Shri Vaishnav Vidyapeeth Vishwavidyalaya

M.Sc. (Chemistry)

Choice Based Credit System (CBCS)(Batch 2018-2020)

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*
MSCHE 401	PG	Principles of Bioinorganic Chemistry	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 bioinorganic chemistry.
2. To develop the understanding of bioinorganic chemistry.

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 concept of bioinorganic chemistry

CO2. Became aware of bioinorganic chemistry.

Syllabus:

UNIT I

Role of alkali and alkaline earth metal ions in biology; Na+-K+ Pump, ionophores and crown ethers. Metal site structure, function.

UNIT II

Metal ion transport and storage: Ferritin, Transferrin, Siderophores and metallothionein.

UNIT III

Electron Transfer: Cytochromes, Iron-Sulfur Proteins and Copper Proteins. Oxygen transport and storage: Hemoglobin, myoglobin, hemerythrin, hemocyanin Oxygen activation: Cytochrome P450, Cytochrome c oxidase.

UNIT IV

Other metal containing enzymes: Catalase, peroxidase, superoxide dismutase, alcohol dehydrogenase, carbonic anhydrase, carboxypeptidase, xanthine oxidase, nitrogenase, vitamin B12 coenzyme, photosystem I and II, oxygen evolving center. Various spectroscopic methods used in bioinorganic chemistry: electronic spectra, EPR (emphasis on first row transition metal ions and their spectra), brief description of CD / MCD and multinuclear NMR.

UNIT V

Applications of newer methods like EXAFS, XANES and ENDOR in characterization of biological molecules. Use of coordination complexes as models for various enzymes, metalloproteins. Role of hazardous materials such as nitric oxide, cyanide and methyl isocyanate etc. in biological systems.

Text Books:

1. S. J. Lippard and J. M. Berg, Principle of Bioinorganic Chemistry , University Science Books (1994).
2. Lawrence Que, Jr, Physical Methods in Bioinorganic Chemistry: Spectroscopy and Magnetism, University Science Books (2000).

Reference Books:

1. F. A. Cotton and G. W. Wilkinson, Advanced Inorganic Chemistry, 5th Ed. , John-Wiley & Sons, (1988).
2. D. Banerjea, Coordination Chemistry, 2nd Ed, Asian Books Pvt. Ltd. (2007).
3. J. E. Huheey, E. A. Keiter and R. L. Keiter, Inorganic Chemistry: Principles of Structure and Reactivity , 4th Ed. Harper Collins (1993).

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

Guidelines for Practical:

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

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							THEORY		PRACTICAL		
							END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*
MSCHE 402	PG	Concepts in Organic Synthesis	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 Organic synthesis.
3. To develop the understanding of Organic synthesis.

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 concept of Organic synthesis

CO2. Became aware of Organic synthesis.

Syllabus:

UNIT I

Pericyclic Reactions: Molecular orbital symmetry, Frontier orbitals of ethylene, 1,3-butadiene, 1,3,5-hexatriene and allyl system. Classification of pericyclic reactions.

UNIT II

Woodward-Hoffmann correlation diagrams. FMO and PMO approach. Electrocyclic reaction; conrotatory and disrotatory motions 4n, 4n+2 and allyl systems. Photochemistry: Quantum yields, intersystem crossing, photosensitization and energy transfer reactions. Photochemistry of olefins and carbonyl compounds, photo oxygenation and photo fragmentation, Photochemistry of aromatic compounds: isomerisation, additions and substitutions. Singlet molecular oxygen reactions. Patterno-Buchi reaction, Di-pimethane rearrangement, Bartons reaction and Photo-Fries rearrangement.

UNIT III

Cycloaddition; antrafacial and suprafacial addition, 4n and 4n+2 systems, 2+2 addition of ketenes, 1,3 dipolar cycloadditions and cheleotropic reactions. Reagents in Organic Synthesis: Use of the following reagents in organic synthesis and functional group transformations; complex metal hydrides, Gilman's reagent, lithium dimethylcuprate, lithium diisopropylamide (LDA).

UNIT IV

Sigmatropic Rearrangements; suprafacial and antrafacial shifts of H, sigmatropic shifts involving carbon moieties, 3,3- and 5,5- sigmatropic rearrangements, Claisen, Cope and Aza-Cope rearrangements. Ene reaction.

UNIT V

Phase transfer catalysts, crown ethers and Merrifield resin, Peterson's synthesis, Wilkinson's catalyst, Baker yeast. Heterocyclic Chemistry: Synthesis and reactivity of furan, thiophene, pyrrole, pyridine, quinoline, isoquinoline and indole; Skraup synthesis, Fisher indole synthesis.

Text Books:

1. Frontier Orbital and Organic Chemical Reactions by I. Fleming, John Wiley, 1976.
2. Some modern Methods of Organic Synthesis by W. Carruthers, Cambridge University Press,1990.
3. Protective Groups in Organic Synthesis by T.W. Greene, Wiley-VCH, 1999.

Reference Books:

1. Modern Heterocyclic Chemistry by L. A. Paquette, W.A. Benjamin, Inc.,1968.
2. Organic Chemistry by I. L. Finar, Vol II, ELBS, 1968.
3. Heterocyclic Chemistry by T. R. Gilchrist, Longman,1989.
4. Selectivity in Organic Synthesis by Ward, Wiley-VCH, 1999.

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

Guidelines for Practical:

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							THEORY		PRACTICAL		
							END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*
MSCHE 403	PG	Inorganic Chemistry	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 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:Covalent and Ionic Bondings

V. B. approach to covalent bonding -Heitler -London, Pauling- Slater refinements, Hybridization and structure of molecule. VSEPR theory -shapes of molecules. M.O. approach to covalent bonding -symmetry and overlap of atomic orbitals -symmetry of molecular orbitals -sigma- pi- and delta -bondings -energy levels in homo -and hetero nuclear diatomic molecules -bond length, bond order and bond energy -ionic character in a covalent bond. The concept of multi centre bonding. Structure and bonding in fluorine and oxygen compounds of xenon and krypton. Bonding in simple tri atomic molecules/ions. Lattice energy and its calculations by Born-lande and born-Meyer equations -Determinations by Born –Haber cycle- Kapustinski equation, Energetics of dissolution of ionic compounds in polar solvents. Properties of ionic compounds- Hardness and electrical conductivity.

Unit II: Chemistry of Lanthanides and Actinides and Studies on Magnetism

Lanthanides- occurrence, extraction and separation techniques (fractional crystalization, precipitation, ion-exchange, solvent-extraction andthermal decomposition, selective reduction and oxidation) -position in the periodic table. - electronic configuation -oxidation states -size relationships -lanthanide contraction -spectral and magnetic properties -condition compounds of lanthanides -uses of lanthanides and their compounds. Actinides : Synthesis of elements -position in the periodic table, electronic configuration and oxidation states- spectral and magnetic properties -comparative account of lanthanides and actinides. Magnetism: Types of magnetic behaviour -determination of magnetic susceptibilities by Gcuy Method and Faraday method -calculation of magnetic moment from experimental data -magnetic properties of free ions -Effects of ligand field and orbital contribution -magnetic behaviour of complexes with A, E and T ground terms -Temperature independent paramagnetism- evaluation of spin orbit coupling constant from spectral and magnetic moment data -the orbital, contribution reduction factor k-magnetic properties of 3d, 4d, 5d, 4f and 5f ions anti-ferromagnetic interactions in simple molecules and in lattice structures.

Unit III. Chemistry of Non-aqueous Solvents

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: Nuclear Chemistry 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: Chemistry of Solid State

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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							THEORY		PRACTICAL		
							END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*
MSCHE 404(I)	PG	Environmental Chemistry	4	0	4	6	60	20	20	60	40

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Course Objectives:

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

Course Outcomes:

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

Syllabus:

UNIT I

Atmospheric composition and principles of contaminant behavior

The atmosphere of Earth; Contaminant behavior in the environment; Greenhouse effect - Global temperature-Acid rain and - Ozone layer depletion

UNIT II

Contaminants and their natural pathways of degradation and their abatement

Carbon Cycle; Nitrogen Cycle; Sulphur Cycle; CO formation in atmosphere; Organic Pollutants; Pollution from Combustion Systems; Coal Combustion; Photochemical Smog; Indoor Air Pollution

UNIT III

Air Pollution Control Techniques

Carbon Monoxide; Oxides of nitrogen; Sulphur Dioxide; Volatile Organic Compounds; Instruments techniques to monitor pollution.

UNIT IV

Water Pollution

Ground and subsurface water contamination; Water pollution sources; Ground Water Pollution; Ocean Pollution. Eutrophication; Acid Mine Drains; Pesticides and Fertilizers; Dying and Tanning

UNIT V

Soil Pollution

Soil Around us; Soil Water Characteristics; Soil Erosion; Soil & Pollution; Water resources: Irrigation and Wetlands; Soil Pollution Management; Nuclear Waste Management; Sewage Treatment; Solid Waste Management.

Text Books:

1. Manahan, Stanley E. Fundamentals of EnvironmentalChemistry Boca Raton: CRC Press LLC,2001.
2. Sonja Krause, Herbert M. Clark, James P. Ferris, Robert L.Strong Chemistry of the Environment, Elsevier Science &Technology Books 2002.
3. Eugene R. Weiner Applications of EnvironmentalChemistry 2000 CRC Press, LLC.
4. By Clair N. Sawyer, Perry L. McCarty, Gene F. ParkinChemistry for environmental engineering and science(5th edition) McGrawHill Professional.

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 2018-2020)

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*
MSCHE 404(II)	PG	Organometalic Chemistry	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 organomattalic Chemistry.
4. To develop the understanding of organomattalic Chemistry.

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 concept of organomattalic Chemistry

CO2. Became aware of organomattalic Chemistry.

Syllabus:

UNIT I

Definition, classifications and bonding in organometallic compounds. Isolobal analogies. Structural methods of Organometallics. Preparative methods. Spectroscopic techniques in Organometallic chemistry. Electronic and magnetic properties of Organometallic compounds.

UNIT II

Stoichiometric and catalytic reactions. Fundamental processes in reactions of organo-transition metal complexes. Applications of transition metal complexes to catalysis, organometallics directed towards organic synthesis.

UNIT III

Bio-organometallics, Organometallics in environmental chemistry. Metal clusters and models for heterogeneous catalysis. Application of Organometallics in Industry. Metallocenes.

UNIT IV

Metal carbonyl complexes, Metal carbonyls –Part II, Ligand substitution reactions, Substitutes for carbonyl ligands, Carbene complexes, Carbene complexes continued Non-Carbon Ancillary ligands Non-Carbon Ancillary ligands continued, Metal alkyl complexes, Ligand Insertion Reactions

UNIT V

Metal alkene complexes, Metal dihydrogen and hydrides, Migratory Insertion reaction with alkynes. Oxidative addition & Vaskas complex mechanism Reductive elimination Reductive Elimination mechanism Oxidative coupling with C-C bondformation, Metathesis reactions.

Text Books:

1. Organometallics: A Concise Introduction Authors: Christoph Elschen broich Year:2006.

2. Fundamentals of Organometallic Catalysis Author: Dirk SteinbornYear:2012Publisher:Wiley-VCHISBN:978-3-527-32717-1.
3. Basic Organometallic Chemistry: Concepts, Syntheses and Application Authors: BD Gupta & Anil J Elias Year:2013 Publisher: Universities PressISBN:978-81-7371-709-3.
4. Fundamentals of Organometallic Catalysis Author: Dirk SteinbornYear:2012 Publisher: Wiley-VCHISBN:978-3-527-32717-1.
5. Organometallic Chemistry and Catalysis Author: Didier Astruc Year: 2007 Publisher: Springer ISBN:978-3-540-46129-6.

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

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M.Sc. (Chemistry)

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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*
MSCHE404(III)	**PG**	**Industrial Chemistry**	**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 Industrial Chemistry.
2. To develop the understanding of Industrial Chemistry.

Course Outcomes:

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

Syllabus:

UNIT I

Purification and Separation: Sample preparation (isolation using a suitable solvent, extraction and separation), Solvent extraction. Distillation (simple, fractional and vacuum distillation), Crystallization. Chromatographic separation: High Performance Liquid Chromatography (HPLC), Gas Liquid Chromatography (GLC), Gas Chromatography (GC), Ion Exchange Chromatography.

UNIT II

Composition Analysis: Elemental analysis both qualitative and quantitative.C.Physical Characterization: Strength, Viscosity, Rheological properties, Molecular weight.

UNIT III

Spectroscopic Methods: Ultraviolet Spectrophotometery (UV), Visible Spectro photometery, Infrared Spectrophotometery (IR), Nuclear Magnetic Resonance Spectroscopy (NMR) and Electron Spin Resonance Spectroscopy(ESR), Flame Photometry, Atomic Absorption Spectroscopy(AAS), Induced Couple Plasma Spectroscopy (ICP), Atomic Fluorescence Spectroscopy.

UNIT IV

Electro Analytical Techniques: Potentiometery, Voltametry, Polarography, Amperometry, Coulometry and Conductometry.

UNIT V

Thermal Methods of Analysis: Thermal Gravimetric Analysis (TGA), Differential Thermal Analysis (DTA), Differential Scanning Calorimetery(DSC), Thermal Mechanical Analysis (TMA)

Text Books:

1. H.H. Willard, L.L. Merrit, J.A. Dean, F. A. Settle: Instrumental Methods of Chemical Analysis,Wadsworth Publishing Company,California.
2. G. D. Christian:Analytical Chemistry, John Wiley, NY.
3. S.M. Khopkar:Basic Concepts of Analytical Chemistry,Wiley Eastern Ltd, New Delhi

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