M.Sc. Chemistry IV-Semester

Inorganic Special – IV (Organometallic Chemistry)

Paper No. CH-602 B **Credits: 04**

04 Hrs /week **External Marks: 100**

Total: 60 Hrs **Sessional Marks: 50**

Duration of Exam: 03 Hrs

OBJECTIVES:

1. To review the basic concepts of organometallic chemistry.
2. To develop an understanding of chemistry of transition metal based Organometallic compounds.
3. To utilize the concept of 18-electron rule for deriving important structural and reaction aspects of organometallic complexes of transition metals.
4. To study the various classes of organo-transition compounds.
5. To understand the bonding and structural features of such complexes including their fluxional behavior.
6. To realize the importance of these compounds from their important applications as homogeneous catalysts.

OUTCOME:

After studying this course the student should be able to

understand the different types of organometallic compounds.

apply the 18-electron rule for solving problems based on the various possible structural features and reaction routes of transition metal-organometallic compunds

comprehend the different types of bondings and related structural aspects of different classes of these compound.

realize the different important reactions including oxidative addition, reductive elimination and migratory insertion.

appreciate the industrial importance of these compounds in catalysis.

Books Suggested

1. Principles and Application of Organotransition Metal Chemistry, J.P. Collman, L.S. Hegsdus, J.R. Norton and R.G. Finke, University Science Books.
2. The Organometallic Chemistry of the Transition Metals, R.H. Crabtree, John Wiley.
3. Organometallic Chemistry, R.C. Mehrotra and A. Singh, New Age International.
4. Organometallics, A. Salzer, Ch. Elschenbrioch.VCH Publications.
5. Basic Organometallic Chemistry: Concepts, Syntheses, and Applications of Transition Metals; B. D. Gupta and A. J. Elias, University Press.
6. Inorganic Chemistry, J.E. Huheey, HarperCollins.
7. Inorganic Chemistry, G. L. Miessler and D. A. Tarr, 2nd Edn. (1999), Prentice Hall International Inc., London.

LECTUREWISE PROGRAMME: **(From 08.01.18 to 27.04.18)**

M.Sc. Chemistry IV-Semester

CH-602B Inorganic Special – IV (Organometallic Chemistry)

UNIT – I (from 08.01.18 to 05.02.18)

Organometallic Chemistry of transition metal complexes: Electron count, application of 18-electron rule. Preparation and properties (Bonding modes, IR Spectra) of transition metal carbonyls and nitrosyls.

Alkyls and Aryls of Transition Metals: Types, routes of synthesis, stability and their decomposition pathways,

UNIT – II (from 06.02.18 to 05-03.18)

Transition Metal π–Complexes: Transition metal π–complexes with unsaturated molecules-alkenes, alkynes, allyl, & arenes and Cp (metallocene) complexes: preparation, properties and nature of bonding (MO picture) and structural features, important reactions related to nucleophilic and electrophilic attack on ligands and to organic synthesis.

UNIT – III (from 05.03.18 to 29.03.18)

Compounds of Transition Metal-Carbon Multiple Bonds: Transition metal- carbene

complexes: Fischer type and Schrock type carbene complexes: synthesis, reactions and structures & bonding; Transition metal-carbyne complexes: synthesis, reactions and structural features.

Fluxional Organometallic Compounds: Fluxionality & dynamic equilibria in compounds such as acyclic alkenes,σ-bonded and π–bonded cyclic alkenes, rotation of ligands on metals, ligand scrambling on metals.

UNIT – IV (from 30.03.18 to 27.04.18)

Catalysis by transition metal organometallics: Oxidative addition, reductive elimination and Insertion reactions.

Zeigler-Natta polymerization; homogeneous catalytic hydrogenation; alkene hydrogenation-Wilkinson Catalyst; Oxidation of olefins-Wacker's process; hydroformylation of olefins – the oxo process; Monsanto process.

Evaluation Procedure

Home Assignments: 4 –5 assignments/quizzes etc. per semester.

1.	Assignment / Performance in the Class	10 Marks
2.	Minor Tests (Two tests having equal weightage) Minor Test I : 14-16 Feb, 2018 Minor Test II : 4 -6 April, 2018	40 Marks(20 marks each minor)
3.	University Examination	100 Marks

Note: The University Examination question paper will comprise of eight questions, two from each unit. The candidates will be required to attempt five questions selecting at least one from each unit. All questions will carry equal marks.

Award of Grades Based on Absolute Marks: The University is following the system of grading based on absolute marks (after applying moderation if any). Following grading will be done based on the % of marks obtained in all the components of evaluation part of the subject.

A+ (90% - 100 %), A (80% - 89%), B+ (70% - 79%) , B(62% - 69%), C+ (55% - 61%), C (46% - 54%), D (40% - 45), F (Less than 40 %)

For F grade, a candidate shallbe required to appear in the major test of concerned course only in the subsequent examination(s) to obtain the requisite marks/grade.

Attendance Record – Candidate should attend at least 75% attendance of the total classes held of the subject

Counselling hour: 12pm-1pm on Tuesday. However, the students are free to approach the teacher during any available free time/period.

Msc. Chemistry - IV - semester CH-604 B

Inorganic Special – V (Inorganic Solids, Polymer and Cluster Compounds)

L	T	P	Credits		
				Sessional Marks:	50
4	-	-	04	Theory Marks:	100
				Duration of Exams:	3 Hours

- **OBJECTIVES:**

- To highlight the need, role and importance of inorganic solids, polymer and cluster compound.
- To familiarize the students with ideas, how solid materials can be used as tools for the welfare of human being and society?
- To discuss the applications of inorganic solids, polymer and cluster compound in the development other branches of Science, Engineering and Technology.
- To familiarize the students with basic aspects of crystalline materials.
- To study various types of structure in the direct and reciprocal space based on symmetry aspects.
- To explore the detailed structure and properties of crystalline materials using X-ray diffraction theories and experimental techniques.
- To discuss the preparation and properties of inorganic polymer.

OUTCOME:

1. Students will be able to understand the crystal structure of different solids.
2. Students will be find the structure of different materials using diffraction methods such as X-ray diffraction, Powder method, single crystal diffraction method etc.
3. Students are able to understand the properties of different inorganic polymers

Books :

Books Recommended

1. A.R. West, Solid State Chemistry and its Applications, (1984) John Wiley and Sons, Singapore.

2. L.V. Azaroff, Introduction to Solids, (1977) Tata McGraw-Hill, New Delhi.

3. L. Smart &E. Moore, Solid State Chemistry: An Introduction, CRC Press.

4.P. B. Saxena, Inorganic Polymers, Discovery Publishing House, New Delhi (2007).

5. R. De Jaeger, M. Gleria, Inorganic Polymers, Nova Science Publishers (2007).

6. Advanced Inorganic Chemistry, F.A. Cotton and Wilkinson, John Wiley.

7. Inorganic Chemistry, J.E. Huheey, HarperCollins.

LECTUREWISE PROGRAMME: (FROM 08-01-2018)

M.Sc. Chemistry IV-Semester CH604B

Inorganic Special – V (Inorganic Solids, Polymer and Cluster Compounds)

Paper No. CH-604 B Credits: 04 04 Hrs /week External
Marks: 100 Total: 60 Hrs Sessional Marks: 50
Duration of Exam: 03 Hrs

Note: The question paper will comprise of eight questions, two from each unit. The candidates will be required to attempt five questions selecting at least one from each unit. All questions will carry equal marks.

UNIT – I (from 08.01.2018 to 29.01.2018)

Crystallography: Crystal structure of solids: Fundamental of lattices, unit cell, atomic coordinates, Bravais lattices, types of close packing, packing efficiency, radius ratios; structure

types – NaCl, ZnS, Na_2O, $CdCl_2$, wurtzite, nickel arsenide, CsCl, CdI_2, rutile and Cs_2O, perovskite ABO_3, K_2NiF_4 and spinels.

UNIT – II (from 30.01.2018 to 27.02.2018)

X-Ray Diffraction: Crystal diffraction by X-rays, Neutrons and Electrons; Braggs Law, Structure determination by X-ray diffraction, Powder and single crystal methods. Band theory of

solids.

UNIT – III (from 28.02.2018 to 21.01.2018)

Inorganic Polymers: Introduction, Preparation and properties of inorganic polymers based on

Phosphorus, Sulfur, Silicone and Boron. Synthetic Co-ordination polymers, polymers with cyclopentadienyl rings, Chelating ligands

UNIT - IV(from 22.01.2018 to 27.01.2018)

Metal Clusters: Introduction, Carbonyl clusters (Low and high nuclearity), Structure, Electron

counting scheme, Wade's rules, Zintl ions, Chevrel phases.

LECTUREWISE PROGRAMME

(from 08.01.18 to 27.04.18)

Home Assignments: 3 –5 assignments are given during the semester.

Evaluation Procedure

1.	Surprise Quiz/ Tutorial Test/presentation	5 Marks
2.	Assignment / Project / Performance in the Class	5 Marks
3.	Minor Tests (Two tests having equal weightage) Minor Test I : 14-16 Feb, 2018 Minor Test II : 4 -6 April, 2018	40 Marks
4.	Major test (University Examination)	100 Marks

Award of Grades Based on Absolute Marks: The University is following the system of grading based on absolute marks (after applying moderation if any). Following grading will be done based on the % of marks obtained in all the components of evaluation part of the subject.

A+ (90% - 100 %), A (80% - 89%), B+ (70% - 79%) , B(62% - 69%), C+ (55% - 61%),C (46% - 54%), D (40% - 45), F (Less than 40 %)

For F grade, a candidate shallbe required to appear in the major test of concerned course only in the subsequent examination(s) to obtain the requisite marks/grade.

Attendance Record – Candidate should attend at least75% attendance of the total classes held of the subject

Chamber consultation hour: Any vacant period.

Note:

1. In the semester examination, the examiner will set 08 questions in all selecting two from each unit (1 & 2 from unit I, 3 & 4 from unit II, 5 &6 from unit III and 7 & 8 from unit IV). The students will be required to attempt only 5 questions selecting at least one question from each unit. All questions will carry equal marks.
2. The use of scientific calculator will be allowed in the examination. However, programmable calculator and cellular phone will not be allowed.
3. The use of properties (water, air, steam etc) tables, heat transfer tables, charts is permitted

M.Sc. Chemistry IV-Semester CH-606B

Inorganic Chemistry Chemistry Special – VI (Inorganic Medicinal Chemistry)

L	T	P	Credits	Sessional Marks: 50
4	-	-	04	Theory Marks: 100
				Duration of Exams: 3 Hours

OBJECTIVES:

1. To review the basic concepts of role of metal ion and their biological significance.
2. To Explain the mode of interaction of drugs in biological system.
3. To understand the basic area of anticancer drugs discovery.
4. To understand the phenomenon of metal interaction in biological system
5. To make aware about advantages and disadvantages of metal interaction in body as well.
6. To interpret the metal ligand coordination their advantages and future scope.
7. To review the area of macro cyclic compound working as drugs.
8. To study the biomedical importance of rare as well as transition metal ions and their complexes .

OUTCOME:

- Give elementary idea about anticancer drugs their mode of interaction and biological and pharmacological significance of metal ions and different inorganic compounds in biomedical applicatios.
- Prepared to adopt a research focus on new drug discovery and improvement in the efficiency of existing one as future scope
- Able to get basic idea about role of metal ions in biological system and their importance in drugs deigning .
- To promote the area of new drug discovery.

Books Suggested

- Principles of Bioinorganic Chemistry, S.J. Lippard and J.M. Berg, University Science Books.
- Bioinorganic Chemistry, I. Bertini, H.B. Gray, S.J. Lippard and J.S. Valentne, University Science Books
- Metallotherapeutic drugs and metal-based diagnostic agents: the use of .metals in medicine, Marcel Gielen, Edward R. T. Tiekink
- Enzo Alessio (Ed.), Bioinorganic Medicinal Chemistry, Wiley-VCH Verlag (2011).
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LECTUREWISE PROGRAMME: **(From 08.01.18 to 27.04.18)**

M. Sc. Chemistry IV-Semester

Inorganic Special – VI (Inorganic Medicinal Chemistry)

Paper No. CH-606 B **Credits: 04**

04 Hrs /week **External Marks: 100**

Total: 60 Hrs **Sessional Marks: 50**

Duration of Exam: 03 Hrs

Note: The question paper will comprise of eight questions, two from each unit. The candidates will be required to attempt five questions selecting at least one from each
unit. All questions will carry equal marks.

LECTUREWISE PROGRAMME : (from 08.01.18 to 27.04.18)

UNIT – I(from 08.01.18 to 30.01.18)

Metals in Medicine: Biochemical bases of essential metal deficient diseases; Iron, copper and zinc deficiencies and their therapies,

Heavy metals in Biological systems: Toxicity of heavy metals – and their detoxification, role of Selenium in Biological systems with reference to its essentiality and toxicity, mechanism of metal ion induced toxicity, interaction between orally administered drugs and metal ions in gut.

UNIT - II(from 31.01.18 to 28-02.18)

Anticancer Agents: Carcinogens and carcinostatic agents, zinc in tumour growth and inhibition, anticancer activity and mechanism of platinum complexes, anticancer activity of Rhodium, copper and Gold complexes, anti cancer activity of Selenium, antibacterial and antiviral properties of metal complexes, polyamino carboxylic acids and polyethylene amines as chelating drugs. Boron Neutron Capture Therapy.

UNIT – III from 01.03.18 to 30.03.18)

Biomedical Applications of Metal-Containing Luminophores: Transition-Metal Containing Luminescent Agents, Photophysical Properties of Transition Metal Complexes (Ruthenium (II), Iridium (III), Rhenium (I) complexes and Lanthanide

based luminophores).

Miscellaneous applications of Inorganic compounds as medicines: Drugs in hypo and hyper activity of thyroids, Inorganic drugs in dental carries, clinical disorders of alkali and alkaline earth metals and their remedies, lithium drugs in psychiatry.

UNIT – IV(from 02.04.18 to 27.04.18)

Ligand Therapy: Ligand induced toxicity, interference with haemoglobin in oxygen transport system, intefererence with metallo-enzymes, beneficial effects of ligand chelation; carcinogenic ligands, carcinostatic ligands, alkylating agents as anticancer drugs, Thiosemicarbazones as anticancer drugs, macrocyclic antibiotic ligands and prodable mechanism of the drug, antiviral activity of chelating agents, aspirin chelation, drugs where chelation and therapeutic activity are unrelated.

Home Assignments: 3 –4 assignments/quiz / class test will be held during the semester.

Evaluation Procedure

1.	Assignment / Performance in the Class	10 Marks
2.	Minor Tests (Two tests having equal weightage) Minor Test I : 14-16 Feb, 2018 Minor Test II : 4 -6 April, 2018	40 Marks(20 marks each minor)
3.	University Examination	100 Marks

Award of Grades Based on Absolute Marks: The University is following the system of grading based on absolute marks (after applying moderation if any). Following grading will be done based on the % of marks obtained in all the components of evaluation part of the subject. A+ (90% - 100 %), A (80% - 89%), B+ (70% - 79%) , B(62% - 69%), C+ (55% - 61%), C (46% - 54%), D (40% - 45), F (Less than 40 %)

For F grade, a candidate shallbe required to appear in the major test of concerned course only in the subsequent examination(s) to obtain the requisite marks/grade.

Attendance Record – Candidate should attend at least75% attendance of the total classes held of the subject

Counselling hour: 12pm-1pm on Monday

CH 614B Organic Chemistry Special – IV (Photochemistry & Pericyclic Reactions)

L	T	P	Credits	Sessional Marks:	50
4	-	-	04	Theory Marks:	100
				Duration of Exams:	3 Hours

Teaching Methodology:- PowerPoint + black board, discussion & solving problems. -

OBJECTIVES:

- To develop interest and good understanding of pericyclic reactions and skills for the utilization of these reactions in organic synthesis.
- To study basic principles of photochemistry and present real-world applications, so that students can gain an understanding of chemical changes that are influenced by photoreactions.
- Recognize and draw different conformational structures of medium and large ring compounds and small ring heterocyclic compounds.

OUTCOMES:

- Able to identify and draw the mechanisms for each of the different types of pericyclic reaction: cycloadditions, electrocylic reactions, sigmatropic reactions and group transfer reactions.
- Understand conrotatory and disrotatory electrocyclic ring-opening and ring-closure, the effect of pathway on stereochemical outcome, and the orbital symmetry explanation of which pathway is allowed under thermal and photochemical conditions.
- Understand photochemical principles, types of excitations, Jablonski diagram, types of photochemical reactions.
- Able to describe photochemistry of alkenes, carbonyl compounds and aromatic compounds.
- Able to Compare between types of singlet oxygen reactions, inter & intra molecular cyclo addition, photo degradation of polymers and free radical reactions.
- Understand the stereochemistry of medium and large ring compounds.
- Able to explain trans annular reactions, effect of conformation on reactivity and stereochemistry of nitrogen containing compounds, strain and their consequences in small ring heterocycles.

BOOKS :

1. Horspool, W. M. Aspects of Organic Photochemistry Academic Press (1976).
2. Lowry, T. H. & Richardson, K. S. Mechanism and Theory in Organic Chemistry AddisonWesley Educational Publishers, Inc. (1981).
3. March, J. Advanced Organic Chemistry John Wiley & Sons (1992).
4. Marchand, A. P. & Lehr, R. E. Pericyclic Reactions Academic Press (1977).
5. Organic Photochemistry and Pericyclic Reactions, M G Arora, Anmol Publishers, New Delhi.
6. Pericyclic Reactions, S.M. Mukherji, Macmillan, India.
7. Stereochemistry of Organic Compounds, D. Nasipuri, New Age International.
8. Stereochemistry of Organic Compounds, P.S. Kalsi, New Age International.
9. Stereochemistry of Organic Compounds, E. L. Eliel and S. H. Wilen, Wiley Interscience.
10. Organic Photochemistry 2e by James Morriss Coxon, Brian Halton from Cambridge.

LECTUREWISE PROGRAMME: (from 08.01.18 to 27.04.18)

Introduction of the subject: **08.01.2018**

Pericyclic Reactions: **09.01.18- 02.02.18**

Molecular orbital symmetry, Frontier orbitals of ethylene, 1,3-butadiene, 1,3,5-hexatriene and allyl system. Classification of pericyclic reactions. Woodward – Hoffmann correlation diagrams. FMO and PMO approach. Electrocyclic reactions – conrotatory and disrotatory motions, 4n, 4n+2 and allyl systems. Cycloadditions – antarafacial and suprafacial additions, 4n and 4n+2 systems, Sigmatropic rearrangements – suprafacial and antarafacial shifts of H, sigmatropic shifts involving carbon moieties, 3,3-and 5,5-sigmatropic rearrangements. Claisen, and Cope rearrangements

05.02.18-01.03.18

Photochemical Reactions: Interaction of electromagnetic radiation with matter, types of excitations, fate of excited molecule, quantum yield, transfer of excitation energy, actinometry.

Photochemistry of Alkenes: Intramolecular reactions of the olefinic bond- geometrical isomerism, cyclisation reactions, rearrangement of 1,4 and 1,5 – dienes.

Photochemistry of Carbonyl Compounds: Intramolecular reactions of carbonyl compounds, saturated, cyclic, acyclic, and α, β unsaturated compounds. Cyclo hexa dienones.

05.03.18-30.03.18

Intermolecular cycloaddition reactions – dimerizations and oxetane formation.

Photochemistry of Aromatic Compounds: Isomerizations, additions and substitutions.

Miscellaneous Photochemical Reactions: Photo-Fries reactions of anilides. Photo-Fries rearrangement. Barton reaction. Singlet molecular oxygen reactions. Photo degradation of polymers.

Free Radicals: Free radicals stability, generation and detection. Types of free radical reactions, free radicals substation at an aromatic substrate, Hunsdiecker reaction.

02.04.18-27.04.18

Stereochemistry:

Conformational analysis of medium and large membered rings, trans annular reactions, conformational analysis of cyclohexanone, effect of conformation on reactivity of acyclic and cyclic compounds.

Stereochemistry of nitrogen containing compounds, strain and their consequences in small ring heterocycles, conformation of six membered heterocyles. Barrier to ring inversion and pyramidal inversion and 1,3-diaxial interactions.

Evaluation Procedure

1.	Home assignment	10 Marks
2.	Minor Tests (Two tests having equal weightage) Minor Test I : 14-16 Feb, 2018 Minor Test II : 4 -6 April, 2018	 20 Marks 20 Marks
3	University Examination	100 Marks

Award of Grades Based on Absolute Marks: The University is following the system of grading based on absolute marks (after applying moderation if any). Following grading will be done based on the % of marks obtained in all the components of evaluation part of the subject.

A+ (90% - 100 %), A (80% - 89%), B+ (70% - 79%) , B(62% - 69%), C+ (55% - 61%), C (46% - 54%), D (40% - 45), F (Less than 40 %)

For F grade, a candidate shall be required to appear in the major test of concerned course only in the subsequent examination(s) to obtain the requisite marks/grade.

Attendance Record – Candidate should attend at least75% attendance of the total classes held of the subject

Chamber consultation hour: Any vacant period.

M. Sc. Chemistry IV-Semester
Organic Chemistry Special – V (Natural Products-2)
Paper No. CH-616 B **Credits: 04**
04 Hrs /week **External Marks: 100**
Total: 60 Hrs **Sessional Marks: 50**
Duration of Exam: 03 Hrs

Note: The question paper will comprise of eight questions, two from each unit. The candidates will be required to attempt five questions selecting at least one from each unit. All questions will carry equal marks.
LECTUREWISE PROGRAMME:

UNIT – I (from 01.03.18 to 30.03.18)

Terpenoids: Classification , nomenclature, occurrence and general method of structural determination , Isoprene rule, Stucture determination, stereochemistry and synthesis of Citral, Farnesol, Zingibrene, Santonin, a- Cadinene, and Abietic acid, Biogenetic pathways and biosynthesis

UNIT – II (from 05.02.18 to 28.02.18)

Alkaloids: Classification, occurrence, general methods of isolation and structure elucidation. Structure, Stereochemistry, synthesis and biosynthesis of following: Papaverine, Nicotine, Quinine, morphine, lysergic acid and Reserpine

UNIT – III (from 02.04.18 to 27.04.18)

Steroids and Harmons: Occurrence, General method of isolation, Diel's Hydrocarbon, Structure elucidation and synthesis of Cholesterol, Bile acids, Testosterone, Progesterone, Esterone and synthetic non-steroidal estrogens, oestrogens. Structure elucidation and synthesis of Adrenaline and Thyroxine.

UNIT – IV (from 08.01.18 to 02.02.18)

Carbohydrates: Classification of carbohydrates (Reducing and non-reducing sugars), Epimerization, Anomers, Mutarotaion , Conventions for indicating ring size of monosaccharides Structure determination of Maltose and Lactose.
Prostaglandins: Classification, Physiological effects and synthesis of PGE_2 and PGF2 a.

M. Sc. Chemistry IV-Semester

Organic Chemistry Special – V (Natural Products-2)

Paper No. CH-616 B **Credits: 04**

04 Hrs /week **External Marks: 100**

Total: 60 Hrs **Sessional Marks: 50**

Duration of Exam: 03 Hrs

OBJECTIVES:

1. **To review the basic concepts of terpenoids,alkaloids,steroids, hormones and carbohydrates.**
2. **To develop an understanding of biogenic pathways and biosynthesis of natural products.**
3. **To clarify the concept of classification, occurance and nomenclature of alkaloids, terpenes, steroids, hormones and carbohydrates.**
4. **To understand the phenomenon in structure elucidation of natural products.**
5. **To make aware about physiological effects of prostaglandins and natural products.**

OUTCOME:

1. **Able to understand about the biogenic pathway and synthesis of citral, farnesol, quinine, morphine, cholesterol and various other natural products.**
2. **Prepared to adopt a structural elucidation method for the synthesis of natural products.**
3. **Increased interest in chemistry of natural products.**

Books :

1. Stryer, L. Biochemistry 4th Ed., W. H. Freeman & Co. (1995).
2. Sykes, P. A Guidebook to Mechanism in Organic Chemistry 6th Ed., Prentice-Hall (1996).
3. Zubay, S. Biochemistry Addison-Wesley (1983).
4. Finar, I. L. & Finar, A. L. Organic Chemistry Vol. 2, Addison-Wesley (1998).
5. Finar, I. L. Organic Chemistry Vol. 1, Longman (1998).
6. Gringauz, A. Introduction to Medicinal Chemistry: How Drugs Act and Why? John Wiley & Sons (1997).
7. Patrick, G. L. Introduction to Medicinal Chemistry Oxford University Press (2001).
8. Natural Products, their chemistry and biological significance. J. Mann, R. S. Davidson,
9. Natural Product Synthesis II: Targets, Methods, Concepts. Topics in Current Chemistry, 24th Ed. Edited by Johann Mulzer (Universität Wien). Springer: Berlin, Heidelberg, New York.2005.
10. Principles of Biochemistry, A.L. Lehninger, Worth Publishers.

M. Sc. Chemistry IV-Semester

Organic Chemistry Special – Vl (Reactions & Reagents)

Paper No. CH-618 B **Credits: 04**

04 Hrs /week **External Marks: 100**

Total: 60 Hrs **Sessional Marks: 50**

Duration of Exam: 03 Hrs

Note: The question paper will comprise of eight questions, two from each unit. The candidates will be required to attempt five questions selecting at least one from each unit. All questions will carry equal marks.

LECTUREWISE PROGRAMME:

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UNIT - I (8.03.2018-20.02.2018)

Preparation, properties and applications of following reagents in organic synthesis with mechanistic details.

Organometallic Reagents:

n-Butyllithium, Grignard reagent, Organo chromium(III) compounds, Dialkyl copper lithium, Pentacarbonyl iron, Tetracarbonyl nickel, octacarbonyl dicobalt, Alkene Palladium (II)complexes, Wilkinsons catalyst, Tri-n-butyl tin hydride, Trimethyl silyl iodide, Diborane.

UNIT - II (20.02.2018-30.02.2018)

General Reagents:DCC, 1,3-dithianes, Polyphosphoric acid, diazomethane, Boron Trifluoride, Trifluoro acetic acid, cuprous chloride, N-bromosuccinamide, Phase Transfer catalysts.

M. Sc. Chemistry IV-Semester

Organic Chemistry Special – Vl(Reactions & reagents)

Paper No. CH-618 B **Credits: 04**

04 Hrs /week **External Marks: 100**

Total: 60 Hrs **Sessional Marks: 50**

Duration of Exam: 03 Hrs

OBJECTIVES:

7. **To review the basic concepts of organometallic reagent, grignard reagent, willkenson's catalyst, DCC, diborane etc**
8. **To develop an understanding of synthesis of reagents and their various properties.**
9. **To clarify the uses of reagents in many reactions.**

OUTCOME:

1. **Able to understand the properties and various appplication of reagents**
2. **Prepared to adopt a mechanism of synthesis of reagents.**
3. **Increased interest in reagents.**

Books :

1. Advanced Organic Chemistry, Reactions Mechanisms and Structure, J. March, John Wiley.
2. Modern Synthetic Reactions, H.O. House, W.A. Benjamin.
3. Some Modern Methods of Organic Synthesis, W. Carruthers, Foundation Books.
4. Principles of Organic Synthesis, R.O.C. Norman and J.M. Coxon, Blackie Academic & Professional.
5. Reagents in Organic Synthesis, Fieser and Fieser, Wiley.
6. Reactions, Rearrangements & Reagents by Sanyal from Bharti Bhawan.
7. Reaction & Rearrangements by O P Agrawal, Goel Publication
8. Organic reaction mechanism, V K Ahuluwalia
9. Name Reactions and Reagents in Organic Synthesis by Bradford P. Mundy, Michael G. Ellerd and Frank G. Favaloro Jr. from Wiley

M.Sc. Chemistry IV-Semester CH-626B

Physical Chemistry Special – IV (Statistical Thermodynamics)

L	T	P	Credits	Sessional Marks:50
4	-	-	04	Theory Marks: 100
				Duration of Exams: 3 Hours

OBJECTIVES:

9. To review the basic concepts of thermodynamics.
10. To develop an understanding of correlation of classical thermodynamic with quantum mechanics.
11. To clarify the concept of distribution.
12. To understand the phenomenon of non-equilibrium thermodynamics

OUTCOME:

- Able to understand how Statistical Thermodynamic helps to link classical thermodynamic and quantum mechanics.
- Able to get information that all natural process are irreversible in nature
- Increased interest in theoretical chemistry like quantum chemistry.

Books Suggested:

1. Physical Chemistry, P.W. Atkins, Oxford University Press.
2. Physical Chemistry, G.W. Castellan, Narosa. Publishers, New Delhi
3. Thermodynamics for Chemists, S. Glasstone, Affiliated East-West Press.
4. Chemical Thermodynamics, I.M. Klotz and R.M. Rosenberg, Benzamin.
5. An Introduction to Chemical Thermodynamics, R.P. Rastogi and R.R. Misra, Vikas Pub
6. Non-Equilibrium Thermodynamics-principles and applications, C.Kalidas and M.V.Sangaranarayanan, McMillan.
7. Introductory Statistical Mechanics by R. Bowley & M. Sanchez, 2nd Ed. Oxford Science publication.

LECTUREWISE PROGRAMME: (From 08.01.18 to 27.04.18)

M.Sc. Chemistry IV-Semester CH-626B

Physical Chemistry Special – IV (Statistical Thermodynamics)

Paper No. CH-626 B Credits: 04

04 Hrs /week External Marks: 100

Total: 60 Hrs Sessional Marks: 50

Duration of Exam: 03 Hrs

Note: The question paper will comprise of eight questions, two from each unit. The candidates will be required to attempt five questions selecting at least one from each unit. All questions will carry equal marks.

LECTUREWISE PROGRAMME : (from 08.01.18 to 27.04.18)

UNIT – I (from 08.01.18 to 02.02.18)

Statistical Thermodynamics I: Concept of distribution, thermodynamic probability and most probable distribution; canonical, grand canonical and micro canonical ensembles. Maxwell - Boltzmann statistics, Statistical thermodynamic formulation of Maxwell - Boltzmann distribution law, Maxwell - Boltzmann law of distribution of energy and evaluation of average velocity, root mean square velocity; law of equipartition of energy; Partition function and its factorization, relationship of atomic and molar partition function to thermodynamic properties(i) internal energy (ii) entropy (iii) Gibb's free energy (iv) heat contant (v) work function (vi) pressure (vii) heat capacity at constant volume. Derivation of equation of state for a mono atomic ideal gas.

UNIT –II (from 05.02.18 to 23.02.18)

Statistical Thermodynamics II: Translational partition function, calculation of absolute entropy of an ideal monoatomic gas, Seckure -Tetrode equation, Vibrational , Rotational, & electronic partition function of diatomic molecules, Derivation of expressions for transitional ,vibrational, rotational, electronic energy; expressions for entropy, Gibbs free energy, work function due to transitional, vibrational and rotational motion of a molecule. Effect of change of zero point energy on partition function and also on thermodynamic properties like internal energy, Gibbs free energy, enthalpy, work

function & entropy. Chemical equilibrium and equilibrium constant in terms of partition functions, Free energy function.

UNIT – III (from 26.02.18 to 30.03.18)

Statistical Thermodynamics III: Free energy functions and the partition functions, calculation of equilibrium constant using partition function, Bose - Einstein statistics, statistics of photon gas, gas degeneration, Fermi-Dirac statistics, extreme gas degeneration, energy of Bosons & Fermi particles, specific heat of electron gas, , Thermionic emission, comparison of Maxwell-Boltsmann, Bose-Einstein and Fermi-Dirac statistics.

UNIT – IV (from 02.04.18 to 27.04.18)

Non-Equilibrium Thermodynamics: General theory of non-equilibrium processes, entropy production and entropy flow; thermodynamic criteria for non-equilibrium states, entropy production in heat flow, mass flow, electric current, chemical reactions, Saxen's relation, Onsager's reciprocity relation, , Electro kinetic phenomenon.

Theory of fluctuation, energy fluctuations in the canonical ensemble, distribution function and fluctuations, fluctuations of density and energy.

M.Sc. Chemistry IV-Semester CH-628B

Physical Chemistry Special – V (Electrochemistry and Quantum Chemistry)

L	T	P	Credits	Sessional Marks: 50
4	-	-	04	Theory Marks: 100
				Duration of Exams: 3 Hours

OBJECTIVES:

13. To review the basic concepts of electrode reactions and electrode kinetics.
14. To develop an understanding of electrolysis and galvanic cells, battery and fuel cells.
15. To clarify the concept of corrosion, its types, theory behind corrosion reactions, corrosion cell and corrosion problems associated with daily life.
16. To understand the phenomenon in corrosion cells and techniques to control corrosion rate
17. To make aware about battery advantages and disadvantages as well.
18. To interpret fuel cells, their advantages and future scope.
19. To review the mass transfer phenomenon, voltaammetry, and polarographic techniques .
20. To study molecular orbital theory and Huckel molecular orbital theory and its applications.

OUTCOME:

- Able to understand electrochemical processes, corrosion and its control, significance of battery and fuel cells, and to inculcate the awareness and importance about these processes and devices, to cultivate and propagate the ideas(innovative) to improve their efficiency further.
- Prepared to adopt a research focus on electrochemical devices and improvement in the efficiency as future scope
- Able to get involved into different voltaammetric techniques like electrogravimetry, cyclic voltammetry, coulometry etc. with examples.
- Increased interest in theoretical chemistry like quantum chemistry.

Books :

1. Electrochemistry-by Glasstone

2. Modern Electrochemistry vol.1 and vol 2A, 2B J.O.M.Bockris and A.K.N.Reddy,

Plenum.

3. *Principles of Electrochemistry,* Koryta, J. Dvorak, J. and Kavan, L., John Wiley, NY

(1993)

4. *Electrochemical Methods: Fundamentals and Applications,* Bard, A. J. Faulkner, L. R.

2nd Ed., John Wiley: New York, 2002

5. Quantum Chemistry, I.N. Levine, Prentice Hall of India

6. Quantum Chemistry, A.K. Chandra, Tata McGraw Hill

7. Chemical Application of Group Theory, F.A. Cotton Interscience.

8. Methods in Molecular Orbital Theory, A.G. Turner, Prentice Hall of India

9. Group Theory and Symmetry in Chemistry, L.H. Hall, McGraw Hill.

10. Symmetry and Spectroscopy of Molecules, K.V. Reddy, New Age International

11. Principles of Polarography by J. Heyrovsky & J. Kuta, Academic Press

12. Polarographic Technique, L. Maites

13. Introduction to Polarography, Kamla Jutshi, New Age International

14. Polarography Technique, Kapoor & Aggarwal

15. Physical Chemistry by Maron & Prutton, The Macmillan company

16. Electroanalytical chemistry (Applications by J. Lingane), John Wiley & Sons.

LECTUREWISE PROGRAMME: **(From 08.01.18 to 27.04.18)**

M.Sc. Chemistry IV-Semester

Physical Chemistry Special – V (**Electrochemistry and Quantum Chemistry**)

Paper No. CH-628 B	**Credits: 04**
04 Hrs /week	**External Marks: 100**
Total: 60 Hrs	**Sessional Marks: 50**
	Duration of Exam: 03 Hrs

Note: The question paper will comprise of eight questions, two from each unit. The candidates will be required to attempt five questions selecting at least one from each unit. All questions will carry equal marks.

LECTUREWISE PROGRAMME : (from 08.01.18 to 27.04.18)

UNIT – I (from 05.02.18 to 28.02.18)

Electrochemistry of Corrosion: Electrode reactions, electrode potentials, electrochemical cell formation, Nernst equation, exchange current density, polarization of electrode (resistance, concentration and activation), mixed potential theory, polarization diagrams, pourbaix diagrams, corrosion rate expression and weight loss method for corrosion rate, galvanic series. Electrochemical techniques to study corrosion –Measurement Cell, Galvanostatic and potentiostatic techniques, Stern –Geary equation, Tafel slopes, measurement of corrosion potential and corrosion current density, Tafel extrapolation and Linear polarization resistance methods, recording and interpretation of anodic and cathodic polarization curves.

UNIT – II (from 08.01.18 to 02-02.18)

Applications of Electrochemistry: The maximum intrinsic efficiency, actual efficiency

Electricity storage: Some important quantities in electricity storage (electricity storage density, energy density, power), desirable conditions for an ideal strorer,charging &discharging of a battery, storage of electricity using the lead-acid battery, dry cell, nickel-cadmium battery, silver-zinc cell and Sodium- Sulfur cell. Fuel cells: Current - potential relation in an electrochemical energy converter, factors influencing the electrochemical energy conversion, the power output of an electrochemical energy converter. Electrochemical electricity generators (fuel cells), brief idea about alkaline fuel cell, high temperature fuel cell and proton exchange membrane fuel cell (H_2-O_2 fuel cell).

UNIT – III (from 01.03.18 to 30.03.18)

Polarography: General principles of polarography, the limiting current and its types, diffusion current, linear diffusion and spherical diffusion, derivation of Ilkovic equation and its consequences, Koutecky's equation for diffusion current, half-wave potential, equations for reversible cathodic, anodic, and cathodic-anodic waves, analysis of reversible polarographic wave, factors(ionic strength and pH) affecting the half-wave potential, reversible processes controlled by diffusion of complex ions, Amperometric titrations, Approximate and rigorous Treatment of Irreversible electrode processes, electrogravimetry and its application, coulometry at constant potential and its application ,cyclic voltammetry(Technique and applications).

UNIT – IV(from 02.04.18 to 27.04.18)

Molecular Orbital Theory: Huckel molecular orbital (HMO) theory of linear and cyclic

conjugated systems, Applications of HMO theory to (i) set up and solve Huckel determent

equation; (ii) calculate resonance energy; (iii) wave functions for molecular orbitals and

molecular diagrams for the following :(a) Ethylene molecule (b) Allyl system (Allyl radical and the related cation and anion) (c)

Butadiene; (d) Cyclobutadiene (e) Cyclopropenyl system (cyclopropenyl radical and the related cation and anion.

Home Assignments: 4 –5 assignments are given during the semester.

Evaluation Procedure

1.	Assignment / Performance in the Class	10 Marks

2.	Minor Tests (Two tests having equal weightage) Minor Test I : 14-16 Feb, 2018 Minor Test II : 4 -6 April, 2018	40 Marks(20 marks each minor)
3.	University Examination	100 Marks

Award of Grades Based on Absolute Marks: The University is following the system of grading based on absolute marks (after applying moderation if any). Following grading will be done based on the % of marks obtained in all the components of evaluation part of the subject. A+ (90% - 100 %), A (80% - 89%), B+ (70% - 79%) , B(62% - 69%), C+ (55% - 61%), C (46% - 54%), D (40% - 45), F (Less than 40 %)

For F grade, a candidate shallbe required to appear in the major test of concerned course only in the subsequent examination(s) to obtain the requisite marks/grade.

Attendance Record – Candidate should attend at least75% attendance of the total classes held of the subject

Counselling hour: 12pm-1pm on Tuesday

M.Sc. Chemistry IV-Semester CH-630B

Physical Chemistry Special – VI (Kinetics, Surface and Polymer Chemistry)

Paper No. CH-630 B **Credits: 04**
04 Hrs /week **External Marks: 100**
Total: 60 Hrs **Sessional Marks: 50**
Duration of Exam: 03 Hrs

OBJECTIVES:

The objectives of this course are to make the students to:

21. Familiar with the concepts of surface chemistry.
22. Analyze principles of kinetics and mechanisms of surface reactions.
23. Study Surface tension, capillary action and pressure difference across curved surface (Laplace equation)

24. Study relationship between surface tension and adsorption (Gibb's adsorption equation) and its applications.
25. Derive BET equation and to study its application for the determination of surface area.
26. Introduce surface active agents, their classification and concept of micelles and to study critical micelle concentration (cmc) and its determination using different methods.
27. Study different theories of unimolecular reactions like Lindemann's theory, Hinshelwood's treatment, R.R.K. and R.R.K.M., theory of absolute reaction rates.
28. Study potential energy surfaces, activation energies and London— Eyring - Polanyi method for the calculation of energy of activation and Kinectics of fast reactions.
29. Introduce the some basic concepts of Polymers, their classifications and polymerization.
30. Study Kinetics and stereochemistry of polymerization.
31. Determine the molecular mass of polymer by different methods.
32. Evaluate Statistical method of biopolymers like Chain configuration of polymer chains
33. Study statistical distribution of end to end dimensions (freely jointed chains in 1D & 3D), influence of bond angle restriction and radius of gyration.
34. Study thermodynamics of biopolymer solution (entropy of mixing & liquid state model along with limitation), free volume theory, heat & free energy of mixing.

Outcomes:

1. Able to know the relation between surface tension and pressure difference across curved surfaces and its applications to drop, bubble etc.
2. Enable us about the formation of monolayer and multilayer (BET equation) on the sufaces.
3. Able to know, how to decrease the surface tension and critical micelle concentration (cmc) of surfactant.
4. Able to know Dynamics of chemical reaction, potential energy surfaces and activation energies.
5. Enable us about the kinetics of fast reactions using Flow methods, Stopped flow, Relaxation method, Flash photolysis and shock tube method.
6. Able to know about the vast applications of polymers in research and developments and in industries as well by knowing their molecular size, degree of polymerization, stereochemistry and their kinetics.
7. Able to know about the molecular weight of polymers by different methods.
8. Able to know about the statistics of biopolymers and thermodynamics of biopolymer solutions.

Unit I (From 08-01-2018 to 09-02-2018)

Adsorption: Surface tension, capillary action, pressure difference across curved surface (Leplace equation), Gibb's adsorption equation and its applications, determination of BET equation and its application for the determination of surface area; surface active agents and their classification, concept of micelles, critical micelle concentration (cmc), determination of cmc by conductivity and surface tension methods; factors affecting cmc, counter - ion binding to micelles, thermodynamics of micellization.

UNIT – II (From 12-02-2018 to 09-03-2018)

Chemical Dynamics: Theories of unimolecular reactions: Lindemann's theory, Hinshelwoods treatment, R.R.K. and R.R.K.M. theories,The theory of absolute reaction rates, potential energy surfaces, activation energies, London— Eyring - Polanyi method for the calculation of energy of activation. Kinectics of fast reactions, Flow methods, Stopped flow, Relaxation method, Flash photolysis and shock tube method.

UNIT – III (From 12-03-2018 to 06-04-2018)

Polymers: Classification of polymers and polymerisation, condensation and addition polymers, kinetics of condensation (step-wise) polymerisation, size distribution in linear condensation polymers, molecular size control, degree of polymerization; mechanism of vinyl radical polymerisation, molecular weight and its determination, effect of temperature and pressure on chain polymerisation, stereochemistry of polymer chain & stereo regular polymerisation, Ionic polymerisation (similarities and contrast), kinetics of cationic, anionic polymerisation, kinetics of copolymerisation, criteria for polymer solubility; Mass number and Mass average molecular weight, determination of molecular weight of polymers by osmometry, viscometry, light scattering and sedimentation method.

UNIT – IV (From 09-04-2018 to 27-04-2018)

Polymers: Statistical method of biopolymers: Chain configuration of polymer chains, statistical distribution of end to end dimensions (freely jointed chains in 1D & 3D); influence of bond angle restriction, radius of gyration, thermodynamics of biopolymer solution (entropy of mixing & liquid state model along with limitation), free volume theory, heat & free energy of mixing.

Books Suggested

1. Chemical Kinetics Methods, C. Kalidas, New Age International.

2. Chemical Kinetics, K.J. Laidler, McGraw Hill.

3. Theory of Absolute Reaction Rates, K.J. Laidler, McGraw Hill.

4. Catalysis at Surfaces, Campbell, I. M. Chapman and Hall, New York/London (1988).

5. Concepts of Modern Catalysis and Kinetics, Chorkendorff, Ib. & Niemantsverdriet, J. W., Wiley-VCH (2003)

6. Zeolites, Molecular Sieves- Structure, Chemistry and Use.Breck, D. W. , John Wiley & Sons.

7. Textbook of Polymer Science, F.W. Billmeyer (Jr), Wiley.

8. Principles of Polymer Chemistry, P J Flory, Cornell University Press.

9. Physical Chemistry of Polymers, A Tager, Mir Publishers, Moscow.

10. Physical Chemistry of Macromolecules, Tanford.

11. Polymers: Chemistry & Physics of Modern materials, J.M.G. Cowie, Blackie Academic and Professional.

12. Plastic Materials, J.A. Brydson, Butter worth Heinemann.

13. Principles of Polymerisation, G.Odian, John Willey.

14. Fundamentals of Polymer Processing, S. Middleman.

15. Polymer Science, V.R. Gowariker, N.V. Viswanathan and J. Sreedhar, Wiley-Eastern.

16. Functional Monomers and Polymers, K. Takemoto, Y. Inaki and R.M. Otta.

17. Symmetry and Spectroscopy of Molecules, K.V. Reddy, New Age International.

18. A.W.Adamson- "The physical chemistry of surfaces"- 4th edition- Wiley 1982.

19. S.J. Gregg and K.S.W. Sing, Adsorption, Surface Area and Porosity, Academic Press, London and New York.

20. Advanced Physical Chemistry, Gurtu & Gurtu, Pragati Prakashan.

Home Assignments: 3-4 assignments are given during the semester.

Evaluation Procedure

1.	Assignment / Performance in the Class	**10 Marks**
2.	Minor Tests (Two Minors having equal Marks) Minor Test I : 14-16 Feb, 2018 Minor Test II : 4 -6 April, 2018	**40 Marks (20 marks each minor)**
3.	University Examination	**100 Marks**

Award of Grades Based on Absolute Marks: The University is following the system of grading based on absolute marks (after applying moderation if any). Following grading will be done based on the % of marks obtained in all the components of evaluation part of the subject.

A+ (90% - 100 %), A (80% - 89%), B+ (70% - 79%) , B(62% - 69%), C+ (55% - 61%), C (46% - 54%), D (40% - 45), F (Less than 40 %)

For F grade, a candidate shall be required to appear in the major test of concerned course only in the subsequent examination(s) to obtain the requisite marks/grade.

Attendance Record – Candidate should attend at least75% attendance of the total classes held of the subject.

Msc. Chemistry - IV - semester CH-652B

Inorganic Chemistry Elective-II **(** Materials and Nano-Technology)

L	T	P	Credits	Sessional Marks:	50
4	-	-	04	Theory Marks:	100
				Duration of Exams:	3 Hours

OBJECTIVES:

- To review the basic concept of NANO SCIENCE & TECHNOLOGY and to develop an intensive understanding of nano technology.
- To quantify the Size dependence of melting point, vapour pressure, chemical reactivity etc
- To discuss the properties, structure and applications of different types of materials.
- To discuss various synthesis techniques used to produce nano particles, clusters and thin film or quantum dots.
- To analyze various physical properties and applications of ceramic, non-ceramic, magnetic and superconducting materials.
- To identify the various applications, used in day to day life by using study of smart materials and physical properties of nano materials.
- To understand the various methods used for the production of ultra pure materials

OUTCOME:

1. Able to understand the various applications of Semiconductor Nanoparticles, Nanowires, Nano-ribbon and Nano-spring.
2. Able to understand about basic of magnetism in various magnetic materials such as ferromagnetic, diamagnetic ,antiferromagnetic materials.
3. Students will able to know about different types of smart materials including superconducning, magnetic, ceramic and dielectric materials
4. Able to synthesis nano particles of various magnetic or non magnetic materials using simple synthesis techniques like Electro-deposition, ball milling, solid state reaction and sol Gel Tech.
5. Able to induce the impulse in students for continuous learning and improvement of technical advancement & skills.

Books :

1. W D Kingery, H K Dowen and R Duhlman- "Introduction to Ceramics" John Wiley.

2. F H Nortion- "Elements of Ceramics" Addison-Wesley Pub. Co.

3. C J Brinker and G W Sherer- "Sol-Gel Science, The Physics and Chemistry of Sol-Gel processing" Academic Press, New York.

4. A G Guy- "Essentials of material Science" - McGraw Hill.

5. M J Starfield and Shrager- "Introductory Materials Science" - McGraw Hill.

6. V Raghavan- "A First Course in Material Science" - Prentice Hall Pvt Ltd, New Delhi.

7. J F Shackelford- "An Introduction to Materials Science for Engineers" McMillan Pub. Co. New York.

8. W F Smith- "Foundation of Materials Science & Engineering" - McGraw Hill Book Co. 2000

9. M W Barsoum- "Fundamentals of Ceramics" - McGraw Hill Book Co. 1997.

10. S K Hajra Chaudhary- "Material Science and Engineering" - Indian Book Dist Co. Culcutta.

11. R S Sharpe - "Research Techniques in Non Destructive Testing, Vol IF" - Academic Press, New York, 1973.

12. J Kraut Kramer and H Kraut Kramer- "Ultrasonic Testing of Materials" - George Allen & Union Ltd, London, 1969.

13. K.N. Tu and R. Rosenberg,"Analytical Techniques for Thin Films in Treatise on Material Science & technology, Vol 27" -Acad. Press Inc., N.Y,1991.

14. S V Subramanyan and E S Rajagopal- "High Temperature Super Conductors" - Wiley Eastern Ltd. 1988.

15. M Tinkham- "Introduction to Super Conductivity" - McGraw Hill, Kogakusha Ltd, 1975.

16. A V Narlikar and S N Edbote- "Super Conductivity and super conducting Materials" - South Asian Pub., New Delhi 1983.

17. Dekker- "Electronic Engineering Materials" - A J Prentice Hall of India Pvt.Ltd. 1985.

18. C M Srivastava and C Srinivasan- "Science of Engineering Materials" - Wiley Eastern Ltd, 1987. 19. Azaroff and Brophy- "Electronic Process in Materials" - McGraw Hill, 1985.

LECTUREWISE PROGRAMME: (FROM 08-01-2018)

M.Sc. Chemistry IV-Semester

Inorganic Chemistry Elective – II (Materials and Nano-Technology)

Paper No. CH-652 B Credits: 04 04 Hrs /week External
Marks: 100 Total: 60 Hrs Sessional Marks: 50
Duration of Exam: 03 Hrs

Note: The question paper will comprise of eight questions, two from each unit. The candidates will be required to attempt five questions selecting at least one from each unit. All questions will carry equal marks.

UNIT-I (from 08.01-2018 to 28.01.2018)

Ceramic materials:

Definition of ceramics, Traditional and new ceramics, structure of ceramics, atomic interactions and types of bonds, phase equilibrium in ceramic systems, one component and multi component systems, use of phase diagrams in predicting material behavior, electrical, magnetic and optical properties of ceramic materials.

UNIT – II (from 29.01-2018 to 23.02.2018)

Crystalline and Non crystalline ceramic materials

Chemical reactions at high temperatures and processing of ceramics, high temperature materials, crystalline ceramic materials, oxide, carbide, nitride, graphite and clay materials and their structures, polymorphism, Non-crystalline ceramic materials, structure and structural requirements for stability, mode of formation, silicate and non-silicate glasses, hydrogen bonded structures.

UNIT – III (26.02.2018 to 27.03.2018)

Nano technology

Nano materials- definition, nano structures, self assembly, nano particles, methods of synthesis, sol- gel process, colloids, hydrolysis of salts and alkoxides, precipitation condensation reactions, electro kinetic potential and peptization reactions, gelation network, xerogels, aero gels, drying of gels, chemical modification of nano surfaces, applications of sol, gel process, sol gel coating, porous solids, catalysts, dispersions and powders.

UNIT - IV (from 28.03-2018 to 27.04.2018)

Materials for special purposes

Production of ultra pure materials- zone refining, vacuum distillation and electro refining. 91

Ferro-electric and piezo electric materials

General properties, classification of ferro electric materials, theory of ferro electricity, ferro electric domains, applications. Piezo electric materials and applications. Metallic glasses, preparation, properties and applications.

Magnetic materials Ferri and ferro magnetism, metallic magnets, soft, hard and super conducting magnets, ceramic magnets, low conducting and super conducting magnets.

Super conducting materials Metallic and ceramic super conducting materials- theories of super conductivity- Meissner effect- high temperature super conductors, their structure and applications.

LECTUREWISE PROGRAMME

(from 08.01.18 to 27.04.18)

Home Assignments: 3 –5 assignments are given during the semester.

Evaluation Procedure

1.	Surprise Quiz/ Tutorial Test/presentation	5 Marks
2.	Assignment / Project / Performance in the Class	5 Marks
3.	Minor Tests (Two tests having equal weightage) Minor Test I : 14-16 Feb, 2018 Minor Test II : 4 -6 April, 2018	40 Marks
4.	Major test (University Examination)	100 Marks

Award of Grades Based on Absolute Marks: The University is following the system of grading based on absolute marks (after applying moderation if any). Following grading will be done based on the % of marks obtained in all the components of evaluation part of the subject.

A+ (90% - 100 %), A (80% - 89%), B+ (70% - 79%) , B(62% - 69%), C+ (55% - 61%),C (46% - 54%), D (40% - 45), F (Less than 40 %)

For F grade, a candidate shallbe required to appear in the major test of concerned course only in the subsequent examination(s) to obtain the requisite marks/grade.

Attendance Record – Candidate should attend at least75% attendance of the total classes held of the subject

Chamber consultation hour: Any vacant period.

Note:

4. In the semester examination, the examiner will set 08 questions in all selecting two from each unit (1 & 2 from unit I, 3 & 4 from unit II, 5 &6 from unit III and 7 & 8 from unit IV). The students will be required to attempt only 5 questions selecting at least one question from each unit. All questions will carry equal marks.
5. The use of scientific calculator will be allowed in the examination. However, programmable calculator and cellular phone will not be allowed.
6. The use of properties (water, air, steam etc) tables, heat transfer tables, charts is permitted

Even Semester -2017-18

M.Sc. Chemistry IV-Semester

Organic Elective – II (Medicinal Chemistry)

Paper No. CH-654 B	**Credits: 04**
04 Hrs /week	**External Marks: 100**
Total: 60 Hrs	**Sessional Marks: 50**
	Duration of Exam: 03 Hrs

Note: The question paper will comprise of eight questions, two from each unit. The candidates will be required to attempt five questions selecting at least one from each unit. All questions will carry equal marks.

OBJECTIVES:

1. To review the fundamental concepts of organic chemistry and their applications in medicinal chemistry.
2. To get familiarized with medicinal chemistry terminology.
3. To study various classes of drugs with their classification and synthesis.
4. To study the actual series of discreet steps involved for prodrug and its utility in medicinal chemistry.
5. To get familiar with new and emerging area "Polymer Therapeutics" where polymer like PEG and PG are used in drug or drug delivery systems design.

OUTCOME:

1. Able to have a firm foundation and fundamental concept of medicinal chemistry.
2. Able to identify several types of drugs and get familiar with the terminology of medicinal chemistry.
3. Able to predict the role of pro drug in pharmaceutics.
4. Able to propose a suitable synthesis for studied classes of drugs.
5. Able to have a firm knowledge of drug delivery systems and polymers use in Therapeutics

Books suggested

1. The Organic Chemistry of Drug Design and Drug action by Richard B. Silverman from Academic press, inc.
2. Principles of Biochemistry, A.L. Lehninger, Worth Publishers.
3. Principles of Organic Synthesis, R. Norman and J. M. Coxon,Blakie, Academic and Professional.
4. Fundamental of Photochemistry, K.K. Rohtagi Mukherjee, Wiley Eastern.
5. Medicinal chemistry, 4^{th} Edition, A. Burger, Wiley Interscience.
6. Medicinal chemistry, 5^{th} Edition, A.Kar, New age International.
7. Text Book of organic medicinal and Pharmaceutical chemistry, 8^{th} Edition, R.F. Boerge, Ed. Wilson and Gisvelds, J.B. Lippincott Co.
8. Natural Products, their chemistry and biological significance. J. Mann, R. S. Davidson, J.B. Hobbs, D.V. Banthrope and J.B. Harborne, Longmann, Essex, 1994.Medicinal Biochemistry, N. V. Bhagavan, Academic Press, Elsevier.

9. Natural Product Synthesis II: Targets, Methods, Concepts. Topics in Current Chemistry, 24thEd. Edited by Johann Mulzer (Universität Wien). Springer: Berlin, Heidelberg, New York.2005.
10. Natural Products from Plants 2nd ed., Cseke: National Scientific Book Agency, Delhi.
11. Gringauz, A. Introduction to Medicinal Chemistry: How Drugs Act and Why? John Wiley & Sons (1997).
12. Patrick, G. L. Introduction to Medicinal Chemistry Oxford University Press (2001).
13. Biomedical Polymers and Polymer Therapeutics By Emo Chiellini from Springer.
14. Polymers as Drugs, Conjugates and Gene Delivery Systems, by Ronit Satchi-Fainaro, Ruth Duncan from Springer.
15. *Cancer Drug Delivery,* Wiley-VCH Books **2011** by Eds. F. Kratz, H. Steinhagen.

LECTUREWISE PROGRAMME: (from 08.01.18 to 27.04.18)

08.01.2018

Introduction about the course and its importance

09.01.18 to 02.02.18

UNIT - II

Classification and important examples with synthesis

Antimalarials

Antipyretics & analgesics

Sulpha drugs

Anthelmintic

Anti-HIV,

Anti-cancer drugs

Anti-hypertensive agents

Structure elucidation of Pencillin, chloroamphenical and Tetracyclins.

05.02.18 to 28.02.18

UNIT-I

Drug and Prodrug Concept, Pharmacokinetics & Pharmacodynamics with ADME & Terminology
Concept of lead compounds with several factors governing drug design,
Drug design (Rational approach and The method of variation),
Structure-activity relationship (SAR),
Factors affecting bioactivity: electronic effects, steric Factors, Hansch Equation , The Craig Plot, isosterism, bio-isosterism.
Concepts of drug receptor, drug- receptor interactions and adverse drug effects.

01.03.18 to 30.03.18

UNIT - III

Enzyme activation of drugs
Utility of prodrugs (Solubility, Absorption and distribution, site specificity, Instability, Prolonged release, toxicity, poor acceptability and formulation)
Types of prodrugs, Mechanism of prodrug activation: carrier linked prodrugs- using alcohol, amine, carbonyl, and carboxylic acid functional groups
Macromolecular and mutual prodrug
Bio-precursor Prodrugs(oxidative and reductive)

02.04.18 to 27.04.18

UNIT - IV

Polymer Therapeutics: Definition, Concept and Applications.

Drug delivery systems (Definition)

EPR effect.

Drug-polymer conjugates, various methods for the synthesis of polymer-drug conjugates (conjugation chemistry, linkers, and reactive groups).

Polyethylene glycol and Polyglycerols (hyperbranced & Dendritic) in biomedical applications.

Home Assignments: 4 –5 assignments are given during the semester.

Evaluation Procedure

1.	Home assignment & Quiz	10 Marks
2.	Minor Tests (Two tests having equal weightage) Minor Test I : 14-16 Feb, 2018 Minor Test II : 4 -6 April, 2018	 20 Marks 20 Marks
3	University Examination	100 Marks

Award of Grades Based on Absolute Marks: The University is following the system of grading based on absolute marks (after applying moderation if any). Following grading will be done based on the % of marks obtained in all the components of evaluation part of the subject.

A+ (90% - 100 %), A (80% - 89%), B+ (70% - 79%), B(62% - 69%), C+ (55% - 61%), C (46% - 54%), D (40% - 45), F (Less than 40 %)

For F grade, a candidate shall be required to appear in the major test of concerned course only in the subsequent examination(s) to obtain the requisite marks/grade.

Attendance Record: Candidate should attend at least75% attendance of the total classes held of the subject

Office consultation time: Any vacant period with appointment.

Note:

1. In the semester examination, the examiner will set 08 questions in all selecting two from each unit (1 & 2 from unit I, 3 & 4 from unit II, 5 &6 from unit III and 7 & 8 from unit IV). The students will be required to attempt only 5 questions selecting at least one question from each unit. All questions will carry equal marks.

M.Sc. Chemistry IV-Semester CH-656B

Elective-II (Photochemistry and Industrial Catalysis)

L	T	P	Credits		
4	-	-	04	Sessional Marks:	50
				Theory Marks:	100
				Duration of Exams:	3 Hours

OBJECTIVES:

1. To review the basic concepts of photochemistry.
2. To develop an understanding of photophysical process in kinetics.
3. To clarify the concept of solar energy and solar cell.
4. To understand the application of catalyst in industrial phenomenon.

OUTCOME:

- Able to understand how transition occur in various energy levels.
- Able to get information about solar cell and its working principle.
- Increased interest in industrial catalyst..

Books Suggested:

1. J.G. Calvert and J.N. Pitts, Jr., Photochemistry, (1966) John Wiley & Sons, New York.
2. K. K. Rohtagi-Mukherjee, Fundamentals of Photochemistry, (1986) New Age International, New Delhi.
3. R. P. Wayne, Principles and Applications of Photochemistry, (1988) Oxford University Press, Oxford.
4. N. J. Turro, Modern Molecular Photochemistry, (1991) Univ. Science Books, Sansalito.
5. J. F. L. Lakowicz, Principles of Fluorescence Spectroscopy, 2nd Edition (1999), Plenum Publishers, New York.
6. ***Dupuy and Chapman-*** "Molecular Reaction and Photochemistry"- ***Prentice Hall***
7. A.W.Adamson- *"The physical chemistry of surfaces*"- 4th edition- Wiley 1982
8. S.J. Gregg and K.S.W. Sing, Adsorption, Surface Area and Porosity, Academic Press, London and New York.
9. Bockris and Reddy- "*Modern electrochemistry*"- Springer 2nd Edition volumes 1, 2A and 2B
10. H.H Willard, LL Merrit, J.A Dean *Instrumental methods of Analysis,.* Van Nostrand
11. J. M Betty,Ed Bruce, E Leach *Applied Industrial Catalysis,* Academic Press

12. Ed Pearce, W.R.Patterson *Catalysis and Chemical Processes*, Blackie and Sons

LECTUREWISE PROGRAMME: (From 08.01.18 to 27.04.18)

M.Sc. Chemistry IV-Semester CH-656B

Elective-II (Photochemistry and Industrial Catalysis)

Paper No. CH-656 B | Credits: 04

04 Hrs /week | Max. Marks: 100+50

Total: 120 Hrs | Duration of Exam: 03 Hrs

Note: The question paper will comprise of eight questions, two from each unit. The candidates will be required to attempt five questions selecting at least one from each unit. All questions will carry equal marks.

UNIT – I (from 08.01.18 to 02.02.18)

Molecular photochemistry: An overview: Transitions between states (Chemical, classical and quantum dynamics, vibronic states). Potential energy surfaces; transitions between potential energy surfaces, The Franck-Condon Principle and radiative transitions. A classical model of radiative transitions. The absorption and emission of light - state mixing, spin-orbit coupling and spin forbidden radiative transitions, absorption complexes, delayed fluorescence and phosphorescence.

Photophysical radiationless transitions: Wave mechanical interpretation of radiation less transitions between state factors that influence the rate of vibrational relaxation. Energy transfer: Theory of radiation less energy transfer, energy transfer by electron exchange: An overlap or collision mechanism. The role of energetics in energy transfer mechanism. Diffusion controlled quenching. The Perrin formulation. Triplet-triplet, triplet-singlet, singlet-triplet energy transfer.

UNIT – II (from 05.02.18 to 23.02.18)

Photophysical Processes in Electronically Excited Molecules : Radiationless transition-fluorescence emission. Triplet states and phosphorescence emission. Photophysical kinetics of unimolecular prosesses. Photophysical Kinetics of Bimolecular Processes : Bimolecular collisions in gases and vapours and the mechanism of fluorescence quenching. Kinetics of collision quenching – Stern-Volmer equation. Concentration dependence of quenching and excimer formation. Mechanism of quenching.

UNIT – III from 26.02.18 to 30.03.18)

Photo electrochemistry: Effect of radiation of light on matter- photo physical phenomena-photovoltaic effect- Solar cell- construction and working principle Storage of solar energy- Photo assisted electrolysis of water,Waste management by photoelectrochemical process.

UNIT – IV from 02.04.18 to 27.04.18)

Industrial catalysis:Theories of adsorption-BET theory, Statistical derivation and its application-Adsorption isotherms and isosters-their significance- Determination of heat of adsorption-Kinetics of heterogeneous catalysis- Absolute rate theory of catalysis- Energy profile diagram in heterogeneous catalysis.

Electronic factors in catalysis by metals and semiconductors- Cooperative electronic interaction in catalysis- Preparation of solid catalyst and supports- Preparation of supported catalyst- Silica, silica-alumina, zeolite, carbon catalysts-selectivity. Polymer support and heterogenisation-catalytic deactivation-poisoning and fouling.

Home Assignments: 4 –5 assignments are given during the semester.

Evaluation Procedure

1.	Assignment / Performance in the Class	10 Marks
2.	Minor Tests (Two tests having equal weightage) Minor Test I : 14-16 Feb, 2018 Minor Test II : 4 -6 April, 2018	40 Marks(20 marks each minor)
3.	University Examination	100 Marks

Award of Grades Based on Absolute Marks: The University is following the system of grading based on absolute marks (after applying moderation if any). Following grading will be done based on the % of marks obtained in all the components of evaluation part of the subject.

A+ (90% - 100 %), A (80% - 89%), B+ (70% - 79%) , B(62% - 69%), C+ (55% - 61%), C (46% - 54%), D (40% - 45), F (Less than 40 %)

For F grade, a candidate shallbe required to appear in the major test of concerned course only in the subsequent examination(s) to obtain the requisite marks/grade.

Attendance Record – Candidate should attend at least75% attendance of the total classes held of the subject

Counselling hour: 12pm-1pm on Tuesday