Chemistry A. Modern Approach, P.S Sindhu, Mac. Millan Publishers Delhi (1986).
37. Surface Chemistry: Theory and Applications, J. J. Bikerman, Academic Press. New York (1972).
38. Physical Chemistry, Laideler K. J. and Meiser J. M. 3rd Ed. McGraw-Hill, (1999).
39. Physical Chemistry, Levine I. N., Physical Chemistry, 4th Ed. McGraw-Hill, (1995).
40. Fundamentals of Molecular Spectroscopy, Banwell, C. N. & McCash E. M. 4th Ed. Tata McGraw-Hill, (2006).
41. Organic Spectroscopy, Kemp, W.
42. Principles of Instrumental Analysis, Douglas A. Skoog, F. James Holler, and Stanley Crouch 6th Ed.
43. Basic Inorganic Chemistry, F. A. Cotton, G. Wilkinson and P. L. Gaus; John Wiley, 6th Ed. (1999).
44. Chemistry of elements, N. N. Greenwood & A. E. Earnshaw, Butterworth Heinemann (1997).
45. Inorganic Chemistry, J. E. Huheey, E. A. Keiter & R. L. Keiter, Addison; 4th Ed. Wesley (1993).

46. Inorganic Electronic spectroscopy, A. B. P. Lever, Elsevier. (1968).
47. Electronic Absorption Spectroscopy & Related Techniques, D. N. Sathyanarayana, University Press (2001).
48. Textbook of Inorganic Chemistry, G. S. Sodhi, Viva books Pvt. Ltd (2011).
49. Vogel's text book of Quantitative Chemical Analysis, J. Bassett, G. H. Jeffery and J. Mendham, and R. C. Denny, 5th Ed. Longman Scientific and Technical (1999).
50. Advanced Organic Chemistry, Jerry March, John Wiley (2008).
51. Advanced Organic Chemistry, F. A. Carey and R. J. Sundberg, Plenum (1990).
52. A Guide Book to Mechanism of Organic Chemistry, Peter Sykes, Longman (2000).
53. Organic Chemistry, R. T. Morrison and R. N. Boyd, Prentice-Hall (1998).
54. Modern Organic Reactions, H. O. House, Benjamin (1972).
55. Stereochemistry of Organic Compounds, D. Nasipuri, New-Age International (1999).
56. Stereochemistry of Carbon Compounds, E. L. Eliel, S. H. Wilen & L. N. Mander, John Wiley (1994).
57. Organic Chemistry, Volumes I and II, I L Finar, Longman. (1999).
58. Medicinal Chemistry, A Kar, Wiley (2000).
59. Peptides: Chemistry and Biology, N Selwad and H.-D. Jakubke, Wiley-VCH, (2002).
60. Practical Organic Chemistry, Mann and Saunders, (1980).
61. Text Book of Practical Organic Chemistry, A. I. Vogel, (1996).
62. Test Book of Quantitative Organic Analysis, A. I. Vogel, (1996).
63. Comprehensive Practical Organic Chemistry: Preparation and Quantitative Analysis, V. K. Ahluwalia, R. Aggarwal, Universities Press (India), (2000).
64. Advanced Practical Organic Chemistry, J. Mohan, Vol. I and II, Himalaya Publishing House, (1992).
65. Molecular Thermodynamics, Donald A. Mc Quarrie, John D. Simon University Science Books California, (1999).
66. Thermodynamics for Chemists, S. Glasstone, East-West Press, New Delhi, (1960).
67. Thermodynamics, Rajaraman and Kuriacose, East-West Press, (1986).
68. Statistical Thermodynamics, M. C. Gupta, Wiley Eastern Ltd. (1993).
69. Thermodynamics, Thomas Engel & Philip Reid, Pearson Education inc. (2007).
70. Modern Electrochemistry, Vol-1, 2, J.O.M Bockris and A.K.N. Raddy, Plenum New York (1978).
71. Principles and Applications of Electrochemistry, D.R. Crow, 3rd Ed. Chapmanhall London (1988).
72. Experiments in Physical Chemistry, Shoemaker & Garland, McGraw Hill Int. Edn. (1966).
73. Advanced Practical Physical Chemistry, J. B. Yadav, Goel Publications Meerut (1988).
74. Experimental Physical Chemistry, R. C. Behra and B Behra, Tata McGraw, New Delhi (1983).
75. Experimental Physical Chemistry, V.D. Atavale & Parul Mathur, New Age Int. NY. (2001).
76. Introduction to Molecular Spectroscopy, C. N. Banwell, TMH Edition (1994).
77. Introduction to Molecular Spectroscopy, G. M. Barrow, McGraw Hill, (1988).
78. Molecular Spectroscopy, J. D. Graybeal, McGraw Hill (Int. Students Ed.) (1990).
79. Spectroscopy, Vols. 1-3, B. P. Straughan and W. Walker, Chapman Hall (1976).
80. Spectroscopic Identification of organic compounds, R. M. Silverstein and F. X. Webster, 6th Ed. Wiley and Sons, India Ltd. (2006).
81. Practicals in Physical Chemistry, by P.S Sindhu, Mac. Millan Publishers Delhi (2006).

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**Scheme of Examination for GME260-5, GME262-6, GMF260-7, and GMF262-8**
**(V and VI Semesters)** **Credits (4:0:0)**

| Formative/Continuous Internal Assessment (Max. Marks: 40) | Marks | | |
|---|---|---|---|
| | Assignment | Test | Total |
| C1 | 10 | 10 | 20 |
| C2 | 10 | 10 | 20 |
| Semester End Examination: C3 | | | 60 |
| | | Total | 100 |

**Question Paper pattern for GME260-5, GME262-6, GMF260-7, and GMF262-8**

**(V and VI Semesters)**

| **Duration: 02 Hours** | **Max. Marks: 60** | |
|---|---|---|
| Part-A | Answer any six out of eight questions (Two questions from each unit) | 6 x 2 =12 |
| Part-B (Inorganic Chemistry) | Answer any two out of three questions | 2 x 6 = 12 |
| Part-C (Organic Chemistry) | Answer any two out of three questions | 2 x 6 = 12 |
| Part-D (Physical Chemistry) | Answer any two out of three questions | 2 x 6 = 12 |
| Part-E (Spectroscopy) | Answer any two out of three questions | 2 x 6 = 12 |
| Questions Pattern: (3 + 3) or (6) | | |

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**Scheme of Examination for GMEP260-5, GMEP262-6, GMFP260-7, and GMFP262-8**

**practical (V and VI Semesters)** **Credits (0:0:2)**

| Formative/Continuous Internal Assessment (Max. Marks: 25) | Marks | | | |
|---|---|---|---|---|
| | Test | Continuous Assessment/ Attendance | Record | Total |
| C1 | 10 | -- | | 10 |
| C2 | -- | 10 | 05 | 15 |
| Semester End Examination: C3 | | | | 25 |
| | | | Total | 50 |

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**Annexure-III**

## Scheme of Evaluation: Practical V

## Semester

# GMEP260-5: Chemistry-V Practical

**Duration: 03 Hours** **Max. Marks: 25**

### DISTRIBUTION OF MARKS

- Procedure writing: 05 Marks
  (Note: If experiments from Part-A were given, procedure writingbe from Part-B experiments, and vice-versa).
- Experimental: (Experiments be given from Part-A or Part-B) 20 Marks

### Part-A: Organic Preparations

| | |
|---|---|
| Skill | 04 Marks |
| Reaction and mechanism | 04 Marks |
| Yield | 03 + 03 Marks |
| Recrystallisation products | 02 + 02 Marks |
| Physical constants | 01 + 01 Marks |

### Part-B: Organic estimations

| Colorimetric estimation of glucose and aspirin | | |
|---|---|---|
| Preparation of standard solution | | 05 Marks |
| Discrepancy | 100 µg | 10 Marks |
| | 200 µg | 08 Marks |
| | 300 µg | 06 Marks |
| | Any other value | 04 Marks |
| Graph | | 05 Marks |

| Estimation of ascorbic acid | | |
|---|---|---|
| Preparation of standard $K_2Cr_2O_7$ solution and calculation of its normality | | 03 Marks |
| Standardization of $Na_2S_2O_3$ solution and calculation of its normality | | 03 Marks |
| Discrepancy | 10 mg | 12 Marks |
| | 15 mg | 10 Marks |
| | 20 mg | 08 Marks |
| | Any other value | 05 Marks |
| Calculation | | 02 Marks |

| Estimation of amino acid/carboxylic acid/amino group | | |
|---|---|---|
| Preparation of standard potassium hydrogen phthalate/ preparation acid solution and calculation of its normality | | 03 Marks |
| Standardization of NaOH solution and calculation of its normality | | 06<br>2Marks |
| Estimation<br>calculation | | 06<br>3 Marks |
| Discrepancy | ± 0.2 $cm^3$ | 06 Marks |
| | ± 0.3 $cm^3$ | 04 Marks |
| | ± 0.4 $cm^3$ | 03Marks |
| | Any other value | 02 Marks |

| Saponification value of an oil | | |
|---|---|---|
| Preparation of standard $Na_2CO_3$ solution and calculation of normality | | 03 Marks |
| Standardization of HCl solution and calculation of its normality | | 03 Marks |
| Discrepancy | ± 10% | 12 Marks |
| | ± 15% | 10 Marks |
| | ± 20% | 08 Marks |
| | Any other value | 05 Marks |
| Calculation | | 02 Marks |

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# Scheme of Evaluation

## V Semester

### GMEP262-6: Chemistry-VI Practical

**Duration: 03 Hours** **Max. Marks: 25**

**DISTRIBUTION OF MARKS**

- Procedure writing: 05 Marks
  (Any one of the experiments from Part-B):
- Experimental: (Experiments be given from Part-A) 20 Marks

| Colorimetric Determinations/Estimations | | |
|---|---|---|
| Preparation of solutions | | 04 Marks |
| Determination of λmax | | 02 Marks |
| Accuracy | ± 4% | 09 Marks |
| | ± 6% | 07 Marks |
| | ± 8% | 05 Marks |
| | Any other value | 03 Marks |
| Graph, Calculation | | 05 Marks |

| Conductometric titrations | | |
|---|---|---|
| Accuracy | ± 0.2 $cm^3$ | 12 Marks |
| | ± 0.3 $cm^3$ | 10 Marks |
| | ± 0.4 $cm^3$ | 08 Marks |
| | Any other value | 05 Marks |
| Graph | | 05 Marks |
| Calculation of Normality, weight/$dm^3$ | | 03 Marks |

| Potentiometric/pH metric/colorimetric titrations | | |
|---|---|---|
| Accuracy | ± 0.2 $cm^3$ | 12 Marks |
| | ± 0.3 $cm^3$ | 10 Marks |
| | ± 0.4 $cm^3$ | 08 Marks |
| | Any other value | 05 Marks |
| Graph | | 05 Marks |
| Calculation of Normality, weight/$dm^3$ | | 03 Marks |

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# Scheme of Evaluation

## VI Semester

### GMFP260-7: Chemistry-VII Practical

**Duration: 03 Hours** **Max. Marks: 25**

**DISTRIBUTION OF MARKS**

- Procedure writing: 05 Marks
  (Any one of the experiments from Part-B):
- Experimental: (Experiments be given from Part-A) 20 Marks

| Gravimetric Determination | | |
|---|---|---|
| Skill | | 05 Marks |
| Accuracy | ± 3% | 12 Marks |
| | ± 5% | 10 Marks |
| | ± 8% | 08 Marks |
| | Any other value | 05 Marks |
| Calculation | | 03 Marks |

| Volumetric Estimations | | |
|---|---|---|
| Preparation of standard solution and calculation of normality | | 01 + 01 Marks |
| Deviation | Standardization | Estimation |
| ± 0.3 $cm^3$ | 05 Marks | 07 Marks |
| ± 0.4 $cm^3$ | 04 Marks | 06 Marks |
| ± 0.5 $cm^3$ | 03 Marks | 05 Marks |
| Any other value | 02 Marks | 04 Marks |
| Calculation of normality of link solution | | 02 Marks |
| Calculation of normality of test solution and wight/$dm^3$ | | 02 + 02 Marks |

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## Scheme of Evaluation

## VI Semester

### GMFP262-8: Chemistry-VIII Practical

**Duration: 03 Hours** **Max. Marks: 25**

**DISTRIBUTION OF MARKS**

- Procedure writing: 05 Marks
  (Any one of the experiments from Part-B):
- Experimental: (Experiments be given from Part-A) 20 Marks

| Potentiometric/Conductometric titrations | | |
|---|---|---|
| Accuracy | ± 0.2 $cm^3$ | 12 Marks |
| | ± 0.3 $cm^3$ | 10 Marks |
| | ± 0.4 $cm^3$ | 08 Marks |
| | Any other value | 05 Marks |
| Graph | | 05 Marks |
| Calculation of normality, weight/$dm^3$ | | 03 Marks |

| Kinetics Expts: Determination rate constant(k) | |
|---|---|
| 6 constant values of k | 12 Marks |
| 5 constant values of k | 10 Marks |
| 4 constant values of k | 08 Marks |
| Any other values of k | 06 Marks |
| Graph | 03 Marks |
| k from graph | 02 Marks |
| Calculation and unit | 03 Marks |

**Note:** For experiments i) Hydrolysis of methyl acetate in presence of two different concentrations of HCl and determination of the relative strength, and ii) Determination of energy of activation for the reaction between $K_2S_2O_8$ versus KI (first order) in two different temperatures; only determination of rate constant for one concentration of acid and one temperature.

| Determination of partial molar volume | | |
|---|---|---|
| Accuracy | ± 4% | 12 Marks |
| | ± 6% | 10 Marks |
| | ± 8% | 08 Marks |
| | Any other value | 06 Marks |
| Graph | | 05 Marks |
| Calculation | | 03 Marks |

| Potentiometric titrations | | |
|---|---|---|
| Accuracy | ± 0.2 $cm^3$ | 12 Marks |
| | ± 0.3 $cm^3$ | 10 Marks |
| | ± 0.4 $cm^3$ | 08 Marks |
| | Any other value | 05 Marks |
| Graph | | 05 Marks |
| Calculation of normality, weight/$dm^3$ | | 03 Marks |

**PANEL OF EXAMINERS FOR 2023 – 2024 Onwards**
**(EXTERNAL)**

| Sl. No. | Name | Designation | College | Teaching Experience |
|---|---|---|---|---|
| 1 | **Dr.K. K Padmanabha** | Associate Professor | Dept. of chemistry Govt. College Mandya | 32 |
| 2 | **Dr. Ajay Kumar** | Associate Professor | Dept. of chemistry Yuvaraja's College Mysore. | 32 |
| 3 | **Smt. Jayaroopa.P** | Associate Professor | Dept. of chemistry Govt. College K.R Nagar | 32 |
| 4 | **Dr. B. K. Kendaganna Swamy** | Associate Professor | Dept. of chemistry JSS College, Nanjangudu. | 32 |
| 5 | **Smt. J. S. Vidya** | Associate Professor | Dept. of chemistry JSS College, Ooty Road Mysore. | 33 |
| 6 | **Jayadevappa H P** | Associate Professor | Dept. of chemistry Yuvaraja's College Mysore. | 24 |
| 7 | **Dr. Chandrashekar P G** | Associate Professor | Dept. of chemistry Yuvaraja's College Mysore. | 29 |
| 8 | **Smt Tara** | Associate Professor | Dept. of chemistry Maharani's Science College for Women, Mysore | 32 |
| 9 | **Dr.Radika.R T** | Associate Professor | Dept. of chemistry Maharani's Science College for Women, Mysore | 30 |
| 10 | **Dr.Venkatesh.B N** | Associate Professor | Dept. of chemistry Yuvaraja's College Mysore. | 32 |
| 11 | **Siddaraju** | Associate Professor | Dept. of chemistry JSS College, Chamarajanagara. | 34 |
| 12 | **Ravi saldona.** | Associate Professor | Dept. of chemistry St philomenous college Mysore. | 23 |
| 13 | **Dr. Umesh B** | Associate Professor | Dept. of chemistry Yuvaraja's College Mysore. | 30 |

| | | | | |
|---|---|---|---|---|
| 14 | **Dr. Shaukath Ara Khanam** | Associate Professor | Dept. of chemistry Yuvaraja's College Mysore. | 34 |
| 15 | **Dr. Devaraju** | Associate Professor | Dept. of chemistry Yuvaraja's College Mysore. | 23 |
| 16 | **Smt. Geetha D** | Assistant Professor | Dept. of chemistry Maharani's Science College for Women, Mysore | 16 |
| 17 | **Smt Kavitha C V** | Associate Professor | Dept. of chemistry AVK Science college Hassan | 25 |
| 18 | **Dr. Jamuna Rani** | Associate Professor | Dept. of chemistry Maharani's Science College for Women, Mysore | 32 |
| 19 | **Dr. Dayanand B P** | Associate Professor | Dept. of chemistry Govt. College K.R Nagar | 35 |
| 20 | **Dr Mallikarjuna I** | Associate Professor | Dept. of chemistry Maharani's Science College for Women, Mysore | 35 |
| 21 | **Dr. Shivaprasad C M** | Associate Professor | Dept. of chemistry G.F.G.C Vijaynagar Mysuru. | 28 |
| 22 | **Dr. Sayeda Ayesha** | Associate Professor | Dept. of chemistry G.F.G.C Kuvempunagar Mysuru. | 28 |
| 23 | **Sri. Dinesh H E** | Assistant Professor | Dept. of chemistry G.F.G.C K.R Nagar | 17 |
| 24 | **Smt. Mamatha M** | Assistant Professor | Dept. of chemistry Maharani's Science College for Women, Mysore | 08 |
| 25 | **Sri. Prabhakar** | Assistant Professor | Dept. of chemistry JSS College, Ooty Road Mysore. | 09 |
| 26 | **Smt. Pushpa C S** | Assistant Professor | Dept. of chemistry JSS College, Ooty Road Mysore. | 11 |
| 27 | **Dr. Kumar** | Associate Professor | Dept. of chemistry Yuvaraja's College Mysore. | 25 |
| 28 | **Sri. Praveenkumar H S** | Assistant Professor | Dept. of chemistry JSS College, Nanjangudu. | 07 |
| 29 | **Dr. Chinmay Bhat** | Assistant Professor | Dept. of chemistry G.F.G.C | 07 |

| | | | | |
|---|---|---|---|---|
| | | | Chamarajanagara | |
| 30 | **Dr. Ravishankar** | Assistant Professor | Dept. of chemistry Mahadeshwara First Grade College Kollegala. | 10 |
| 31 | **Pradeepa S** | Assistant Professor | Dept. of chemistry Maharani's Science College for Women, Mysore | 10 |
| 32 | **Dr. Preethi Thalwar** | Associate Professor | Dept. of chemistry Maharani's Science College for Women, Mysore | 23 |
| 33 | **Pradeep kumar** | Assistant Professor | Dept. of chemistry G.F.G.C Kuvempunagar Mysuru. | 08 |
| 34 | **Dr. Tippeswamy** | Associate Professor | Dept. of chemistry Maharani's Science College for Women, Mysore | 17 |
| 35 | **Dr. Siddaraju** | Assistant Professor | Dept. of chemistry Maharani's Science College for Women, Mysore | 10 |
| 36 | **Thanay kumar M N** | Assistant Professor | Dept. of chemistry JSS College, Chamarajanagara. | 06 |
| 37 | **Dr. Deelip kumar A** | Assistant Professor | Dept. of chemistry R.I.E College Mysuru | 06 |
| 38 | **Dr. Sushma** | Assistant Professor | Dept. of chemistry R.I.E College Mysuru | 05 |
| 39 | **Sowmya** | Assistant Professor | Dept. of chemistry JSS College, Chamarajanagara. | 08 |

**PANEL OF EXAMINERS FOR 2023 – 2024 Onwards**
**(INTERNAL)**

| Sl. No. | Name | Designation | College | Teaching Experience |
|---|---|---|---|---|
| 1 | **Dr.Lokeshwari D M** | Assistant Professor | Dept.of Chemistry JSS College for Women, Saraswathipuram Mysuru | 17 |
| 2 | **Rajeshwari P R** | Assistant Professor | Dept.of Chemistry JSS College for Women, Saraswathipuram Mysuru | 10 |
| 3 | **Poornima S** | Assistant Professor | Dept.of Chemistry JSS College for Women, Saraswathipuram Mysuru | 10 |
| 4 | **Shanmukha Raju M R** | Assistant Professor | Dept.of Chemistry JSS College for Women, Saraswathipuram Mysuru | 08 |
| 5 | **Chaitra kumari L C** | Assistant Professor | Dept.of Chemistry JSS College for Women, Saraswathipuram Mysuru | 07 |