Shri Vaishnav Vidyapeeth Vishwavidyalaya

M.Sc. (Chemistry)

Choice Based Credit System (CBCS)(Batch 2019-2021)

COURSE CODE	CATEGORY	COURSE NAME	L	T	P	CREDITS	TEACHING & EVALUATION SCHEME				
							THEORY		PRACTICAL		
							END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*
MSCHE101	**PG**	**PHYSICAL METHOD OF ANALYSIS**	**4**	**0**	**4**	**6**	**60**	**20**	**20**	**60**	**40**

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit;
***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Course Objectives:

1. To give basic knowledge of concept of Physical Method of analysis.
2. To develop the understanding of Chemistry Separation techniques.

Course Outcomes:

1. Theoretical understanding of concept of Physical Method of analysis.
2. Became aware of the Chemistry Separation techniques.

Syllabus:

Unit I: Introduction to Analytical Chemistry

Applications of analytical chemistry. Methods of quantitative analysis, Selection of methods of analysis. Chemical analysis and analytical methods. Quantitative analysis and scale of operation. Various steps in quantitative analysis. Methods of analytical determinations.

Unit II : Statistics for Chemist

Introduction and significance of statistical analysis. Statistical analysis and validation: Errors in chemical analysis. Classification of errors-systematic and random, additive and proportional, absolute and relative. Accuracy and precision.
Mean, median, average deviation and standard deviation. Correlation coefficient and regression analysis. Applications of Computer in chemistry. Chemical structures drawing by ACD lab and CHEMDRAW.

Unit III: Separation Techniques

Chromatography: Introduction and Classification, Principles, Applications and Techniques used in Paper chromatography, Thin Layer chromatography Column chromatography, Gas chromatography and HPLC. Ion exchange: Principle and technique. Types of ion exchangers. Ion exchange equilibria. Ion exchange capacity. Effect of complexing ions. Zeolites as ion-exchangers.
Principle and techniques of Fractional crystallization, Fractional distillation, Precipitation and

Solvent extraction.

Unit IV: Classical Methods of Analysis

Volumetric analysis: General principle. Criteria for reactions used in titrations. Primary standards and secondary standards. Theory of indicators. Types of titrations with examples- Acid-base, precipitation, redox and complexometric. Titration curves for monoprotic and polyprotic acids and bases. Indicators used in various types of titrations. Masking and demasking agents.
Gravimetric analysis: General principles and conditions of precipitation. Concepts of solubility, solubility product and precipitation equilibria. Purity of precipitate: Co-precipitation and post-precipitation. Fractional precipitation. Precipitation from homogeneous solution. Particle size, crystal growth, colloidal state, agingand peptization phenomena.

Unit V: Optical Methods of Analysis

Spectrophotometry and Colorimetry: Principle of colorimetry. Beer's law, its verification and deviations. Instrumentation in colorimetry and spectrophotometry (single and double beam). Sensitivity and analytical significance of molar extinction coefficient and λmax. Comparison method, calibration curve method and standard addition method for quantitative estimation. Role of organic ligands in spectrophotometric analysis of metal ions.

Text Books:

1. Quantitative analysis: Day and Underwood (Prentice-Hall of India)
2. Vogel's Text Book of Quantitative norganic Analysis-Bassett, Denney, Jeffery and Mendham (ELBS)
3. Analytical Chemistry: Gary D. Christian (Wiley,India).
4. Instrumental Methods of Analysis: Willard, Merrit, Dean, Settle (CBS Publishers, Delhi, 1986)
5. Instrumental Methods of Chemical Analysis: Braun (Tata McGraw-Hill)
6. Advanced Analytical Chemistry: Meites and Thomas (McGraw-Hill)

Reference Books:

1. Instrumental Methods of Analysis: G. Chatwal and S. Anand (Himalaya Publishing House)
2. Analytical Chemistry: Problems and Solution-S. M. Khopkar (New Age International Publication)
3. Basic Concepts in Analytical Chemistry: S. M. Khopkar (New Age International Publication)
4. Advance Analytical Chemistry: Meites and Thomas: (Mc Graw Hill)
5. An Introduction to Separation Science: L. R. Shyder and C. H. Harvath (Wiley Interscience)

List of Practical's: (If Practical Credit Shown in Syllabus)
Guidelines for Practical:

Shri Vaishnav Vidyapeeth Vishwavidyalaya

M.Sc. (Chemistry)

Choice Based Credit System (CBCS)(Batch 2019-2021)

A two credit lab is to be conducted by covering the most relevant and useful topics from mentioned syllabus.

Shri Vaishnav Vidyapeeth Vishwavidyalaya

M.Sc. (Chemistry)

Choice Based Credit System (CBCS)(Batch 2019-2021)

COURSE CODE	CATEGORY	COURSE NAME	L	T	P	CREDITS	TEACHING & EVALUATION SCHEME				
							THEORY		PRACTICAL		
							END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*
MSCHE102	PG	PHYSICAL CHEMISTRY	4	0	4	6	60	20	20	60	40

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Course Objectives:

1. To give basic knowledge of concept of quantum mechanics & Physical chemistry.
2. To develop the understanding of Quantum Chemistry and physical chemistry.

Course Outcomes:

1. Theoretical understanding of concept concept of quantum mechanics & physical chemistry.
2. Became aware of Quantum Chemistry and physical chemistry.

Syllabus:

UNIT I

Postulates of quantum mechanics, quantum mechanical operators, Schrödinger equation and its application to free particle and “particle-in-a- ox” (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.

UNIT II

Conductivity of solutions and their measurement - the Arrhenius ionisation theory - transport numbers and mobilities of ions - measurement of transport numbers - Hittorff method and moving boundary method - ionic activities and activity coefficients and their determination by various methods - Debye Huckel-Onsager theory - ionic atmosphere - Debye-Huckel limiting law - dissociation constant of acids and bases.

UNIT III

Electromotive force - measurement of EMF – the cell EMF and the cell reaction - reversible cells - types of half cells - classification of cells - the standard EMF of a cell - electrochemical potential - standard electrode potentials -

calculation of the EMF of a cell - Nernst equation and its limitations - calculation of solubility products - standard free energies and entropies of aqueous ions - electrode concentration cells - electrolyte concentration cells - cells with liquid junctions - oxidation - reduction reactions, measurement of PH, concentration cells - decomposition voltages - concentration polarisation and over voltage - polarography.

UNIT IV

Simple collision theory, absolute reaction rate theory(ARRT),thermodynamic treatment, potential energy surfaces, application of ARRT to simple bimolecular process; chain reactions – general characteristics, study of kinetics of chain reaction like H –Br reaction, decomposition of acetaldehyde.

UNIT V

Radioactive decay and equilibrium, Nuclear reactions, Q-value, Cross-sections, Types of reactions, Nuclear models, Chemical effects of molecular transformations, Fission and Fusion reactions, Fission products and Fission yields, Radioactive techniques, tracer technique, Neutron activation analysis (NAA), Nuclear detectors .

Text Books:

1. Chandra, A. K. Introductory Quantum Chemistry, Tata McGraw-Hill 2001.
2. House, J. E. Fundamentals of Quantum Chemistry 2nd Ed., Elsevier: USA 2004.
3. Lowe, J. P. & Peterson, K., Quantum Chemistry, Academic Press 2005.
4. Atkins, P. W. & Paula, J. de Atkin's Physical Chemistry 8th Ed., Oxford University Press 2006.
5. Ball, D. W. Physical Chemistry, Cengage, India 2012.

Reference Books:

1. Physical Chemistry, P. W. Atkins, ELBS, 1998.
2. Physical Chemistry, G. M. Barrow, International student edition, 2003.
3. Essentials of Nuclear Chemistry, H. J. Arnikar, New Age Publication Ltd., 1995.
4. Introduction to Nuclear Physics and Chemistry, B. G. Harwey, Prentice Hall, 1963.

List of Practical's: (If Practical Credit Shown in Syllabus)

Guidelines for Practical:

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M.Sc. (Chemistry)

Choice Based Credit System (CBCS)(Batch 2019-2021)

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							THEORY		PRACTICAL		
							END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*
MSCHE103	PG	ORGANIC CHEMISTRY	4	0	4	6	60	20	20	60	40

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Course Objectives:

1. To give basic knowledge of concept of Organic Chemistry.
2. To develop the understanding of Organic Chemistry.

Course Outcomes:

1. Theoretical understanding of concept concept of Organic Chemistry.
2. Became aware of Organic Chemistry.

Syllabus:

Unit I : Electron Displacement

Introduction to Reaction Mechanism and Aromaticity Electron Displacement : Inductive and field effects - Bond distances - Bond energies- Delocalised bonds - Cross conjugation - Rules of resonance - The resonance effect - Steric inhibition of resonance - Hyperconjugation - Hydrogen bonding - Effect of structure on the dissociation consants of acids and bases. Introduction to Reaction Mechanisms : Reactive Intermediates - Carbocations, cabanions, free radicals, carbenes and nitrenes - formation and stability of reactive intermetiates - Methods of determination of reaction mechanisms - Kinetic and non - kinetic methods. Aromaticity : Concept of aromaticiy - Huckels and Criag' rules - Concept of homo - and anti - aromaticity - cyclopentadienyl anion, fulvene, ferrocene azulene, tropolones, sydnone and annulenes - Alternant and nonalternant hydrocarbons.

Unit: II Reaction Mechanisms I

Substitution Reactions Aliphatic Nucleophilic Substituion : SN1 andSN2 mechanisms - Effect of substrate structure, attacking nucleophile, leaving group and reaction medium -Ambient nucleophiles and substrates - Neighbouring group participation -SNi mechanism - Nucleophilic

substitution at allytic, vinylic and aliphatic trigonal carbons-Mechanism of esterification and hydrolysis. Aliphatic Electrophilic Substitution : Electrophilic substitution at aliphatic saturated carbon - SE1 SE2 and SEi mechanisms Aromatic Electrophilic Substitution : Orientation - Reactivity - Mechanisms of Friedel - Craft reaction, Sulphonation and Gattermann - Koch formylation. Aromatic Nucleophilic Substitution : SNAr, SN1 mechanisms - Benzyne mechanism

Unit: III Reaction Mechanism II

Elimation and Addition ReactionsElimination Reactions : Alpha and beta eliminations - El, E2 and El CB mechanisms - Sterochemistry of elimination - Orientation of the double bond - Effects of the changes in the substrate, base, leaving group and reaction medium on El, E2 andE1CB reactions - Elimination versus substitution - Pyrolytic cis eliminaitons and their stereochemistry Bredt's rule. Addition to carbon - carbon multiple bonds : Electrophilic, nucleophilic and free radical additions . Addition to alpha, beta unsaturated carbonyl groups - Michael addition - of Grignard reagents and lithium dimethyl cuprate - Diels Alder addition. Addition to carbonyl groups : Mechanisms of Aldol, Benzoin, Claisen and Dieckmann condensations - Perkin, Knoevenagel, Mannich, Cannizaro, Reformatsky and Darzen's reactions - Wittig reaction and its modifications.

Unit: IV Stereochemistry and Free Radical Reactions

:Optical Isomerism : Elements of symmetry - Newmann, Sawhorse and Fischer projection formulae - Concept of Chirality - Cahn Prelog - Ingold system of nomenclature - Enantiotopic and diastereotopic atoms, Optical activity of biphenyl, allenes and spiranes - Stereospecific and Stereoselective synthesis - Resolution, recemisation and asymmetric synthesis - Crams' and prelog's rules. Geometrical Isomerism : E, Z nomenclature - Determination of configuration of geometrical Free Radical Reactions : Formation, detection and stability of free radicals - Free radical reactions - Halogenation, addition, oxidation, reduction and rearrangement reactions - Barton, Sandmeyer, Gomberg - Bachmann, Ullmann, and Hunsdiecker reactions.

Unit: V Heterocyclic compounds

Structure, Nomenclature, synthesis and reactions of indole, carbozole, oxazole, imidazole and thiazole Pyrimidines - Generai chemistry and detailed study of uracil, thymine and cytosine.

Purines - General chemistry and detailed study of uric acid and caffeine. Coumarins - General chemistry and detailed study of umbelliferone

Text Books:

1. March,J (2000): Advanced Organic Chemistry: Reactions, Mechanisms and Structure, 5thedition, Wiley.

2. Morrison, R.Tand Boyd, R.N (1992): Organic Chemistry, 6thedition, Pearson.

References

1. Nasipuri, D (2002): Stereochemistry of organic compounds-Principles and applications,, 2nd edition, New Age International.

2. Bansal,R.K (1975): Organic Reaction Mechanisms, Tata McGraw Hill.

Guidelines for Practical:

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							END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*
MSCHE 104	**PG**	**Inorganic Chemistry**	4	0	4	6	60	20	20	60	40

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Course Objectives:

1. To give basic knowledge of concept of Inorganic Chemistry.
2. To develop the understanding of Inorganic Chemistry.
3. **Course Outcomes:**

After completion of this course the students are expected to be able to demonstrate following knowledge, skills and attitudes. The student will demonstrate capability of

CO1. Theoretical understanding of concept of Inorganic Chemistry.

CO2. Became aware of Inorganic Chemistry.

Syllabus:

Unit-I:

Reactivity of metal complexes, inert and labile complexes, kinetic application of valence bond and crystal field theories, kinetics of octahedral substitution, acid hydrolysis, factors affecting acid hydrolysis, base hydrolysis, conjugate base mechanism, direct and indirect evidences in favour of conjugate mechanism, anation reactions, reactions without metal ligand bond cleavage.

Unit II:

Substitution reactions in square planar complexes, the trans effect, mechanism of the substitution reaction. Redox reactions,electron transfer reactions, mechanism of one electron transfer reaction, outersphere type reactions, cross reactions and Marcus-Hush theory, inner sphere type reactions

Unit III.

Classification of solvents -properties of ionising solvents -a general study of the typical reactions in liquid ammonia, sulphur dioxide, dinitrogen tetroxide, anhydrous hydrogen fluoride, sulphuric acid and acetic acid -solution in fused salts non-acqueous titration's. HSAB concept of acids and bases -acid, base strength and hardness and softness -symbiosis -theories of hardness and softness -electronegativity and hardness and softness.

Unit IV:

Properties of nucleus -different types of nuclear forces -liquid drop model, shell model of nucleus -nuclear reactions induced by charged particles -nuclear reaction cross -section, significance and determination -theory of nuclear fission -conditions for controlled fission chain reaction -Nuclear reactor and its components -Production of feed materials for nuclear reactors -disposal of radioactive wastes- nuclear fusion, steller energy, Application of radioisotopes in agriculture, industry and medicine -neutron activation analysis -hot atom chemistry.

Unit V:

Close packing of atoms and ions FCC,HCP and BCC types of packing tetrahedral and octahedral void redius ratio -derivation -its influence on structures -representative structures of AB and AB., types of compounds- rock salt, calcium chloride,wurtzite, sine blende,rutile, fluorite,antifluorite,cadmimum iodide and nickel arsenide. .Structure of graphite and diamond -spinels normal and inverse types and perovskite structure

Text Books:

1.Day,M.C and Selbin,J (1985): Theoretical Inorganic Chemistry, 2ndEdit ion, Affiliated East West Press Pvt.Ltd.

2.Cotton,F. A and Wilkinson,G (2009): Advanced Inorganic Chemistry,4thEdition, A Wiley-Interscience Publication,John–Wiley & Sons,USA.

3.Huheey,J.E (1983): Inorganic Chemistry, 3rd Edition, Harper & Row publisher, Singapore.

Reference Books:

1.Kettle,S.F.A. (1996): Physical Inorganic Chemistry –A Coordination Chemistry Approach, Spectrum, Academic Publishers, Oxford University Press.

2.Adamson, A.W (1975): Inorganic Photochemistry,John Wiley&Sons,NewYork.

3.Basolo,F. and Pearson, R.G (1967): Mechanism of Inorganic Reactions, John Wiley,NewYork.

List of Practical's: (If Practical Credit Shown in Syllabus)

Guidelines for Practical:

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