VELS

INSTITUTE OF SCIENCE, TECHNOLOGY & ADVANCED STUDIES (VISTAS)

(DEEMED TO BE UNIVERSITY Estd. u/s 3 OF THE UGC ACT, 1956)

NAAC ACCREDITED

PALLAVARAM - CHENNAI - INDIA

M.Sc

General Chemistry

Program Specific Outcome :

After completion of this programme the candidate will be

PSO1 : Well equipped to phase TRB exams, conducted by state and Central Government in teaching profession

PSO2 : Job opportunities wide sector of Chemical & Allied industries

PSO3 : Research opportunities in all branch of Chemistry

PSO4: To fair well CSIR NET exams

PSO5: Disciplined specific competitive exams conducted by service commission

Vels Institute of Science, Technology and Advanced Studies

Pallavaram, Chennai 600 117

School of Basic Sciences
Department of Chemistry

M.Sc General Chemistry

BOS Members Details

Sl.No.	Name & Address	Designation
1.	**Ms.N. Malathy,** Associate Professor, Department of Chemistry, Govt. Arts College for Men, Nandanam, Chennai 600 035.	External Expert
2.	**Dr. Malika** Associate Professor, Department of Chemistry, SDNB Vaishnav College, Chromepet, Chennai 600 044.	External Expert
3.	**Jayakumar .K** Malladi drugs and Pharmacutical (p) Ltd Thirumazeisai, Chennai .	Alumini Member
4.	**Dr . V. Mahalingam** Professor Department of Chemistry, School of Basic Chemistry Vels University, Pallavaram,Chennai - 600 117	Member
5.	**Dr. R. A. Kalaivani,** Director HOD, Department of Chemistry, School of Basic Sciences, Vels University, Pallavaram,Chennai - 600 117	Convernor
6.	**Dr. A. Perumal** Professor Department of Chemistry, School of Basic Chemistry Vels University, Pallavaram,Chennai - 600 117	Member

VELS

INSTITUTE OF SCIENCE, TECHNOLOGY
& ADVANCED STUDIES (VISTAS)

(DEEMED TO BE UNIVERSITY Estd. u/s 3 OF THE UGC ACT, 1956)

NAAC ACCREDITED

PALLAVARAM - CHENNAI - INDIA

M.Sc

General Chemistry

Curriculum and Syllabus

(Based on Choice based credit system)

2015 – 2016

Department of Chemistry

School of Basic Sciences

M.Sc. GENERAL CHEMISTRY CURRICULUM

Total number of Credits: 90

Category	Code	Course	Hour/Week			Credits
			Lecture	Tutorial	Practical	
SEMESTER-I						
CORE	15MGC001	Organic Chemistry-I	**5**	**0**	**0**	**4**
CORE	15MGC002	Inorganic Chemistry - I	**5**	**0**	**0**	**4**
CORE	15MGC003	Physical Chemistry-I	**4**	**0**	**0**	**4**
DSE		Discipline Specific Elective- I	**4**	**0**	**0**	**3**
DSE		Discipline Specific Elective- II	**4**	**0**	**0**	**3**
GE		Generic Elective-I	**1**	**0**	**1**	**2**
CORE	15MGC004	Practical-I Physical Chemistry	**0**	**0**	**6**	**3**
			23	**0**	**7**	**23**
SEMESTER – II						
CORE	15MGC005	Organic Chemistry – II	**5**	**0**	**0**	**4**
CORE	15MGC006	Inorganic Chemistry – II	**4**	**0**	**0**	**3**
CORE	15MGC007	Physical Chemistry - II	**4**	**0**	**0**	**3**
DSE		Discipline Specific Elective- III	**3**	**0**	**0**	**3**
GE		Generic Elective-II	**1**	**0**	**1**	**2**
GE		Generic Elective-III	**2**	**0**	**0**	**2**
CORE	15MGC008	Practical –II Organic Chemistry	**0**	**0**	**5**	**3**
CORE	15MGC009	Practical – III Analytical Chemistry	**0**	**0**	**5**	**3**
CORE	15MGC010	Internship	**0**	**0**	**0**	**2**
			19	**0**	**11**	**25**
SEMESTER – III						
CORE	15MGC011	Organic Chemistry –III	**5**	**0**	**0**	**4**
CORE	15MGC012	Inorganic Chemistry – III	**5**	**0**	**0**	**4**
CORE	15MGC013	Physical Chemistry-III	**5**	**0**	**0**	**4**
DSE		Discipline Specific Elective-IV	**4**	**0**	**0**	**3**
DSE		Discipline Specific Elective- V	**3**	**0**	**0**	**3**
GE		Generic Elective-IV	**2**	**0**	**0**	**2**
CORE	15MGC014	Practical IV- Inorganic Chemistry	**0**	**0**	**6**	**3**
			24	**0**	**6**	**23**
SEMESTER – IV						
CORE	15MGC015	Electro analytical and Separation Techniques	**4**	**0**	**0**	**4**
DSE		Discipline Specific Elective –VI	**4**	**0**	**0**	**3**
CORE	15MGC016	Project work/Review of Journals	**0**	**0**	**22**	**12**
			8	**0**	**22**	**19**
		Total	**74**	**0**	**46**	**90**

List of Discipline Specific Elective Courses

S.No.	Subject Code	Title of the Paper
1.	15MGC101	Macromolecular Chemistry
2.	15MGC102	Analytical Techniques
3.	15MGC103	Separation Techniques
4.	15MGC104	Natural products
5.	15MGC105	Pharmaceutical Chemistry
6.	15MGC106	Nuclear and photochemistry
7.	15MGC107	Chemical & Instrumental Methods of Drug Analysis
8.	15MGC108	Synthesis of active Pharmaceutical ingredients and their manufacture
9.	15MGC109	Organometallic Chemistry and Photochemistry
10.	15MGC110	Organic Spectroscopy
11.	15MGC111	Stereochemistry and Reaction Mechanism
12.	15MGC112	Novel materials and green industrial catalysis
13.	15MGC113	Electrochemistry and Group Theory
14.	15MGC114	Inorganic Chemistry
15.	15MGC115	Fundamentals of Biochemistry
16.	15MGC116	Organic name reactions and synthesis of reagents
17.	15MGC117	Pharmaceutical Formulation Technology
18.	15MGC118	Enzyme technology and their entrepreneurial skills
19.	15MGC119	Synthetic Organic Chemistry
20.	15MGC120	Strategic Management of Pharma Industry.

List of Generic Elective Courses

S.No.	Subject Code	Title of the Paper
1.	15SSK151	Soft skill – I
2.	15SSK152	Soft skill - II
3.	15MGC151	Green Chemistry
4.	15MGC152	Cheminformatics
5.	15MGC153	Introduction to nanoscience and nanotechnology
6.	15MGC154	Food Chemistry and Adulteration

Syllabus

Core Courses

		L	T	P	C
15MGC001	**ORGANIC CHEMISTRY – I**	**5**	**0**	**0**	**4**

Objectives:

To learn the salient features of optical activity and geometrical isomers of organic compounds.

To study the mechanism of substitution reactions in aliphatic and aromatic systems.

UNIT-I Stereochemistry 15

Optical activity and chirality. Classification of chiral molecules as asymmetric and dissymmetric. A brief study of dissymmetry of allenes, biphenyls, spiro compounds, trans cyclooctene and cyclononene and molecules with helical structures. Absolute c:onfiguration-R,S notation of biphenyls and allenes. Fischer projection. Inter conversion of Sawhorse, Newman and Fischer projections. Molecules with more than one asymmetric center (restricted to five carbons) Eg. Erythro and threo compounds. Asymmetric synthesis. Crams's rule.

Geometrical isomerism. E,Z nomenclature of olefins. Geometrical and optical isomerism (if shown) of disubstituted cyclopropane, cyclobutane and cyclopentanes. Identification of enantiotopic, homotopic, diastereotopic hydrogens and prochiral carbons in compounds containing up to ten carbons only. Stereospecific and stereo selective reactions.

UNIT-II Aliphatic Nucleophilic Substitution reactions 15

Kinetic and non-kinetic methods of determining organic reaction mechanisms. Hammett and Taft equations- Simple problems.

S_N^1, S_N^2 and S_Ni mechanisms –Neighbouring group participation –reactivity, structural and solvent effects- substitutuion in norbornyl and bridgehead systems –substitution at allylic and vinylic carbons substitution by ambident nucleophiles-substitution at carbon doubly bonded to oxygen and nitrogen-alkylation and acylation of amines, halogen exchange. Von-Braun reaction, alkylation and acylation of active methylene carbon compounds, hydrolysis of esters, Claisen and Dieckmann condensations.

UNIT-III Aromatic Substitution Reaction – II 15

Nucleophilic substitutions-Method for the generation of benzyne intermediate and reactions of aryne intermediate-Nucleophilic substitution involving diazonium ions. Aromatic Nucleophilic substitutions of activated halides. Ziegler alkylation. Chichibabin reaction.

UNIT-IV Aromaticity 15

Aromaticity of benzenoid, heterocyclic and non-benzenoid compounds, Huckel's rule-Aromatic systems with pi electron numbers other than six-non-aromatic (cyclooctatetraene etc.) and anti-aromatic systems (cyclobutadiene etc.) –systems with more than 10pi electrons – Annulenes up to C_{18} (synthesis of all these compounds is not expected).

UNIT-V Aromatic Substitution Reaction–I 15

Electrophilic Substitutions-The arenium ion mechanism –Orientation and reactivity (ortho, meta and para directing groups), Hammett equations. Typical reactions –nitration, halogenation, alkylation, acylation and diazonium coupling. Formylation reactions-Gatterman, Gatterman-Koch, Vilsmeyer-Hack and Reimer –Tieman reaction. Synthesis of di and tri substituted benzenes (symmetrical tribromo benzene, 2-amino 5-methylphenol, 3-nitro - 4-bromobenzoic acid, 3,4-dibromonitrobenzene, 1,2,3trimethylbenzene) starting from benzene or any monosubstituted benzene. Electrophilic substitution of furan, pyrrole, thiophene, pyridine and pyridine -N-oxide.

TOTAL: 75hours

Outcomes:

- To learn the concept stereochemistry and its importance
- To know what is aliphatic nucleophilic substitution
- To understand the various types of aliphatic nucleophilic substitution
- To learn what is aromatic substitution reaction
- To familiarize the various types of aromatic substitution reaction and their Mechanism
- To learn the concept aromaticity To understand the various types of aromaticity
- To learn the stereochemistry substitution and aromaticity
- To learn familiar name reactions
- To identify the stereochemical notation

TEXT BOOKS:

1. R.O.C. Norman, Organic Synthesis, Chapman and Hall, New York, 2nd edition, 1980.
2. S.M. Mukherji, S.P. Singh, Organic Reaction Mechanism, MacMillan India Ltd., Chennai, 1990.
3. Francis A. Carey, Richard J. Sunderg, Advanced Organic Chemistry Part A and B, Plenum Press, 3rd Edition, 1990.

REFERENCE BOOKS:

1. Jerry March, Advanced Organic Chemistry, Wiley Eastern Limited, Fourth edition, New Delhi, 1999.
2. John Mc. Murray, Organic Chemistry, Cengage Learning, 8th edition,2011.
3. T.L. Gilchrish and C.W. Rees, Carbenes, Nitrenes and Arynes ,Thomas Nelson and Sons Ltd., London,1969.

L T P C

15MGC002 INORGANIC CHEMISTRY – I 5 0 0 4

Objectives:

Structural study of poly acid, Inorganic polymers and Boron hydrides.

To learn about the complexes with respect to stability, stereoisomerism, the nature of bonding, electron transfer reactions and substitution reaction in square planar and octahedral complexes.

UNIT–I Chemistry of Main Elements 15

Polyacids: Isopolyacids and heteropolyacids of vanadium, chromium, molybdenum and Tungsten.Inorganic Polymers: Polysulphur-nitrogen compounds, poly-organo phosphazenes, polysilanes & silicones.Boron hydrides: Polyhydral boranes, hydroborate ions, carboranes and metallo – carboranes.

UNIT–II Stability of complexes and Stereochemistry 15

Stability of complexes: thermodynamic aspects of complex formation, thermodynamic stability- stepwise and overall stability constants, their relationships, factors affecting stability of the complexes, HSAB approach.

Determination of stability constant by spectrophotometric, polarographic and potentiometric methods.

Stereochemical aspects; Stereoisomerism in inorganic complexes, isomerism arising out of ligand and ligand conformation, chirality and nomenclature of chiral complexes.

UNIT–III Coordination Chemistry 15

Crystal field theory and its limitations, d-orbital splittings, LFSE, spectrochemical series, evidences for metal ligand orbital overlap.

Molecular orbital theory and energy level diagrams (σ & π bonding), Jahn-Teller distortion. Terms states for d^n - ions, energy level diagrams, d-d transitions, Orgel and Tanabe-Sugano diagrams, spin orbit coupling, nephelauxetic effect, charge transfer spectra.

UNIT–IV Reactions of Coordination Complexes - I 15

Electron transfer reactions; outer and inner sphere processes; atom transfer reaction, complementary and non complementary reaction. Formation and rearrangement of precursor complexes, the bridging ligand, successor complexes, Marcus theory.

UNIT –V Reactions of Coordination Complexes - I 15

Substitution Reactions: Substitution in square planar complexes, reactivity of platinum complexes- Influences of entering, leaving groups- Trans effect, substitution of octahedral complexes of cobalt-S_N1CB.

TOTAL: 75hours

Outcomes:

- To understand what are polyacids
- To study the stability of the coordination complex
- To familiarize stereochemical aspect of coordination complex

- To know various theories of coordination complex
- To learn the reaction mechanism of coordination complex
- To know reactivity of various complexes
- To understand the HSAB approach and sugano-tanube diagrams
- To know the complete chemistry of silicones, borohydrates and poly organo phosphosine
- To understand the influence of trans effect in complex reaction
- To master the advanced level of coordination compounds chemistry

TEXT BOOKS :

1. K.F. Purcell and J.C. Kotz, Inorganic Chemistry, W.B. Saunders Co., 1977.
2. J. Huheey, Inorganic Chemistry, Harper and Collins, New York, Fourth Edition, 1983.

REFERENCE BOOKS :

1. R.B.Jordan, Reaction Mechanism of inorganic and Organometallic Systems, Oxford University Press, Third Edition,1991.
2. F.A. Cotton, F.A. Hart, the Heavy Transition Elements, McMillan Co., 1975.

		L T P C
15MGC003	**PHYSICAL CHEMISTRY-I**	**4 0 0 4**

Objectives:

To understand the fundamental aspects of classical thermodynamics and chemical potential.
To learn the important aspects of statistical thermodynamics and chemical potential. To study the simultaneous reaction, fast reaction, reaction in solution and the effect of temperature on reaction rate.

UNIT – I Classical thermodynamics 12

Definition - Fugacity : Determination of Fugacity- Variation of Fugacity with temperature and pressure. Fugacity of solids and liquids. Mixture of ideal gases. Maxwell's relationships, spontaneity, equlibria-Temperature, pressure dependence of thermodynamic quantities, Lechatlier principle. The concepts of activity and activity coefficients and determination of activity coefficient.

Chemical potential - Partial molar properties -Partial molar free energy –Partial molar volume and partial molar heat content –their significance and determination of these quantities. Equilibrium in heterogeneous system. Variation of chemical potential with temperature and pressure. Alternative definition of chemical potential.

UNIT – II Statistical thermodynamics 12

Concept of thermodynamic probability – distribution of distinguishable and non distinguishable particles.

Maxwell – Boltzmann, Fermi – Dirac and Bohr's Einstein statistics- Comparison and applications – modes of contribution to energy- Partition function – evaluation of translational, vibrational and rotational, nuclear and electronic partition functions for mono, di atomic and poly atomic ideal gases-thermodynamic functions in terms of partition functions to heat capacities of ideal gases – Law of equipartition energy- heat capacity of solids (Einstein and Debye models).

UNIT – III Chemical Kinetics-I 12

Simultaneous reaction- A detail study of reversible reaction-First order opposed first order, first order opposed second order reactions-.Kinetics of complex/composite reactions, reversible reactions, consecutive reactions, parallel reactions, chain reactions, general treatment of chain reactions – chain length - Rice Herzfeld mechanism – explosion limits.

Study of fast reaction – relaxation methods – temperature and pressure jump method – stopped flow and flash photolysis methods.

UNIT – IV Chemical Kinetics-II 12

Effect of temperature on reaction rate – Collision theory of reaction rates- Molecular beams – Collision cross sections- Effectiveness of collisions-Probability factor – Potential energy surfaces. Langmuir and BET absorption isotherms – study of kinetics of surface reaction – catalysis by metals semiconductor oxides – Mechanism of heterogeneous catalytic reaction – Absorption coefficient and its significance.

UNIT – V Chemical Kinetics-III 12

Partition functions and activated complex. Eyring equation Estimation of free energy, enthalpy and entropy of activation and their significances.

Reactions in solutions – Effect of pressure, dielectric constant and ionic strength on reactions in solutions – Kinetic isotope effects – Linear free energy relationships – Hammett and Taft equations – Acid base catalysis – Mechanism of acid base catalysed reactions – Bronsted catalysis law.

TOTAL: 60hours

Outcomes:

- To learn about the Principle and applications of ultraviolet and Woodward Fisher Rule
- To understand the Maxwell's relationships, spontaneity, equlibria-Temperature, pressure dependence of thermodynamic quantities
- To know about the concepts of activity and activity coefficients and determination of activity coefficient
- To familiarize the Partial molar properties and its determination
- To learn about the chemical potential and its determination
- To study the concept of thermodynamic probability

- To learn the Maxwell – Boltzmann, Fermi – Dirac and Bohr's Einstein statistics-Comparison and applications
- To know about the Partition functions
- To know the detail study of Simultaneous reaction
- To study the Kinetics of different types reactions
- To learn the reaction rate theories and reactions in solution

TEXT BOOKS:

1. K.J. Laidler, Chemical Kinetics, Harper and Row, New York, third edition, 1987.
2. Rajaram J. and Kuriacose J.C. – Kinetics and Mechanism of Chemical Transformation, Mc Millan India Ltd., New Delhi, first edition, 1993.

REFERENCE BOOKS:

1. S. Glasstone and D.Lewis, Elements of Physical Chemistry, Macmillan, 2nd Edition,1995.
2. P.W. Atkins, Physical Chemistry, Oxford University Press, 5th edition, 1995.

		L	T	P	C
15MGC004	**PRACTICAL-I: PHYSICAL CHEMISTRY**	**0**	**0**	**6**	**3**

Objectives:

To understand and analyse the kinetic and thermodynamic. aspects of reactions.
To learn the significance of potentiometric and conductometric titrations.

Non Electrical experiments:

1. Determination of relative strength of the given 2 acids catalysed by methyl acetate.
2. Determine the temperature coefficient & energy of activation of hydrolysis of methyl acetate.
3. Construction of Phase diagram for a simple binary system.
4. Determination of rate constant & order of reaction between $K_2S_2O_8$ & KI
5. Study the primary salt effect on the Kinetics of ionic reactions & test the Bronsted relationship ($K_2S_2O_8$ + KI)
6. Determination of equilibrium constant of the reaction between I_2 + KI by Partition method.
7. Study the adsorption of acetic acid by charcoal (Fruendlich isotherm).

Electrical Experiments:

I. Potentiometric titrations:

1. Strong acid Vs Strong Base

2. Weak acid Vs Strong Base

3. Mixture of acid Vs Strong Base

4. Halides Vs $AgNO_3$

5. Mixture of halides Vs $AgNO_3$

6. Redox Titration

a. $FeSO_4$ Vs $K_2Cr_2O_7$ b. KI Vs $KMnO_4$

7. Determination of pKa of a weak acid using Henderson equation.

II. Conductometric titrations:

1. Strong acid Vs Strong base.

2. Strong acid & weak acid Vs Strong base (Mixture of acids Vs Strong base)

3. Weak acid Vs Strong base.

4. Determination of cell constant and verification of Debye-Huckel Onsager equation for strong electrolyte.

5. Determination of dissociation constant of weak electrolyte by conductivity method.

TOTAL:90hours

Outcomes :

- The student will be learning the concept of electrical experiments
- To learn to construct phase diagram
- To understand the concept distribution coefficient
- To know how to hydrolyze ester
- To study the reaction kinetics
- To familiarize the potentiometric and conductometric titration
- To learn to verify Debye-Huckel Onsagar equation
- To understand the skill aspects of electrical experiments
- To learn the calibration of electrical experiments
- To generate precise and accurate results with graphical representation

TEXT BOOKS:

1. P. S. Raghavan, B. Viswanathan, Practical Physical Chemistry, Viva books Private Limited, New Delhi, 2005.
2. B.D. Khosla and V.S. Garg,Senior Practical Physical Chemistry, R. Chand and Co., New Delhi, 1998.

REFERENCE BOOKS:

1. A. Findary, T.A. Kitchner Practical physical chemistry, Longmans, Green and Co., 1997.
2. J.M. Wilson, K.J. Newcombe, A.R. Denko. R.M.W. richett, Experiments in Physical Chemistry, Pergamon Press,2007.

		L	T	P	C
15MGC005	**ORGANIC CHEMISTRY-II**	**5**	**0**	**0**	**4**

Objectives:

To study mechanisms of addition reactions, elimination reactions, oxidation and reduction reactions and reactions involving rearrangements.
To understand the conformation of some important organic compounds.

UNIT – I Addition to carbon - carbon and carbon-hetero multiple bonds 15

Electrophilic, nucleophilic and neighbouring group participation mechanism-Addition of halogen and nitrosyl chloride to olefins. Hydration of olefins and acetylenes. Hydroboration, Hydroxylations, Michael addition, Diels Alder reaction,1,3-dipolar additions.

Carbenes and their addition to double bonds-Simmon Smith reaction, Mannich, Stobbe, Drzen, Wittig, Wittig – Horner and Benzoin reactions. Stereochemical aspects to be studied wherever applicable. Nitrene : methods for generating nitrenes and their reactions.

UNIT – II Elimination Reactions 15

E_1, E_2 and E_1cB mechanism- E_1, E_2 and E_1cB Spectrum—orientation of the double bond –Hoffmann and Saytzeff rule s- competition between elimination and substitution. Typical elimination reactions – dehydration, dehydrohalogenation and dehalogenation. Stereochemistry of E_2 eliminations in cyclohexane systems. Mechanism of pyrolytic elimination. Chugaev and Cope eliminations.

UNIT – III Molecular Rearrangements 15

A detailed study with suitable examples of the mechanism of the following rearrangements: Pinacol-pinacolone(examples other than tetra methyl ethylene glycol)-

Wagner-Meerwein , Demjanov, dienone – pheonol, Favorski , Baeyer – Villiger , Wolf, Stevens (in cyclic systems) and Von Richter rearrangements.

UNIT – IV Oxidation and Reduction 15

Mechanisms – study of the following oxidation reactions – oxidation of alcohols-use of DMSO in combination with DCC or acetic anhydride in oxidizing alcohols- oxidation of methylene to carbonyl- oxidation of aryl methanes – allylic oxidation of olefins. Reductions : selectivity in reduction of 4-T- Butyl cyclo hexanone using selectrides hydride reductions – synthetic importance of Clemmenson and Wolff- Kishner reductions- modifications of Wolff-Kishner reduction – Birch reduction , MPV reduction.

UNIT – V Conformational Analysis 15

Conformation of some simple 1,2 disubstituted ethane derivatives. Conformational analysis of disubstituted cyclohexanes and their stereochemical features (geometric and optical isomerism (if shown) by these derivatives). Conformation and reactivity of substituted cyclohexanols (oxidation and acylation), cyclohexanones (reduction) and cyclohexane carboxylic acid derivatives (esterification and hydrolysis) Conformation and stereochemistry of *cis* and *trans* decalin and 9-methyldecalin.

TOTAL: 75 hours

Outcomes:

- The learn the principle of addition reaction
- To study the mechanism of familiar organic name reactions followed by addition mechanism
- To learn the concepts of elimination reaction
- To understand the detail mechanism of various types of molecular rearrangement
- To study the various familiar oxidation reactions like oppenaur oxidation
- To learn the mechanism of reduction reaction like clemensen, wolf kishnar, birtch reaction and MPV reaction
- To know the concept of conformational analysis
- To learn the relation of conformation and reactivity
- To understand combined oxidation and reduction reaction
- To master the important concepts of organic chemistry with detail mechanism

TEXT BOOKS:

1. R.O.C. Norman, Principles of Organic Synthesis, Chapman and Hall, London, 2nd 1980.
2. Francis A. Carey, Richard J. Sundberg, Advanced Organic Chemistry-Part B Reactions and Synthesis, Plenum Press, 3rd Edition,1990.

REFERENCE BOOKS:

1. S.M. Mukherji and S.P. Singh, Organic Reaction Mechanism,Macmillan India Ltd.,1990.
2. P.S. Kalsi, Textbook of Organic Chemistry, Macmillan India Ltd., 1999.

		L	T	P	C
15MGC006	**INORGANIC CHEMISTRY-II**	**4**	**0**	**0**	**3**

Objectives:

To learn about some organometallic compounds and their applications in industry.
To learn the applications of IR, Raman, NMR ESR and Massbauer techniques.
To study the salient features of solid state chemistry.

UNIT –I Metallocenes 12

Alkyls and arene complexes; metalation, bonding in metal carbonyls and nitrosyls, chain and cyclic donors, olefin, acetylene and allyl systems, synthesis, structure and bonding metallocenes.

UNIT –II Organo metallic Reactions 12

Catalysis-Hydrogenation of olefins (Wilkinson's catalyst), hydroformylation of olefins using cobalt or rhodium catalysts (oxoprocess), oxidation of olefins to aldehydes and ketones (Wacker process) polymersiation (Zeigler-Natta catalyst); cyclo oligomerisation of acetylene using nickel catalyst (Reppes' catalyst)-Synthetic Gasoline-mobil Reaction.

UNIT –III Spectroscopic studies 12

Spectral and magnetic properties of transition metal complexes-Guoy method, Faraday method.Applications of IR, Raman, NMR, ESR, Massbauer to the study of coordination compounds.

UNIT-IV Solid state - I 12

Structure of solids: Comparison of X-ray, Neutron and Electron diffraction,structure of ZnS, Rutile, Pervoskite, Cadmium iodide and Nickel arsenide: Spinels and inverse spinels: defects in solids, non-stochiometric compounds.

UNIT-V Solid state - II 12

Band theory, semiconductors, superconductors, solid state electrolytes, types of magnetic behaviour, Dia, Para, Ferro, Antiferro and ferri magnetism: Hysterisis, Solid state lasers, inorganic Phosphors.

TOTAL: 60hours

Outcomes:

- To learn what are metallocenes
- To understand various types of metallocenes synthesis, structure and bonding
- To learn what are organometallics
- To know the uses of various catalyst Wilkinson,Reppes,Zeiglar Natta
- To understand Oxo and wacker process
- To study the inorganic approach of spectroscopic studies
- Tolearn the uses of IR, NMR, ESR and Massbauer to various inorganic system
- To study the structure of various solids like Zinc sulphide,rutile,Cadium iodide,nickel asenate
- To learn the various magnetic behaviours of inorganic complexes

- To learn Band theory, lasers and inorganic Phosphours.

TEXT BOOKS:

1. J.E. Huheey, Inorganic Chemistry – Principles, Structure and Reactivity: Harper Collins, New York, 4th Edition,1993.
2. F.A. Cotton and G. Wilkinson, Advanced Inorganic Chemistry- A Comprehensive Text, John Wiley and Sons, 5th Edition,1998.
3. K. F. Purcell and J.C. Kotz, Inorganic Chemistry,WB Saunders Co., USA 1977.

REFERENCE BOOKS:

1. M.C. Day and J. Selbin, Theoretical Inorganic Chemistry, Van Nostrand Co., New York, 1974
2. D.F. Shrivers, P.W. Atkins and C.H. Langfor, Inorganic Chemistry, CH Langford, 1990.
3. N.N. Greenwood and Earnshaw, Chemistry of the Elements, Pergamon Press New York,1984.

		L T P C
15MGC007	**PHYSICAL CHEMISTRY-II**	**4 0 0 3**

Objectives:

To study fundamental aspects of classical mechanics, the harmonic oscillator, rigid rotor and Born –Oppenheimer approximation.

To learn about the general aspects of group theory.

UNIT – I Quantum Chemistry- I 12

Classical mechanics- reason for failure- Basic principles of quantum mechanics. Atomic spectra, block body radiation, photoelectric effect-, Bohr's correspondence principle-deBroglie wave particle duality- Heisenberg uncertainty principle.

Quantum mechanical postulates – the Schrodinger equation – elementary applications of Schrodinger's equation – the particle in a box (one and three dimensional cases) – particle in a ring.

UNIT – II Quantum Chemistry- II 12

The harmonic oscillator – the rigid rotor- the hydrogen atom – Schrodinger equation for hydrogen atom –unnormalised and normalised wave equations-the solution- the origin of quantum numbers (Angular momentum and spin)- their physical significance. Radial and angular plots- 1S,2S,2P orbitals.

UNIT – III Quantum Chemistry- III 12

Approximation methods –Variation and Perturbation theorem, methods – application to hydrogen, helium atoms – R, S Coupling and term symbols for atoms.

Born-Oppenheimer approximation –valence bond theory for hydrogen molecule – LCAO-MO theory for di and poly atomic molecules- concept of hybridization –Huckel theory

for conjugated molecules (ethylene, butadiene and benzene) – semi-empirical methods-Slater orbital and HF-SCF methods.

UNIT – IV Group theory-I 12

Symmetry elements and symmetry operations – Mathematical rules for the formation of a group- Definition and classification of Point groups – Identification and determination – Matrix representations- Reducible and irreducible representations- Similarity transformation - Orthogonality theorem and its consequences – Character table- Construction of Character table for C_{2V} and C_{3V} point group. Determination of symmetry of hybrid orbitals-Symmetry of hybrid orbitals in non linear molecules (H_2O,CH_4,XeF_4,BF_3,SF_6 and NH_3).

UNIT – V Group theory-II 12

Molecular vibrations -Direct product representation-Determination – IR and Raman activity of vibrational modes in non linear molecules (H_2O, CH_4,XeF_4,BF_3,SF_6 and NH_3). Mutual exclusion principle. Symmetry selection rules of infrared and Raman Spectra. Selection rules for electronic transitions. Symmetry of molecular orbitals and electronic states of HCHO. Selection rules for electronic transitions of HCHO.

TOTAL: 60hours

Outcomes:

- To learn the posulates of Quantum mechanics
- To know the basisc principles of quntum mechanics
- To understand Hessinberg uncertainity principle
- To Familaries approximation methods in quntum chemistry
- To understand importants of schordingers wave equations
- To learn what is symmetry elements, symmetry operations and point groups
- To know how to construct the character table
- To carlate the group theory aspects to IR and Raman spectra.
- To derive the symmetry selection rules
- To master the important concepts of group theory and quantum mechanics.

TEXT BOOKS:

1. R. Anantharaman, Fundamentals of Quantum chemistry, Macmillan India Limited 2001.
2. I.N. Levine, Quantum Chemistry, Prentice Hall India, 4th edition, 1994.
3. Ramakrishnan, M.S Gopinathan, Group Theory in Chemistry, Vishal Publications, New Delhi,1988.
4. K. V.Raman, Group theory and its applications to Chemistry, Tata McGrawHill, New Delhi, 1990.

REFERENCE BOOKS:

1. D.A. McQuarrie, Quantum chemistry, University Science Books, Mil Valley, California,1983.

2. T.N. Levine, Quantum Chemistry, Allyn and Bacon, Boston, 1983.

		L	T	P	C
15MGC008	**PRACTICAL- II: ORGANIC CHEMISTRY**	**0**	**0**	**5**	**3**

Objectives:

To know the techniques of separating organic compounds from the mixture.
To learn the methods of crystallization and the method of purification.

I. Identification of components in a two component mixture and preparation of their derivatives.

1. Acid substance and neutral substance
2. Basic substance and neutral substance
3. Phenolic substance and neutral substance
4. Acid substance and phenolic substance
5. Phenolic substance and basic substance

II. Determination of b.pt. /m.pt. for components and m.pt. for the derivatives.

Preparations:

1. p-Nitrobenzoic acid from p-Nitrotoluene
2. Anthroquinone from anthracene
3. Benzhydrol from benzophenone
4. m-nitroaniline from m-dinitrobenzene
5. 1,2,3,4-Tetrahydrocarbazole from cyclohexanone
6. Methyl orange from sulphanilic acid.
7. Iodobenzene from aniline

TOTAL:75hours

Outcomes:

- To familiarize the solubility nature of organic substances of different functional group.
- To learn the pilot separation of bimixtures .
- To familiarize the systematic producers organic substances analysis
- To learn two stage preparation involving molecular rearrangement oxidation .
- To know the preparation involving nitration and bromination

- To familiarize the test involving indentification of special elements
- To learn the conformatory test for various functional groups.
- To learn the preparations of derivative all functional groups aspects of electrical experiments
- To understand the techniques involving drying and recrystalliation by various method
- To expertise the various techniques of preparation and analysis of organic substances

TEXT BOOKS:

1. N.S. Gnanapragasam, G. Ramamurthy, Organic Chemistry Lab Manual, S.Vishwanath Printers & Publishers Pvt. Ltd.,Chennai, 2010.
2. Day & Underwood, Quantitative Analysis, Prentice Hall of India Pvt. Ltd., New Delhi. 6th Edition,2004.

REFERENCE BOOKS:

1. Arthur I.Vogel, Elementary Practical Organic Chemistry (Part 1, 2 and 3*)*, CBS Publishers and Distributors, New Delhi,5th Edition, 1989.
2. J Leonard, B Lygo, G Procter, "Advanced Practical Organic Chemistry", Stanley Thornes (Publishers) Ltd., First Indian Edition, 2004.

		L	T	P	C
15MGC009	**PRACTICAL-III: ANALYTICAL CHEMISTRY**	**0**	**0**	**5**	**3**

Objectives:

To learn the separation technique and the instrumentation in the analysis of metals.
To understand the volumetric estimations of organic compounds.

Inorganic Experiments

I. Quantitative analysis

Gravimetric analysis of mixtures of

1. Iron and magnesium
2. Iron and nickel + Cr
3. Copper and nickel and
4. Copper and Zinc.
5. Copper and Tin.

II. Analysis of Ores

1. Dolomite
2. Copper Pyrites
3. Pyrollusite

III. List of spectra to be given for interpretation.

1. ^{31}P NMR Spectra of methylphosphate
2. ^{31}P NMR Spectra of HPF_2

3. ^{19}F NMR Spectra of ClF_3
4. Expanded high resolution 1H NMR spectra of
   (N-propylisonitrosoacetylacetoneiminato) (acetylacetoneiminato)Nicketl(II)
5. ESR Spectra of the aqueous $ON(SO_3)_2^{2-}$ ion
6. ESR Spectra of the $[Mn(H_2O)_6]^{2+}$ion
7. IR Spectra of the nitro and nitritopentaminecobalt (III) chloride
8. IR Spectra of carbonyls
9. Mossbauer spectra of $FeSO_4.7H_2O$
10. Mossbauer spectra of $[Fe(CN)_6]^{3-}$

Organic Experiments:

I) Any Six Preparations from the following involving two stages:

1. Sym-Tribromo benzene from aniline.
2. Benzanilide from benzophenone.
3. *m*-Nitrobenzoic acid from methylbenzoate
4. 2,4-Dinitrobenzoic acid from p-nitrotoluene
5. m-nitrobenzoic acid from benzaldehyde
6. Benzil from benzaldehyde
7. Anthaquinone from phthalic anhydride
8. Phthalide from phthalic anhydride
9. 2-phenyl indole from phenylhydrazine
10. 2,4-Dinitrophenyl hydrazine from p-nitrochlorobenzene.

II) Any Five Estimations:

1. Estimation of aniline.
2. Estimation of Phenol
3. Estimation of glucose
4. Estimation of amino group
5. Estimation of amide group
6. Saponification of fat or an oil
7. Iodine value of an oil
8. Estimation of sulphur in an organic compound
9. Estimation of methyl ketone.

III) Special Interpretation of organic compounds, UV,IR, PMR and Mass spectra of 15 compounds

1. 1,3,5-Trimethylbenzene
2. Isopropyl alcohol
3. Pinacolone
4. Acetone
5. 2-N, N-Dimethylamino thanol
6. Benzyl bromide
7. Pyridine
8. Phenylacetone
9. Cinnamaldehyde
10. 1,3-dibromo-1, 1-dichloropropene

TOTAL:75hours

Outcomes:

- To learn the technique of separating the one cationic mixture by precipitation and estimating another by gravimetric.
- To learn the technique of precipitation of cations as glyoximates, oxinates and sulphates and estimating them by gravimetrically.
- To involve the techniques of time management of multi stage organic preparation.
- To learn the multi stage preparation by electrophilic substitution, oxidation and hydrolysis.
- To witness the utility of protecting and deprotecting steric hindering groups.
- To learn the interpretation of multi spectral data of familiar inorganic complexes.
- To learn the familiar ore analysis.
- To understand the techniques in the filtering, drying and estimating the analyte in gravimetric in micro level
- To learnhow the spectral pattern of various organic compounds in different spectral techniques.

- To understand the estimation procedure of organic compounds involving back titration.

TEXT BOOKS:

1. Gary D. Christian, "Analytical Chemistry", John Wiely & Sons, INC, New York, Fifth Edition, 1994.
2. V.K. Ahluwalia, Sunita Dhingra, "Comprehensive Practical Organic Chemistry – Qualitative Analysis", University Press Private Limited, India, First Indian Edition, 2010.

REFERENCE BOOKS:

1. John H. Kennedy, "Analytical Chemistry: Practice", Saunders College Publishing, New York, Second Edition, 1990.
2. Russell.S.Drago, Physical Methods in Inorganic Chemistry, West Press Private Limited, New Delhi, 1965

		L	T	P	C
15MGC010	**INTERNSHIP**	**0**	**0**	**0**	**2**

Objectives:

To gain practical experience by working in a professional chemistry -related environment.

To demonstrate an ability to work independently and utilize principles of chemistry to solve real-world problems

Course Requirements:

Students wishing to receive credit for internship are required to find, apply for, and be selected for a chemistry or materials related internship position with an organization of

their choice. They will then need to seek permission by the Department Chair to register for the appropriate internship course.

The student must complete at least 90 hr of work during the semester for each hour of academic credit awarded, and these work hours must be completed during the term (odd or even semester vacation) in which the student is registered for the internship course.

After the student has completed the internship, the student must submit the final evaluation report of the internship experience and 20 minute presentation to department at conclusion of semester. The Department Chair and class instructor will allot the marks for the internship evaluation report.

Outcomes:

- To know the various types of industries.
- To learn the procedure of identifying, approaching, applying and getting approval of internship from a leading industry.
- To witness the entire work area of the industry.
- To understand the nature of job involved in the various sector of the industry.
- To adapt with the working people.
- To identify the manufacturing procedures and technical skills involved.
- To understand the complete mechanism of the reactions involved in the manufacturing areas at different sectors.
- To correlate the manufacturing procedures with simple laboratory synthesis.
- To learn the environment aspects, pollution their control involved in the manufacturing unit.
- To prepare a final evalution report and presentation for the internship carried out for minimum 30 days.

		L	T	P	C
15MGC011	**ORGANIC CHEMISTRY-III**	**5**	**0**	**0**	**4**

Objectives:

To study the structure elucidation of organic molecules using NMR, Mass spectroscopy and IR spectroscopy.

To know about the general aspects of organic photochemistry.

To learn about Heterocycles, terpenoids, steroids and cholesterol.

UNIT-I Physical Methods of Structure Determination 15

Principle and applications of ultraviolet Woodward Fisher Rule (only application) and infra-red spectroscopy in organic structure determination.

Nuclear magnetic resonance spectroscopy. Proton chemical shift, spin-spin coupling, coupling constants and applications to organic structures ^{13}C resonance spectroscopy (elementary treatment).

UNIT-II Mass Spectroscopy 15

Mass spectrometry and its applications Optical rotatory dispersion and its applications. Cotton effect, axial haloketone rule and octant rule. Problem solving using spectral data. (for molecules with a maximum number of C_{10})

UNIT-III Organic Photochemistry 15

Photochemical excitation-rate of the excited molecules –Jablonski diagram-study of photochemistry of ketone - photo reduction-photo cyclo addition-Paterno-Buchi reaction-di-pi-methane rearrangement.

UNIT-IV Pericyclic Reactions 15

Pericyclic reactions- classification –orbital symmetry-Woodward Hoffman rules-Analysis of electrocyclic, inter conversion of hexatrienes to cyclohexadienes. Cyclo addition and sigmatropic reactions-correlations diagram for butadiene-cyclobutene system. Structure of butylene, a fluxional molecule –Cope and Claissen rearrangements.

UNIT-V Heterocycles, Terpenoids and Steroids synthesis 15

Imidazole, oxazole, thiazole, flavones, isoflavones, anthocyanins, pyrimidines (cytocine and uracil only) and purines (adenine, guanine only). Synthesis of parent and simple (alkyl or aryl substituted derivates are expected). Synthesis of vitamin A1 (Reformatsky and Wittig reaction methods only) Conversion of cholesterol to progesterone, estrone and testosterone.Elucidation of structure of cholesterol (by chemical degradation).

TOTAL: 75hours

Outcomes:

- To learn principle and application of UV-Visible and IR Spectroscopy.
- To practice the calculation of λmax using woodward fischer rule.
- To learn the principle behind NMR Spectroscopy H^1, C^{13}, P^{31}.
- To understand the principle behind Mass spectroscopy and its applications.
- To know what is ORD and CD.
- To practice problems of structure determination with multi spectral data of compounds with C^{10} carbons.
- To know what are pericyclic reaction, their types, mechanism and synthetic utility.
- To know photochemistry of organic compounds
- To learn the synthesis of familiar heterocyclic compounds.
- To learn the synthesis of important steroids and terpenoids.

TEXT BOOKS:

1. I.L. Finar, Organic Chemistry, ELBS Publication, 5th Edition, 2000.
2. B.K. Sharma, Instrumental methods of Chemical analysis, Goel Publishing House, 24th Edition, 2005.

REFERENCE BOOKS:

1. J. Dyer, Application of absorption spectroscopy of organic compounds, Prentice-Hall India Pvt. New Delhi, 2008
2. R. M. Silverstein, G. C. Bassler and Monsil, Spectrometric identification of Organic compounds, John Wiley and Sons, New York, 1998.

		L	T	P	C
15MGC012	**INORGANIC CHEMISTRY-IV**	**5**	**0**	**0**	**4**

Objectives:

To study the biological aspects, metalloenzymes, oxygen carriers, nitrogen fixation, photosynthesis and toxicity of heavy metals.

UNIT – I Basic concepts of Bioinorganic Chemistry 15

Thermodynamics and biology – Basic concepts of structure and functionality – membranes – structure, function transport properties, aspects of electrochemical phenomena – active transport, ionophores, biological energy storage and Phosphate hydrolysis.

UNIT – II Enzymes 15

Essential and trace metal ions.Coenzymes – Vitamin B coenzymes, carboxy peptidase and Superoxide dismutase. Heme – enzyme – Peroxidase and catalases.

UNIT – III Hemeproteins 15

Oxygen carriers – Hemeproteins – Hemoglobin, myoglobin – Structure Oxygenation and Stereochemistry – Bohr effect. Non-heme oxygen carriers – Hemerythrin and hemocyanin-Iron storage and transport proteins.

UNIT – IV Nitrogen fixation and biological redox systems 15

Nitrogen fixation – Introduction, types of nitrogen fixing micro-organisms. Nitrogenase enzyme – Metal clusters in nitrogenase – redox property – Dinitrogen complexes – transition metal complexes of dinitrogen – nitrogen fixation via nitride formation and reduction of dinitrogen to ammonia. Biological redox systems: Cytochromes – Classification, cytochrome a, b and c Cytochrome P-450.
Iron – sulphur proteins – rubredoxin and ferredoxin.Photosynthesis and chlorophyll's.

UNIT – V Bio analytical Chemistry 15

Bio analytical Chemistry, Toxicity & medicine, Toxicity of Hg, Cd, Zn, Pb, As, Sb. Anti cancer agents, Metal ion poisoning: Failure of metal ion control systems, role of metal ion Diagnosis and treatment – use of radio isotopes; Pollution studies: Effluents and treatment. Inorganic plant nutrition and indicator plants for mineral exploration.

TOTAL: 75hours

Outcomes:

- To learn the basic concepts of bio inorganic chemistry.
- To learn what are the essential metal ions and their role in biological system.
- To learn Heme proteins and porphyrin complexes.
- To understand biological redox systems, metal clusters and nitrogen fixation
- To know the concepts of bio analytical chemistry.
- To know the diagnosis technique and treatment using radio isotopes.
- To learn thermodynamic aspects of cell membrane and blood component.
- To know what are cytochromes their types and uses.
- To know important pollution treatment method.
- To master the bio inorganic aspects in everyday life

TEXT BOOKS:

1. Williams, D.R., Introduction to Bioinorganic Chemistry, C.C.Thomas, Springfield, 1976.
2. M.Satake and Y.Mido, Bioinorganic Chemistry,Discovery Publishing House,New Delhi,1996.

REFERENCE BOOKS:

1. G.Eichron, G.,Inorganic Bio-Chemistry, Vol. I and II, Elsevier, 1973.
2. J.Huheey, Inorganic Chemistry, Harper and Collins,New York, fourth Edition, 1993.

		L	T	P	C
15MGC013	**PHYSICAL CHEMISTRY-III**	**5**	**0**	**0**	**4**

Objectives:

- To learn the electrochemical aspects of reactions
- To analyse the structure of different compounds by using different Techniques.

UNIT-I Electro Chemistry-I 15

Mean ionic activity and mean ionic activity coefficient – concepts ionic strength. Nernst equation- redox system- electrochemical cell- Electrolytic conductance- Kohlraush's law and its applications, ionic equlibria. Debye- Huckel theory of strong electrolytes – Determination of activity coefficient by electrical method –Debye-Huckel limiting law qualitative and quantitative verification – Limitation of Debye –Huckel theory at appreciable concentration – Huckel equation – Debye- Huckel –Bronsted equation.

UNIT-II Electro Chemistry-II 15

Electrode –electrolyte interface – adsorption at electrified interface- electrical double layer – Electrocapillary phenomenon – Lippmann Equation – Structure of double layers – Helmholtz – Perrin- Guoy-Chapman and Stern model of electrical double layers.

UNIT-III Electro Chemistry-III 15

Mechanism of electrode reaction – Polarisation and overpotential – the Butler Volmer equation for one step and multi step electron transfer reaction – Significance of exchange current density and symmetric factor-transfer coefficient and its significance – Mechanism of the hydrogen and oxygen evolution reactions.

UNIT-IV Spectroscopy-I 15

Interaction of matter with radiation – Einstein's theory of transition probability – rotation spectroscopy of a rigid rotor – non- rigid rotor – di atomic and poly atomic molecules. Vibrational spectroscopy – harmonic Oscillator – anharmonicity – Vibrational spectra of poly atomic molecules- Vibrational frequencies - group frequencies – Vibrational coupling overtones – Fermi resonance. Raman Spectra.

UNIT-V Spectroscopy-II 15

Equation of motion of spin in magnetic fields –Chemical shift – spin-spin coupling – NMR of simple AX and AMX type molecules –calculation of coupling constants- ^{13}C, ^{19}F, ^{31}P NMR spectra – applications – a brief discussion of Fourier transform resonance Spectroscopy.

TOTAL: 75hours

Outcomes:

- To learn the concepts of the activity coefficients and electrochemical cell.
- To study the theory of Debye Huckel rule, limitations and its applications.
- To know the structure of electrical double layers of Helmholtz, perrin-guoy-chapman.

- To know the adsorption of electrolyte interface.
- To practice the mechanism of hydrogen and oxygen evolution reaction.
- To study the Butler Volmer equation for one step and multi step electron transfer reaction.
- To familiarize the spectral studies of Raman spectra.
- To learn the vibrational spectra of atomic molecules.
- To know the concepts of NMR Spectrophotometer.
- To know the concepts of C^{13}, F^{9}, P^{31}. NMR spectra and its applications

TEXT BOOKS:

1. S. Glasstone, Principles and Applications to Electrochemistry, Chapman and Hall, 1991.
2. D. R. Crow, Introduction to Electrochemistry, Affiliated East West Press, New Delhi,1960.

REFERENCE BOOKS:

1. P. H. Rieger, Electrochemistry, chapman and hall, New York, 1994.
2. G. Aruldas, Molecular Structure and Spectroscopy, Prentice Hall, 2002.
3. G. M. Barrow, Introduction to Molecular Spectroscopy, McGraw Hill, New York, 1962.

		L	T	P	C
15MGC014	**Practical-IV: INORGANIC CHEMISTRY**	**0**	**0**	**6**	**3**

Objectives:

- To learn the quantitative determination of compound by volumetric titration method.
- To learn the qualitative analysis of a given salt mixture.

I. Volumetric Estimations :

1. Estimation of Zinc
2. Estimation of Magnesium
3. Estimation of Calcium
4. Estimation of Nickel

II. Colorimetric analysis:

5. Estimation of iron
6. Estimation of nickel
7. Estimation of manganese
8. Estimation of copper.

III. Qualitative analysis:

9. Analysis of Salt mixture- I (W, Se, Pb, Cu)
10. Analysis of Salt mixture- II (Te, Th, Al, Fe)
11. Analysis of Salt mixture- III (Ti, Zr, Mn,Co)
12. Analysis of Salt mixture- IV (Ce, V, Ni, Zn)

TOTAL: 90hours

Outcomes:

- To know about the Volumetric analysis of cations.
- To identify the simple cations
- The communication of the results of scientific experiments in oral reports and written reports
- The chemical literature and to read and understand technical literature related to the discipline
- To analysis the simple Inorganic salt mixture
- To estimate the Inorganic cations.
- To know how to estimate the Inorganic cations using the colorimetric method
- To identify the rare earth metals.

TEXT BOOKS:

1) Jeyavathana Samuel, Chemistry Practical Book, G.G.Printers, Chennai, 2012.
2) Vickie.M.Williamson, M.Larry Peck, Lab manual for General Chemistry, Cengage Learning India Private Limited, New Delhi, 2009.

REFERENCE BOOKS:

1) V.V. Ramanujam, Inorganic Semimicro Qualitative Analysis, The National Publishing Company, Chennai, third edition,1974.
2) Vogel's "Textbook of Quantitative chemical Analysis", Pearson Education Ltd. Sixth Edition, 2008

		L	T	P	C
15MGC015	**ELECTROANALYTICAL AND SEPARATION TECHNIQUES**	**4**	**0**	**0**	**4**

Objectives:

To understand the electrolytic conductance, electrode and mechanism of electrode reaction.

To study the interaction of matter with radiation.

To know about B_c, K_F, pNMR Spectroscopy and fourier transform resonance spectroscopy

UNIT – I Analytical Techniques –I 12

Polarography – theory, apparatus, DME, Diffusion, Kinetic and catalytic currents, Current - voltage curves for reversible and irreversible system, qualitative and quantitative applications to inorganic systems.

UNIT – II Analytical Techniques –II 12

Amperometric titrations – theory, apparatus, types of titration curves, successive titrations and indicator electrodes – Applications. Cyclic voltammetry - theory, application to inorganic systems-Coulometry.

UNIT – III Introduction to Chromatography 12

Adsorption and partition chromatography, definition of terms, techniques and chemical concept of column, paper, TLC and HPTLC

UNIT – IV Separation Technique-I 12

Chromatography: Gas-liquid Chromatography, Principles, Retention Volumes, Instrumentation, Carrier Gas, Columns, Stationary Phase, Detectors, Thermal Conductivity, Flame Ionization, Electron Capture, Application of G.L.C.

UNIT – V Separation Technique-II 12

High Performance Liquid chromatography: Scope, Column efficiency, Instrumentation, Pumping Systems, Columns, Column packing, Detectors, Applications. Ion exchange and gel – permeation chromatography.

TOTAL: 60hours

Outcomes:

- To learn about the definition of Adsorption and partition chromatography
- To understand the Column, Paper, Thin Layer Chromatography
- To know about the High Performance Thin Layer Chromatography
- To familiarize the Two dimensional Paper Chromatography, Reverse phase paper
- chromatography.
- To learn about the Gas-liquid Chromatography.
- To learn the applications of Gas-liquid Chromatography
- To know about the High Performance Liquid chromatography
- To know the detail study of Various types Ion exchange and gel–permeation chromatography.

TEXT BOOKS:

1. J. Huheey, Inorganic Chemistry, Harper and Collins, New York,IV Edition, 1983.
2. H.J. Arnikar, Nuclear Chemistry, Wiley Eastern Co., II Edition, 1987.

REFERENCE BOOKS:

1. F.A. Cotton and G. Wilkinson, Advanced Inorganic Chemistry- A Comprehensive Text, John Wiley and Sons, V Edition, 1998.
2. K. F. Purcell and J.C. Kotz, Inorganic Chemistry,WB Saunders Co., USA, 1977

Syllabus

Discipline Specific Elective Courses

		L	T	P	C
15MGC101	**MACROMOLECULAR CHEMISTRY**	**4**	**0**	**0**	**3**

Objectives:

To study the types of polymerization,polymerization techniques,crystallinity in polymers, applications of polymer, polymer degradation and additives for polymers

.

UNIT –I Basic Concepts of Polymers. 12

Monomer, Repeat unit, degree of polymerization. Classification of polymers, Stereochemistry of polymer, nomenclature of stereo regular polymers.Chain polymerization, free radical polymerization and ionic polymerization.

UNIT- II Types of Polymerisation 12

Coordination polymerization; Ziegler Natta catalyst. Step polymerization, ring opening polymerization. Co polymerization, random, block and graft co polymers- preparation. Polymerisation techniques; bulk, solution, suspension and emulsion polymerization.

UNIT- III Molecular Weight and Glass Transition Temperature 12

Measurement of molecular weight and size; number average and weight average molecular weights. Glass transition temperature, concepts of glass transition temperature and associated properties.

UNIT- IV Glassy Solids and Polymer Crystallization 12

Glassy solids and glass transition, factors influencing glass transition temperature (Tg).

Crystallinity in polymers; Polymer crystallization, structural and other factors affecting crystallisability, effect of crystallinity on the properties of polymers.

UNIT –V Types of Polymers and Polymer Degradation 12

Synthetic resins and plastics; Manufacture and applications of polyethylene, PVC, Teflon, poly styrene, polymethylmethacrylate, poly urethane, phenol – formaldehyde resins, urea- formaldehyde resins and epoxy polymers.

Polymer degradation: Types of degradation- thermal, mechanical, photo, hydrolytic and oxidative degradations.Additives for polymers: Fillers, plasticizers, thermal stabilizers, photo stabilizers, anti oxidants and colourants.

TOTAL: 60hours

Outcomes:

- To know about basic ideas of polymers like monomer, repeat unit and degree of polymerization.
- To learn about the stereochemistry and nomenclature of polymers.
- To understand the various types of polymerization.
- To know the preparation and polymerization techniques.
- To understand the number average and weight average molecular weights.
- To learn about the concepts of glass transition temperature.
- To know the various factors influencing glass transition temperature.
- To understand the principle of crystallinity.

TEXT BOOKS:

1. Fred. W. Billmeyer, Text Book of Polymer Science, John Wiley & Sons, Third Edition, 2007.
2. R. V. Gowariker, Polymer Science, New Age International Publication, 2006.

REFERENCE BOOKS:

1. A. Ravve, Principles of Polymer Chemistry, Springer New York, Third Edition, 2012.
2. R. J. Young and P. A. Powell, Introduction to Polymers, CRC Press, Third Edition,1991.

		L	T	P	C
15MGC102	**ANALYTICAL TECHNIQUES**	**4**	**0**	**0**	**3**

Objectives:

To understand the basic principles, instrumentation and applications of UV-visible spectroscopy, mass, IR Spectroscopy, Raman spectroscopy, calorimetric analysis and resonance spectroscopy.

UNIT- I Techniques of UV- Visible spectroscopy and Infrared Spectroscopy 12

Colourimetric analysis and UV- Visible spectroscopy: Beer Lambert's law, Principles of single and double beam instruments – applications for analysis of inorganic and organic samples.

Infrared spectrophotometric analysis – principle and instrumentation and molecular structure determination.

UNIT – II Raman Spectra and Nuclear Magnetic Resonance 12

Raman Spectra – principle, basic instrumentation – structural analysis.

Nuclear Magnetic Resonance – Principle, instrumentation, structure determination, NMR of ^{1}H, ^{13}C, ^{31}P, ^{19}F.

UNIT – III Electron Spin Resonance and Mass Spectrometry 12

Electron Spin Resonance – Principle, instrumentation, applications to coordination compounds.

Mass Spectrometry – Principle, basic instrumentation, fragmentation patterns – organic molecular structural determination.

UNIT- IV Thermogravimetric Analysis 12

Thermo gravimetric and differential thermal analysis, DSC thermometric titrations, differential scanning colourimetry – principles, basic instrumentation properties and applications.

UNIT – V Atomic Absorption and Photoelectron Spectroscopy 12

Atomic absorption spectroscopy: Theory, Atomizers, Flame and Electro thermal. Radiation sources, Instrumentation, spectral and chemical interferences, application.

Photoelectron spectroscopy (UV and X-Ray) –photo electron spectra Koopman's theorem, fine structure in PES, chemical shift and correlation with electronic charges.

TOTAL: 60hours

Outcomes:

- To learn about the Colourimetric analysis
- To understand the UV spectroscopy
- To know about the Mass Spectrometry – Principle, basic instrumentation, fragmentation patterns
- To familiarize the Thermogravimetric Analysis .
- To learn about the Infrared spectrophotometric analysis principle and instrumentation and molecular structure determination.
- To learn the principle, instrumentation and applications of Raman Spectra
- To know about the principle, instrumentation and applications of NMR Spectra
- To know the detail study of the Electron Spin Resonance and Mass Spectra.
- To learn about the Atomic Absorption and Photoelectron Spectroscopy

TEXT BOOKS:

1. D. A. Skoog and D. M. West, Fundamentals of Analytical Chemistry, IV Edition, Old Reinhord & Winston, Publication,1982. (Refer for UNIT V).
2. B. K. Sharma, Instrumental methods of Chemical analysis, Goel Publishing House, 4th Edition, 2005. (Refer for UNIT I, II, III)
3. Gurdeep R. Chatwal, Sham K. Anand, Instrumental Methods of Chemical Analysis, Himalay Publ, 1979.(Refer for UNIT IV)

REFERENCE BOOKS:

1. Willard Merrit, Dean and Settle, Instrumental methods of analysis, VI Edition, CBS Publ, 1986.
2. A. I. Vogel, Textbook of Qualitative Inorganic Analysis, III Edition, ELBS, 1976 Old Reinhord & Winston, Publication,1982.

		L	T	P	C
15MGC103	**SEPARATION TECHNIQUES**	**4**	**0**	**0**	**3**

Objectives:

To study lsalient features of thermal methods and atomic absorption spectroscopy..
To study the general features of chromotographs and their Basic principles.
To understand HPLC Ion exchange and gel permeation chromotograpy.

.

UNIT- I Chromatographic Techniques 12

Adsorption and partition chromatography- definition of terms- Techniques and applications - Column, Paper, Thin Layer and High Performance Thin Layer Chromatography, Retention Factor, Two dimensional Paper Chromatography, Reverse phase paper chromatography.

UNIT-II Gas Liquid Chromatography 12

Chromatography: Gas-liquid Chromatography, Principles, Retention Volumes, Instrumentation, Carrier Gas, Columns, Stationary Phase, types of Detectors, Thermal Conductivity, Flame Ionization, Electron Capture, Retention time, Application of G.L.C.

UNIT-III High Performance Liquid chromatography 12

High Performance Liquid chromatography: Scope, Column efficiency, Instrumentation, Pumping Systems, Columns, Column packing, Detectors, Applications. Ion exchange and gel – permeation chromatography. Standard deviation and correlation coefficient.

UNIT- IV Ion Exchange Chromatography 12

Basic principle, instrumentation and application of Ion-Exchange chromatography (IEC).

UNIT V Gel Permeation Chromatography 12

Basic principle, instrumentation and application of Gel Permeation chromatography (GPC). Standard deviation and correlation coefficient.

TOTAL: 60hours

Outcomes:

- To learn the basic principles of chromatography.
- To know about the various techniques involved in chromatography.
- To understand the applications of gas liquid chromatography.
- To know about scope and instrumentation of high performance liquid chromatography.
- To know about scope and column efficiency of high performance liquid chromatography.
- To learn about standard deviation and correlation coefficient of high liquid chromatography.
- To understand the concepts of gel permeation chromatography
- To learn standard deviation and correlation coefficient of gel permeation chromatography

TEXT BOOKS:

1. J. Huheey, Inorganic Chemistry, Harper and Collins, NY IV Edition, 1983.
2. H.J. Arnikar, Nuclear Chemistry, Wiley Eastern Co. II Edition, 1987.
3. F.A. Cotton and G. Wilkinson, Advanced Inorganic Chemistry- A Comprehensive Text, John Wiley and Sons,V Edition,1998.

REFERENCE BOOKS:

1. K. F. Purcell and J.C. Kotz, Inorganic Chemistry-WB Saunders Co., USA,
2. M.C. Day and J. Selbin, Theoretical Inorganic Chemistry, Van Nostrand Co., New York, 1974.
3. D.F. Shrivers, P.W. Atkins and C.H. Langfor, Inorganic Chemistry,Freeman, New York, 1990.

	L	T	P	C
NATURAL PRODUCTS	**4**	**0**	**0**	**3**

Objectives:

To study the general aspects of alkaloids, steroids, camphor, squalene, Acetic acid, carbohydrates and polysaccharids.

UNIT – I Alkaloids **12**

Definition, nomenclature and physiological action, occurrence, isolation, general methods of structure elucidation, degradation, classification based on nitrogen heterocyclic ring, role of alkaloids in plants. Structure, stereochemistry, synthesis of the following: Ephedrine, Atropine, Quinine and Morphine.

UNIT – II Steroids-I **12**

Occurrence, nomenclature, basic skeleton, Diel's hydrocarbon, stereochemistry, isolation, structure determination and interconversions of steroids.

UNIT – III Steroids-II **12**

Bile acids, Androsterone, Testosterone, Estrone, Progestrone, Aldosterone and bio synthesis of cholesterol

UNIT – IV Terpenoids **12**

Terpenoids-Classification, Isoprene rule, Structural elucidation by chemical degradation and synthesis of camphor, Squalene, and Abetic acid.

UNIT – V Carbohydrates **12**

Carbohydrates –Oligosaccharides, trisaccharides glycosides. Structural Elucidation of Starch and cellulose, Primary concept.

TOTAL : 60hours

Outcomes:

- To learn the general aspects of alkaloids in plants.
- To know the structure, stereochemistry and synthesis of quinine and morphine.
- To learn about the occurrence, nomenclature and basic skeleton of steroids.
- To elucidate the structure and interconversions of steroids.
- To understand the types of steroids.
- To familiarize the classification of terpenoids and synthesis of camphor.
- To know how to elucidate the structure of terpenoids by chemical degradation method.
- To understand how to elucidate the structure of starch and cellulose.

TEXT BOOKS:

1. R.O.C. Norman, Chapman and Hall, Principles of Organic Synthesis, London, 1980.
2. E.S. Gould, Structure and mechanism in Organic Chemistry, Henry Holt and Co. New York, 1957.
3. Francis A. Carey and Richard J. Sundberg, Advanced Organic Chemistry-Part B, 3rd Edition, 1990.
4. S.M. Mukherji and S.P. Singh, Organic Reaction Mechanism, Macmillan India Ltd., 1990.

REFERENCE BOOKS:

1. Michael.B.Smith, Organic Synthesis, Elsevier Inc, Third Edition, 2010.
2. Mc.Murray, Advanced organic chemistry, Thomson Pvt. Ltd.,1998.

		L	T	P	C
15MGC105	**PHARMACEUTICAL CHEMISTRY**	**4**	**0**	**0**	**3**

Objectives:

To study the anaesthetics, sedatives, hypnotics, analgesics, antibiotics, enzymes, coenzymes, vitamin and photo transfer catalysis.

UNIT – I Classification of Drugs **12**

Classification of drugs- general and local anesthetics. Sedatives and hypnotics. Narcotics and analgesics.

UNIT – II Antibiotics **12**

Antibiotics – structure and synthesis; Chloromphenicol, pencillins and streptomycin.

UNIT – III Enzymes **12**

Enzymes, co enzymes, theory Enzymes structure – primary, secondary, tertiary and quaternary. Enzyme kinetics, Enzyme inhibitors, irreversible and reversible inhibitions, K_{cat} inhibitors. Transition – State analogues. Enzyme Inhibitors as drugs like cytochrome P450 inhibitors, Aromatase, lipoxygenases. Protein and peptide drugs – insulin, somatostatin, Relaxin, DNAse interferon, inteleukin, Growth stimulating factors and urokinase enzymes.

UNIT – IV Phase transfer catalysis **12**

Phase transfer catalysis- principle, uses of crown ethers,ionic liquids and miscellaneous catalysts.

UNIT – V Vitamins **12**

Vitamins – Introduction, water, fat soluble vitamins. Details of vitamin A, C, B_1, B_2, B_6.

TOTAL: 60hours

Outcomes:

- To familiarize the basic classification of drugs.
- To learn about the structure and synthesis of antibiotics.
- To know the classification of enzymes.
- To understand the protein and peptide drugs.
- To learn the principles of phase transfer catalysis.
- To know about the uses of crown ethers.
- To familiarize the water and fat soluble vitamins.
- To know the functions of vitamin A, C, B1, B2 and B6 in the body.

TEXT BOOKS:

1. William O. Foye, Thomas L. Lemke, David A. Williams, Principles of Medicinal Chemistry, Lippincott Williams & Wilkins, 4th Edition, 1995.
2. Wilson & Gisvold's Textbook of Organic Pharmaceutical and Medicinal Chemistry, John.M. Beale and John. H. Block, Lippincott Williams & Wilkins,10th Edition, 1998.

REFERENCE BOOKS:

1. M.E. Wolf, Burger's Medicinal Chemistry and Drug Discovery:Therapautic Agents,Wiley Blackwell; 5th Edition edition,1997.
2. G.L. Patrick, "Introduction to medicinal chemistry", Oxford University Press, 1995

		L	T	P	C
15MGC106	**NUCLEAR AND PHOTOCHEMISTRY**	**4**	**0**	**0**	**3**

Objectives:

To under Nuclear fission and nuclear fusion, reaction and applications of tracers

To study; the features of inorganic photochemistry like solar energy conversion and photo electrochemistry.

UNIT-I Electron Capture Detectors **12**

Orbital electron capture: nuclear isomerism, internal conversion, detection and determination of activity by cloud chamber, nuclear emulsion, bubble chamber, G.M., Scintillation and Cherenkov counters.

UNIT-II Nuclear fission and fusion reactions **12**

Nuclear fission and fusion reactions as energy sources: direct reactions, photonuclear and thermo nuclear reactions.Components of nuclear reactors – the breeder reactor – nuclear reactors in India.

UNIT-III Tracer study in Analytical Chemistry 12

Applications of tracer in study of reaction mechanism and in analytical chemistry – neutron activation analysis – isotope dilution analysis –Carbon dating- radio active tracer in the diagnosis and treatment in field of medicine.

UNIT-IV Photochemistry 12

Physical properties of electronically excited molecules – Dipole moment, pKa and redox potentials - Fluorescence, phosphorescence and delayed emission - Stern Volmer equation- Derivation, limitations and applications - Photosensitisation and chemiluminescence - Experimental techniques-

UNIT- V Photo redox reactions and Photo substitution reactions 12

Photo redox reactions and photo substitution reactions in coordination chemistry - photovoltaic and photo galvanic cells. Photo electro chemistry, Aspects of solar energy conversion.

TOTAL: 60hours

Outcomes:

- To learn what is cloud chamber and bubble chamber.
- To know various reactions of nuclear fission and nuclear fusion.
- To familiarize the nuclear reactors in India.
- To apply tracer study in analytical chemistry.
- To learn how radioactive tracer is used in diagnosis and treatment in the field of medicine.
- To understand fluorescence, phosphorescence and delayed emission.
- To know what is photo voltaic and photo galvanic cells.
- To learn the concepts of solar energy conversion.

TEXT BOOKS:

1. G.S. Manku, Inorganic Chemistry, TMG Co., 1984
2. F.A. Cotton and G. Wilkinson, Advanced Inorganic Chemistry- A Comprehensive Text, John Wiley and Sons, V Edition,1998.

REFERENCE BOOKS:

1. D.F. Shrivers, P.W. Atkins and C.H. Langfor, Inorganic Chemistry, CH Langford, 1990
2. N.N. Greenwood and Earnshaw, Chemistry of the Elements, Pergamon Press New York, 1984.

		L	T	P	C
15MGC107	**CHEMICAL AND INSTRUMENTAL METHODS OF DRUG ANALYSIS**	**4**	**0**	**0**	**3**

Objectives:

To understand the basic principles, instrumentation and applications in drug analysis using IR, UV-Visible, NMR and Mass spectrometry.

UNIT – I UV-visible Spectrophotometry 12

Theory – Beer Lambert's law – limitations of the law, Design and working of single beam and double beam spectrophotometry. Applications of UV absorption spectrometry in qualitative analysis and quantitative analysis.

UNIT– II Differential Thermal Analysis 12

Differential Thermal Analysis and Differential Scanning Calorimetry. Polymorphism/XRD – analysis.

UNIT– III IR-Spectrometry 12

Theory - Molecular vibration, instrumentation and mechanics of measurement – sample preparation –IR Spectrometry,. FTIR and use in structural elucidation .

UNIT – IV NMR Spectrometry 12

Theory, spin-spin coupling, chemical shift, magnetic equivalence – spin-spin decoupling – shift reagents instrumentation. Applications of NMR spectrometry in characterization of chemical structure using spectra of simple organic compound as examples. Principles, Instruments and applications of C^{13} NMR.

UNIT – V Mass Spectrometry 12

Theory, fragmentation pattern, ionization techniques; electron bombardment, chemical ionization, field desorption, fast atom bombardment. Different analysers, Interpretation of mass spectra, Determination of molecular weight and molecular formula and applications of mass spectrometry.

TOTAL : 60hours

Outcomes:

- To familiarize the theory and working of single and double beam spectrophotometry.
- To apply the UV absorption spectrometry in analysis.
- To know about differential thermal and scanning calorimetry.
- To elucidate the structure using FTIR technique.
- To apply NMR spectrometry in characterization of chemical structure using some examples.
- To understand the applications of 13C NMR.
- To know how to write fragmentation pattern of mass spectrometry.
- To understand what is molecular formula and molecular weight.

TEXT BOOKS:

1. Y.R.Sharma, Elementary Organic Absorption Spectroscopy, S.Chand & Co., 2nd edition New Delhi,1996.
2. Robert M.Silverstein, Clayton Bassler and Terence C.Morril, Spectrophotometric Identification of Organic Compounds, 6th Edition, John Wiley & Sons, New York, 2002.

REFRENCE BOOKS:

1. A. H. Beckett and J. B. Stenlake, Practical Pharmaceutical Chemistry Part-I and II, 4th Edition, CBS Publisher, Delhi,1998.
2. H. H. Willard, L.L. Meritt, J. A. Dean and F. A. Settle, Instrumental Methods of Analysis, 7th edition, Wadsworth, New York,1986.
3. John R. Dyer, Applications of absorption spectroscopy of Organic Compounds, Prentice Hall, London, 1987.

	L	T	P	C
15MGC108 SYNTHESIS OF ACTIVE PHARMACEUTICAL INGREDIENTS AND THEIR MANUFACTURE	**4**	**0**	**0**	**3**

Objectives:

To understand the process chemistry, combinatorial chemistry, phase transfer catalysis and asymmetric synthesis and strategy of process research.

UNIT – I Process Chemistry in Pharmaceutical Industry – An overview 12

Introduction, top 200 prescription drugs by worldwide sales ; Top ten drugs in the US market constituting 10% of world wide sales – Premarin, Synthroid, Lipitor, Prilosec, Hydrocone, Albuterol, Norvasc, Claritin, Timox and Prozac ($ one billion). Background of process chemistry – role of process chemistry.

UNIT – II Strategy of Process Research & Development in Pharma Industry 12

Process research and development of PenicillinG CAS Reg.No.[61-33-6](antibacterial); fosinopril CAS Reg. No.[98048-97-6](antihypertensive) ; Rabeprazole CAS Reg. No.[117976-89-3] (antiulcerative) Time based competition – portfolio management – stages of process research and development.

UNIT – III Combinatorial chemistry 12

Introduction – Drug Optimization – Drug discovery – Solid Phase Technique – parallel synthesis – Mixed Combinatorial Synthesis – Deconvolution – Structure Determination and limitations – Drug design / Drug discovery.

UNIT– IV Phase transfer catalysis and Asymmetric synthesis 12

Application of phase transfer catalysts in pharmaceutical industry for drug synthesis – enantioselective synthesis of chiral 2-hydroxycarboxylic acids and esters – asymmetric catalysis – eg. Asymmetric hydrogenation – L-Dopa process; Sharpless asymmetric epoxidations eg. Synthesis of Fluoxetine enantiomers

UNIT –V Polymorphism and Process safety in Drug synthesis 12

Polymorphism – solid state – crystallization – recrystallization of drug molecules eg. Isolation techniques and characterization of polymorphs of Venlafaxine hydrochloride [99300-78-4] Clopidogrel bisulphate [135046-48-9] and Lorazepam[846-49-1] (any two) Chemical Process safety – Principles and Practice-guidelines and norms-Green chemistry.

TOTAL : 60hours

Outcomes:

- To familiarize about 200 prescription drugs by worldwide sales.
- To learn the background role of process chemistry.
- To familiarize the role of process research and development of pencillin G fosinopril and rabeprazole.
- To know the various stages of process research and development.

- To learn the drug discovery, drug design and optimization.
- To apply phase transfer catalysts in pharmaceutical industry for drug synthesis.
- To understand what is crystallization and recrystallization of drug molecules.
- To know the guidelines of green chemistry.

TEXT BOOKS:

1. R. Hilfiker, Polymorphism in Pharmaceutical industry, Wiley-VCH, 2006.
2. H.G. Britain, Polymorphism in Pharmaceutical solids, CRC Press, Second edition,1998.
3. Guidelines for safe process operations and maintenance, CCPS, John Wiley & Sons.
4. Guidelines for integrating Process safety management, environment, safety, health and quality, CCPS, Jon Wiley & Sons.

REFERENCE BOOKS:

1. Process Chemistry Eds M F Lipton, A G M Barrett & J Michl, Chemical Review 2006 V109 pp. 2581-3027.
2. The Merck Index, Merck & Co./ Inc. NJ USA,14th Edition,2006.
3. K G Gadamasetti, Process chemistry in Pharmaceutical industry Ed.,Marcel dekker, Inc. NY USA, 1999.

L T P C
4 0 0 3

ORGANOMETALLIC CHEMISTRY AND PHOTOCHEMISTRY

Objectives:

To know the bonding in some important organometallic compounds and their reactions.
To study some fundamental aspects of inorganic photochemistry.

UNIT – I Alkyls and Arene complexes 12

Alkyls and Arene complexes; metalation, bonding in metal carbonyls and nitrosyls, chain and cyclic donors, olefin, acetylene and allyl systems, synthesis, structure and bonding metallocenes.

UNIT – II Organometallic reactions 12

Organometallic reactions- Association, Carbonylation, decarbonylation, Insertion, Elimination and rearrangement.

UNIT – III Organometallic Catalysis 12

Hydrogenation of olefins (Wilkinson's catalyst), hydroformylation of olefins using cobalt or rhodium catalysts (oxoprocess), oxidation of olefins to aldehydes and ketones (Wacker process).

UNIT-IV Polymerization 12

Polymerization (Zeigler-Natta catalyst); cyclo oligomerisation of acetylene using nickel catalyst (Reppes' catalyst)-Synthetic Gasoline-Mobil reaction.

UNIT – V Photo redox reactions and photo substitution reactions 12

Photo redox reactions and photo substitution reactions in coordination chemistry - photovoltaic and photo galvanic cells. Photo electro chemistry, Aspects of solar energy conversion.

TOTAL: 60hours

Outcomes:

- To learn the bonding in metal carbonyls and nitrosyls.
- To understand the synthesis, structure of metallocenes.
- To familiarize the various reactions of organometallic reactions.
- To know hydrogenation, hydroformylation and oxidation of olefins.
- To learn what is polymerization reactions.
- To understand synthetic gasoline.

- To know what is photovoltaic and photogalvanic cells.
- To learn the aspects of solar energy.

TEXT BOOKS:

1. J.E. Huheey, Inorganic Chemistry, Principles, Structure and Reactivity: Harper Collins, New York, fourth Edition, 1993.
2. F.A. Cotton and G. Wilkinson, Advanced Inorganic Chemistry- A Comprehensive Text, John Wiley and Sons, fifth Edition, 1998.

REFERENCE BOOKS:

1. K. F. Purcell and J.C. Kotz, Inorganic Chemistry, WB Saunders Co., USA,1977.
2. Peter Atkins, Tina Overton, Jonathan Rourke, Mark Weller, Fraser Armstrong, Shriver and Atkins Inorganic Chemistry, Oxford University Press, New Delhi, fourth edition,2006.

		L	T	P	C
15MGC110	**ORGANIC SPECTROSCOPY**	**4**	**0**	**0**	**3**

Objectives:

To understand the salient features of UV, visible, mass, infrared spectroscopy. To account of proton and ^{13}C-NMR.

UNIT – I UV and Visible Spectroscopy 12

Introduction – the energy of excitation. The absorption laws, measurement of the spectrum – choice of solvent – selection rules and intensity – Chromospheres – solvent effects – Conjugated dienes, polyenes, ketones and aldehydes.$\pi - \pi^*$ transitions, n - π^* transition, ∞,β- unsaturated ketones, acids, esters, nitriles, amides. The benzene ring, the substituted benzene ring – polycyclic aromatic hydrocarbons the effect of steric hindrance to co planarity.

UNIT – II Mass spectroscopy 12

Introduction – Instrumentation – High resolution and low resolution mass spectra – Determination of molecular formula – Molecular peaks rule. M^+ ion. Natural isotope abundance analysis – fragmentation process – nitrogen rule, metastable ions, metastable peaks, retro Diels – Alder fragmentation – McLafferty rearrangement, loss of odd electron, neutral fragments from molecular ions – Factors which influence fragment abundance – Mass spectra of various functional groups containing compounds to be studied: aromatic, aliphatic hydrocarbons, ketones, acids, esters, amides, ethers, alcohols, amine and nitriles.

UNIT – III Infrared spectra 12

Introduction – Preparation of samples and examination in an infrared spectrometer – The infrared spectrum – the use of the table of characteristic group frequencies – correlation charts. Absorption frequencies of triple bond and cumulative double bonds – the aromatic

overtone and combination – Region 2000 – 1200 cm^{-1} . Absorption frequencies' of the double bond region – Groups absorbing in the finger print region – identification of functional groups.

UNIT – IV Proton carbon – 13 nuclear magnetic resonance 12

The spinning nucleus – The effect of an external magnetic field, precessional motion, precessional frequency, energy transitions.

Theory of NMR – Measurement of chemical shifts – Internal standards – Units used in NMR. Factors influencing chemical shift – electronegativity, shielding and deshielding, Van der Walls deshielding, Anisotropic effects – Correlation data, use of correlation tables. Influence of restricted rotation. Chemically equivalent and magnetically equivalent protons. Solvents used in NMR – Choice of solvent – solvent shifts – concentration and temperature effects.

UNIT-V Splitting of signals in NMR and ^{13}C-NMR 12

Integrals – Spin spin splitting – The splitting of NMR signals – Theory of spin-spin splitting. Magnitude of coupling, coupling constants. Proton exchange reactions. Factors influencing geminal coupling – vicinal coupling – Hetero annular coupling, Deuterium exchange. Improving the NMR spectrum – shift reagents. Effect of changing the magnetic field. Nuclear overhauser effect, spin tickling. Problems (Problems involving UV, IR and NMR to be solved)

Carbon – 13 NMR: Principle, spin decoupled spectra, single frequency off resonance decoupled (SFORD) spectra, chemical shift values, problems.

TOTAL: 60hours

Outcomes:

- To learn the salient features of UV and Visible spectroscopy.
- To know about the instrumentation of mass spectroscopy.
- To understand what molecular peaks rule and fragmentation pattern.
- To identify characteristic group frequencies and functional groups in IR spectra.
- To know the theory of NMR like chemical shift and internal standard used.
- To learn the solvents used in NMR and choice of solvent.
- To understand the splitting of NMR signals and C13 NMR.
- To solve the problems related to UV,IR and NMR.

TEXT BOOKS:

1. Robert M. Silverstein, Clayton Bassler and Terence C. Morril, Spectrophotometer Identification of Organic Compounds, 6th Edition, John Wiley & Sons, New York, 2002
2. Donald L.Pavia, Gary M.L.Lampman, George S. Kriz, James R. Vyvyan, Spectroscopy, Cengage Learning India Private Ltd., 2007.

REFERENCE BOOKS:

1. H. H. Willard, L. L. Meritt, J. A. Dean and F. A. Settle, Instrumental Methods of Analysis, Wadsworth, New York, 7th edition, 1986.
2. John R. Dyer, Applications of absorption spectroscopy of Organic Compounds, Prentice Hall, London, 1987.

	L	T	P	C
STEREOCHEMISTRY AND REACTION MECHANISM	**4**	**0**	**0**	**3**

Objectives:

To learn about the basic concept of stereochemistry of organic compounds. To learn about coupling reactions, retro synthesis analysis, and green chemistry.

UNIT – I Stereochemistry **12**

Stereochemistry: a) General consideration of molecular asymmetry and dissymmetry. Configuration – absolute and relative methods of determination, Chemical transformation, asymmetric synthesis.

UNIT – II Coupling Reactions **12**

Chiral auxiliaries, chiral reagents and catalysts, Enantiomeric excess, Quasiracemates Atropisomerism of biphenyls. Coupling reactions – Hock coupling – Suzuki coupling – Tin coupling – Transaction metal catalyses coupling reaction.

UNIT – III Retrosynthetic Analysis-I **12**

Basic principles and terminology of retro synthesis , synthesis of aromatic compounds, one group an disconnections, one group C-C and two group C-C Disconnection.

UNIT – IV Retrosynthetic Analysis-II **12**

Amine and alkene synthesis, important strategies of ret rosy group transposition, important functional group interconversions.

UNIT – IV Green Chemistry **12**

Non-conventional techniques in organic synthesis-Green chemistry-Microwave assisted reaction-U.S Catalyzed reaction. Reaction in ionic organic liquids-Solid state melts reaction.

TOTAL: 60 hours

Outcomes:

- To learn the molecular asymmetry and dissymmetry of stereochemistry.
- To know about the absolute and relative methods of determination.
- To understand what is chiral auxiliaries, chiral reagents and catalysts.
- To familiarize the various coupling reactions.
- To know the basic principles and terminology of retro synthesis.
- To learn the important strategies of ret rosy group transposition.
- To understand the important functional group interconversions
- To know about the concept of green chemist

TEXT BOOKS:

1. P. S. Kalsi, Stereochemistry Conformation and Mechanism, New Age International Publication, 2005.
2. Eliel, Stereochemistry of Carbon Compounds, Tata Mc Grawhill Education, 1975.
3. E.S. Gould, Mechanism & structure in organic Chemistry, Holt, Rinehart & Winston, New Delhi,1963.

REFERENCE BOOKS:

1. Morrison and Boyd, Organic Chemistry, Pearson Education Inc, Sixth Edition, 1992.
2. I.L. Finar, Organic Chemistry, Longmans Green & Co., Third Edition,1964.

		L	T	P	C
15MGC112	**NOVEL MATERIALS AND GREEN INDUSTRIAL CATALYSIS**	**4**	**0**	**0**	**3**

Objectives:

To know about nanomaterials, supported metallic clusters, metal oxides, supported metal oxides and environmental catalyst.

UNIT-I Introduction to Functional and Nanomaterials 12

An overview-, materials, molecular materials, functional materials, nanomaterial's classification /properties and industrial applications.

UNIT- II Properties of Metallic clusters

Supported metallic clusters, Catalysts preparation method, physical and chemical properties.

UNIT- III Characterization 12

Tools for Structural Characterization of novel materials-IR, NMR, Mass, ESR, Raman, SEM and TEM

UNIT- IV Metal Oxides 12

Metal oxides, Supported metal oxides, Industrial catalysis (Synthesis Gas and Hydrogen).

UNIT-V Catalysts in chemical transformation 12

Ammonia Synthesis, Methanol and Fischer – Tropsch Synthesis, Hydrocarbon Transformations, Environmental Catalysis

TOTAL: 60hours

Outcomes:

- To overview the functional and nanomaterial.
- To know about the classification and industrial applications of nanomaterial.
- To familiarize the preparation and properties of metallic clusters.
- To understand the tools used for structural characterization of novel materials.
- To know the metal and supported metal oxides.
- To learn the use of industrial catalysts.
- To familiarize the catalysts in chemical transformation.
- To know about the environmental catalysis.

TEXT BOOKS:

1. Harry R. Allcock, Introduction to Materials Chemistry, Wiley Interscience Publisher.
2. Bradley D. Fahlman, Materials Chemistry, 2nd edition, Springer Publisher, 2011.

REFERENCE BOOK:

1. Paul T. Anastas, Tracy C. Williamson, Green Chemistry: Frontiers in Benign Chemical Syntheses and Processes, Oxford University Press, 1998

		L	T	P	C
15MGC113	**ELECTROCHEMISTRY AND GROUP THEORY**	**4**	**0**	**0**	**3**

Objectives:

To understand the electrolytic conductance and the electrode and mechanism of electrode reaction.
To know about the general salient features of group theory.

UNIT-I Electro Chemistry-I 12

Mean ionic activity and mean ionic activity coefficient – concepts ionic strength. Nernst equation- redox system- electrochemical cell- Electrolytic conductance- Kohlraush's law and its applications, ionic equlibria. Debye- Huckel theory of strong electrolytes – Determination of activity coefficient by electrical method –Debye-Huckel limiting law qualitative and quantitative verification – Limitation of Debye –Huckel theory at appreciable concentration – Huckel equation – Debye- Huckel –Bronsted equation.

UNIT-II Electro Chemistry-II 12

Electrode –electrolyte interface – adsorption at electrified interface- electrical double layer – Electrocapillary phenomenon – Lippmann Equation – Structure of double layers – Helmholtz – Perrin- Guoy-Chapman and Stern model of electrical double layers.Mechanism of electrode reaction – Polarisation and overpotential – the Butler Volmer equation for one step and multi-step electron transfer reaction – Significance of exchange current density and symmetric factor-transfer coefficient and its significance – Mechanism of the hydrogen and oxygen evolution reactions.

UNIT-III Group Theory- I 12

Symmetry elements and symmetry operations – Mathematical rules for the formation of a group- Definition and classification of Point groups – Identification and determination – Matrix representations- Reducible and irreducible representations- Similarity transformation - Orthogonality theorem and its consequences.

UNIT-IV Group theory-II 12

Character table- Construction of Character table for C_{2V} and C_{3V} point group. Determination of symmetry of hybrid orbitals-Symmetry of hybrid orbitals in non linear molecules (H_2O, CH_4, XeF_4, BF_3, SF_6 and NH_3).

UNIT-V Group theory-III 12

Molecular vibrations -Direct product representation-Determination – IR and Raman activity of vibrational modes in non linear molecules (H_2O, CH_4, XeF_4, BF_3, SF_6 and NH_3). Mutual exclusion principle. Symmetry selection rules of infrared and Raman Spectra. Selection rules for electronic transitions. Symmetry of molecular orbitals and electronic states of HCHO. Selection rules for electronic transitions of HCHO.

TOTAL: 60hours

Outcomes:

- To learn the electrochemical cell and electrolytic conductance.
- To determine the activity coefficient by electrical method.
- To understand the mechanism of electrode reaction.
- To know about the mechanism of hydrogen and oxygen evolution reactions.
- To define and classify the point groups.
- To identify and determine the matrix representations.
- To learn how to construct the character table for C2v and C3v point group.
- To determine the IR and Raman activity of vibrationsl modes in non-lineae molecules.

TEXT BOOKS:

1. Ramakrishnan and M.S Gopinathan, Group Theory in Chemistry, Vishal Publishing Co.,1988.
2. K.V.Raman, Group theory and its applications to Chemistry, Tata McGrowHill,1990.

REFERENCE BOOKS:

1. J. O. M.Bokris & A.K.N.Reddy, Electrochemistry, Plenum, New York, Vol 1 & 2, 1997.
2. P. Delahay, Electrode kinetics & Structure of double layer, Interscience, New York, 1965.

3. Robbins, Ions in solution, An introduction in electrochemistry, Clarendon press, Oxford, 1993.

		L	T	P	C
15MGC114	**INORGANIC CHEMISTRY**	**4**	**0**	**0**	**3**

Objectives:

To understand the bonding in polyacids, polymers and boronhydrides.
To study the complexes with references to bonding, stability and stereo chemistry.

Course Outcome

UNIT -I Bonding In Inorganic Compounds –I **12**

Poly acids: Isopolyacids and heteropolyacids of vanadium, chromium, molybdenum and tungsten. Inorganic Polymers: Polysilanes and Silicones.Poly sulphur – nitrogen compounds.

UNIT- II Bonding In Inorganic Compounds –II **12**

Boron hydrides: Polyhedral boranes, carboranes and metallo carboranes.Metal Clusters: binuclear compounds, multiple metal-metal bonds.

UNIT – III Coordination Chemistry-I **12**

Stability of complexes; thermodynamic aspects of complex formation; factors affecting stability; HSAB approach.Determination of stability constants by spectrophotometric, polarographic and potentiometric methods.

UNIT- IV Coordination Chemistry- II **12**

Stereochemical aspects; Stereoisomerism in inorganic complexes, isomerism arising out of ligand and ligand conformation; chirality and nomenclature of chiral complexes; optical rotatory dispersion and circular dichroism.

UNIT- V Theories of Coordination **12**

Crystal field theory and its limitations, d-orbital splitings, LFSE, spectro chemical series, evidences for metal ligand orbital overlap, molecular orbital theory - octahedral complex with σ and π bonding, John-Teller distortion, charge-transfer spectroscopy.

TOTAL: 60hours

Outcomes:

- To know the structure and bonding in molecules / ions and predict the structure of molecules / ions.
- To learn the periodic properties of the different groups of compounds focusing on production methods and application of selected elements and compounds.
- 1To know the different definitions of acids / bases and predict the reactions between acids and bases.
- To learn the selected crystal structures and to explain what kind of parameters that affect the crystal structure of a compound
- To be able to use Crystal Field Theory to understand the magnetic properties (and in simple terms the colour) of coordination compounds.
- 1To be able to describe the stability of metal complexes by the use of formation constants and to calculate thermodynamic parameters from them.
- To be able to recognize the types of isomers in coordination compounds
- To be able to name coordination compounds and to be able to draw the structure based on it's name
- To become familiar with some applications of coordination compounds
- To be able to predict the geometries of simple molecules

TEXT BOOKS:

1. K.F. Purcell and J.C. Kotz, Inorganic Chemistry, W.B. Saunders Co., 1977.
2. J. Huheey, Inorganic Chemistry, Harper and Collins, New York, IV Edition, 1983.

REFERENCE BOOKS:

1. R. B. Jordan, Reaction Mechanism of inorganic and Organometallic Systems, Oxford University Press, Third edition, 1991.
2. F.A. Cotton, F.A. Hart, The Heavy Transition Elements, McMillan Co., 1975.

		L	T	P	C
15MGC115	**FUNDAMENTALS OF BIOCHEMISTRY**	**4**	**0**	**0**	**3**

Objectives:

To study the metabolism of carbohydrates, aminoacids, proteins and lipids.
To understand the functions of DNA and RNA.
To know about vitamins.

UNIT- I Chemistry and Metabolism of Carbohydrates 12

Definition, Classification and biological role of carbohydrates. Monosaccharides Linear and ring structures (Haworth formula) of ribose, glucose, fructose and mannose (structural determination not required) physical and chemical properties of glucose and fructose.

Disaccharides: Ring structures (Haworth formula) – occurrence, physical and chemical properties of maltose, lactose and sucrose

Glycolysis of carbohydrates.

UNIT – II Chemistry and Metabolism of Amino acids and Proteins 12

Amino acids: Various classification, essential amino acids, physical properties (amphoteric nature and isoelectric point) reactions.

Proteins: Classifications (based on shape, composition and solubility), physical properties.

Primary structure – End group analysis (N – terminal analysis – Edman's method, dansyl chloride method; C – terminal analysis – hydrazinolysis and bio-chemical mehods)

Biological functions of proteins, Deamination, transamination reactions, Urea cycle.

UNIT – III Chemistry and Metabolism of lipids 12

Definition, classification – simple lipids (fatty acids), compound lipids and derived lipids, Properties: saponification number, Acetyl number.

Cholesterol (structure not needed), biological importance and chemical properties. Bile acids – functions. Biological functions of lipids.

UNIT- IV Nucleic Acids 12

Purine and pyrimidine bases, nucleosides, nucleotides, polynucleotides, DNA structure – various types, RNA structure – various types.

Biological functions of DNA and RNA, Genetic code.

UNIT- V Vitamins 12

Vitamins: Definition, classification – water – soluble vitamins ($B_{v,}$ B_2,B_3,B_6,B_{12} and vitamin – C) and fat- soluble vitamins (A,D,E and K) – occurrence, structure, deficiency diseases, biochemical rules and daily requirements.

TOTAL : 60hours

Outcomes:

- To define, classify and biological role of carbohydrates.
- To know about the glycolysis of carbohydrates.
- To learn the essentials of amino acids in biology.
- To familiarize the biological functions of proteins.
- To understand the various types of lipids along with their properties.
- To know the biological functions of cholesterol and lipids.
- To learn what is nucleosides and nucleotides.
- To understand the role of water soluble and fat soluble vitamins in the body.

TEXT BOOKS:

1. G.R. Agarwal and O. P. Agarwal, "Text book of Biochemistry", Goel publishing House, 1984.
2. L. Styrer, "Biochemistry", Free man & Co., New York,1994.

REFERENCE BOOKS:

1. R.K. Murray, P.A., Mayes, D.K. Granner and V.W. Rodwell, "Harper's Biochemistry" (Lange Medical Book), 1990
2. B.L. William and K. Wilson, "Principles and Techniques of practical Biochemistry", Edward Arnold, London, 1990.

		L	T	P	C
15MGC116	**ORGANIC NAME REACTIONS AND SYNTHESIS OF REAGENTS**	**4**	**0**	**0**	**3**

Objectives:

To study condensation reaction oxidation and reduction reaction. To know the synthesis and application of important reagent.

UNIT-I Organic Reactions - I **12**

Condensation reactions of the following; Aldol, Claisen ester condensations. Cannizzaro reaction, Dieckmann cyclisation, Reformatsky reaction, Dakin reaction, Etard reaction, HVZ reaction, Umpolung synthesis and Stephen reaction.

UNIT-II Organic Reactions – Oxidations **12**

Barton reaction, Jones oxidation, Oppenauer oxidation and Michel addition.

UNIT-III Organic Reactions – Reductions **12**

Birch reduction, Clemmenson reduction, Meerwin P.V reduction, rosenmund reduction.

UNIT-IV Organic Reagents- I **12**

Synthesis and applications of the following reagents: 9-BBN, n-butyl lithium, ceric ammonium nitrate(CAN), DCC, Grignard reagent, LDA, Gilman reagent, NBS and PCC.

UNIT-V Organic Reagents- II **12**

Use of the following reagents in organic synthesis and functional group transformations- complex metal hydrides, Hilmans reagent, lithium dimethyl cuprate,, dicyclohexyl carbodimide,1,3-dithiane, woodward and provost hydroxylation, selenium dioxide, crown ethers and Peterson's synthesis, Wilkinson's catalyst, Baker yeast.

TOTAL: 60hours

Outcomes:

- To learn what is condensation reactions.
- To familiarize the various condensation reactions.
- To know the organic reactions of oxidations.
- To know the organic reactions of reductions.
- To understand how to synthesize some reagents.
- To learn what is the applications of these synthesized reagents.
- To understand how to use the reagents in organic synthesis.
- To learn the functional group transformations using reagents.

TEXT BOOKS:

1. R.O.C. Norman, Principles of Organic Synthesis, Chapman and Hall, London, 1980.
2. Francis A. Carey, Richard J. Sundberg, Advanced Organic Chemistry-Part B,3rd Edition 1990.
3. S.M. Mukherji, S.P. Singh, Organic Reaction Mechanism,Macmillan India Ltd. 1990.

REFERENCE BOOKS:

1. F.A. Cary, Organic Chemistry, Second edition, McGraw Hill, Inc., 1992.
2. P.S. Kalsi, Stereochemistry, Wiley Eastern Limited, New Delhi, 1990.

		L	T	P	C
15MGC117	**PHARMACEUTICAL FORMULATION TECHNOLOGY**	**4**	**0**	**0**	**3**

Objectives:

- To understand physicochemical principles, pharmaceutical operation and profile formulation.

UNIT- I Introduction 12

Need for formulation; History of formulation; Challenges in early formulations; Drug substance to Drug product with reference to formulating for the patient; Physical and chemical properties of Formulation.

UNIT-II Physicochemical Principles 12

Solutions ; pH, EMF and redox potentials ; physicochemical properties evolving into in vivo bioavailability; Absorption, Dissolution, Permeability, Distribution, Metabolism, Excretion; Complexation,; Modifies release dosage forms; profile of common formulations; colloidal systems, Rheology; Drug stability and ICH Guidelines for stability testing.

UNIT- III Pharmaceutical Operations-I 12

Extraction; Drying ; Evaporation; Distillation; Filtration/Centrifugatio; Size reduction and handling of solids in the powder form.

UNIT- IV Pharmaceutical Operations-II 12

Antisolvent and reactive crystallization; Melting approaches to particle size; Wet milling and dry milling; packaging.

UNIT-V Profile of Formulations 12

Tablets, capsules, solution and suspension formulation; Modified release formulation; Parenteral Formulation; Inhaled formulations/aerosols.

TOTAL: 60hours

Outcomes:

- To learn the need, history and challenges in early formulations.
- To know what is drug substance to drug product with reference to formulating.
- To familiarize the various physicochemical properties evolving in bioavailability.
- To view the profile of common formulations.
- To know the ICH guidelines for stability testing.
- To understand the different types of pharmaceutical operations in powder form.
- To familiarize the reactive crystallization, wet and dry milling.

- To understand the modified, parenteral and inhaled formulations.

TEXT BOOKS:

1. H. Mollet, H. A. Grubenmann, Pharmaceutical Technology, in Formulation Technology: Emulsions, Suspensions, Solid Forms, Wiley-VCH Verlag GmbH, Weinheim, Germany,2007.
2. Mark Gibson, Drug Preformulation and formulation, Informa, New York, Second Edition, 2007.

REFERENCE BOOKS:

1. S. K. Jain and V. Soni, Bentley's Textbook of Pharmaceutics-An Adaptation, Elsevier, 2012
2. C. B. Gupta and S. S. Khanka, Entrepreneurship and Small Business Management, Sultan Chand & Sons, New Delhi, 2013.

		L	T	P	C
15MGC118	**ENZYME TECHNOLOGY AND RELATED ENTEREPRENEURIAL SKILLS**	**4**	**0**	**0**	**3**

Objectives:

To learn biological aspects, metelloenzyms, oxygen carriers, nitrogen fixation, photosynthesis and cytochrome, and bioanalytical aspects.

UNIT – I Basic concepts of Bioinorganic Chemistry 12

Thermodynamics and biology – Basic concepts of structure and functionality – membranes – structure, function transport properties, aspects of electrochemical phenomena – active transport, ionophores, biological energy storage and Phosphate hydrolysis.

UNIT – II Enzymes 12

Essential and trace metal ions.Coenzymes – Vitamin B coenzymes, carboxy peptidase and Superoxide dismutase.

Heme – enzyme – Peroxidase and catalases.

UNIT – III Heme Proteins 12

Oxygen carriers – Hemeproteins – Hemoglobin, myoglobin – Structure Oxygenation and Stereochemistry – Bohr effect. Non-heme oxygen carriers – Hemerythrin and hemocyanin-Iron storage and transport proteins.

UNIT – IV Nitrogen fixation and biological redox reactions 12

Nitrogen fixation – Introduction, types of nitrogen fixing micro organisms. Nitrogenase enzyme – Metal clusters in nitrogenase – redox property – Dinitrogen complexes – transition metal complexes of dinitrogen – nitrogen fixation via nitride formation and reduction of

dinitrogen to ammonia. Biological redox systems:Cytochromes – Classification, cytochrome a, b and c Cytochrome P-450.
Iron – sulphur proteins – rubredoxin and ferredoxin. Photosynthesis and chlorophyll's.

UNIT – V Bio analytical Chemistry 12

Bio analytical Chemistry,Toxicity & medicine,Toxicity of Hg, Cd, Zn, Pb, As, Sb,Anti cancer agents,Metal ion poisoning: Failure of metal ion control systems, role of metal ion

Diagnosis and treatment – use of radio isotopes,Pollution studies: Effluents and treatment. Inorganic plant nutrition and indicator plants for mineral exploration.

TOTAL: 60 hours

Outcomes:

- To learn the basic concepts of structure and functionality of thermodynamics and biology.
- To understand the various aspects of electrochemical phenomena.
- To familiarize the role of essential and trace metal ions in human body.
- To know the concepts of coenzymes, carboxy peptidase and superoxide dismutase.
- To learn the role of hemoglobin and myoglobin functions in human body.
- To understand what is non-heme oxygen carriers.
- To know the various types of nitrogen fixing microorganisms and biological redox reactions.
- To learn the concepts of bio analytical chemistry.

TEXT BOOKS:

1. K.F. Purcell and J.C. Kotz, Inorganic Chemistry, W.B. Saunders Co., 1977.
2. G. N. Mugherjee, Arabinda Das, Elements of Bioinorganic Chemistry,1993.
3. M. Satake and Y.Mido, "Bioinorganic Chemistry", Discovery Publishing House, New Delhi,1996.

REFERENCE BOOK:

1. G. Eichron, Inorganic Bio-chemistry Vol. I and II, Elsevier, 1973.

		L	T	P	C
15MGC119	**SYNTHETIC ORGANIC CHEMISTRY**	**4**	**0**	**0**	**3**

Objectives:

To understand, electrocyclic reaction, sigma tropic rearrangement, photochemistry synthon, robinson ambulation, synthesis of carbene..

UNIT – I Electro cyclic reactions 12

Electro cyclic reactions – definition, classification, M.O treatment, FMO- PMO - correlation diagram treatment with example. Application of electro cyclic reactions in organic synthesis. Cyclo addition reactions – classification – definition.

UNIT – II Sigma topic rearrangement 12

Sigma topic rearrangement – Hydrogen migration [1,3],[1,5]&[1,7] definition, classification, FMO-PMO treatment and correlation diagram.Hydrogen migration in cyclic system like cyclopentadiene, Indene cyclohepta trienes. Sigma topic rearrangement involving methyl group and chiral groups. Sigmatopic rearrangements in cope & Claisen reactions – FMO&PMO treatment. Degenerates molecules, Fluxional molecules, application of sigma topic rearrangement in organic synthesis.

UNIT – III Photo chemistry 12

Photo chemistry – Introduction to photochemistry.cyclisation reaction and ring opening of 1, 3 Butadiene, 1, 3, 5 hexatriene systems. Jablonski diagram - Norish I & Norish II reaction, quantum yield. Primary & Secondary, photochemical reactions, Rearrangement – Paterno – Buchi reaction. Barton reaction di-pi methane rearrangement, Photo reduction of ketones.

UNIT – IV Retrosynthetic Analysis 12

Synthon, C-C, C = C bond formation by various method. (Aldol, Michael, Peterson, Shapiro, Wittig, Benzoin, Robinson annulations, Deick Mann condensation. Synthesis of enamines and their applications.

UNIT – V Reagents in Organic Synthesis 12

Reagents in organic synthesis: metal hydrides, Lithium dimethyl cuprates, LDA, 1, 3 dithione, trimethyl silyl iodide, 9BBN, DCC.

Synthesis of cubane, 5- hexenoic acid, Bicyclo [4, 1, 0] heptanes -2-one.

TOTAL: 60 hours

Outcomes:

- To understand the definition, classification, applications and example of M.O, FMO and PMO.
- To know the classification and definition of cycloaddition reactions.
- To learn what is sigma topic rearrangement with definition and classification.
- To familiarize the various sigma topic rearrangement involving methyl, chiral, cope and claisen reactions along with their applications.
- To introduce the concept of photochemistry in organic chemistry.

- To know the Norish I and Norish II reactions.
- To learn the synthon of C-C and C=C bond formation by various method
- To familiarize the various reagents used in organic synthesis

TEXT BOOKS:

1. R.O.C. Norman, Chapman and Hall, "Principles of Organic Synthesis" London, 1980.
2. Francis A. Carey and Richard J. Sundberg, "Advanced Organic Chemistry-Part B", 3rd Edition1990.
3. S.M. Mukherji and S.P. Singh, "Organic Reaction Mechanism", Macmillan India Ltd.,1990.
4.

REFERENCE BOOKS:

1. Micheal Smith, Organic synthesis, Elsevier Inc,third edition, 1946.
2. Mc. Murray, Advanced Organic Chemistry, Thomson Pvt. Ltd,1980.

		L	T	P	C
15MGC120	**STRATEGIC MANAGEMENT OF PHARMA INDUSTRY**	**4**	**0**	**0**	**3**

Objectives:

To know about pharma industry, technology opportunity for innovation, project evaluation, intellectual property protective and business strategy.

UNIT I Introduction and Technology Evolution 12

Pharma industry-Specifics, Importance and role in health sector; the Global scenario and Positioning of Indian Pharma industry ; Specific challenges of the Pharma industry versus the general industrial matrix; Understanding technological change; Need for technology strategy as step towards innovation and competitive advantage; Defining technological innovation and benefits.

Technology S- curves and management; Number of firms in the industry, Process obsolescence and Reverse Engineering; Innovative synthetic routes and atom economy dovetailing aspects of Green chemistry; Technology adoption and diffusion; Forecasting demand and confronting substitution.

UNIT II Opportunity for Innovation 12

Technological, Political and Regulatory changes, Diversification, Demographic changes; Research and Development (R&D); Investment in R&D and return on investment – a profit centre; Linking of Research and Development for leverage; Cost reduction exercises.

UNIT III Project evaluation 12

Managing uncertainty, Analytical hierarchy process, Net Present Value(NPV), Internal Rate of Return(IRR), scenario analysis and decision tree; Portfolio Management, customer-friendly solutions; Product pricing ; Market segmentation and market research.

UNIT IV Intellectual Property Protection 12

Role of IP protection in knowledge era; Patents- process and Product and the patenting process; Lead molecule development and cost; ANDA; Patent litigation; Non-disclosure agreement; Expiry of patents and generic drugs marketing and issues in IP.

UNIT V Business strategy 12

Networking; Joint venturing; Licensing; Contract manufacturing; Outsourcing; Human resource management of technical professionals- R&D personnel, Product Development team, Cross-Functional team, Internal communication, Organization structure-decentralizing R&D, acquisitions.

TOTAL: 60 hours

Outcomes:

- To know the various pharma industry and their role in health sector.
- To understand technological change, innovation and benefits.
- To learn the evolution in technology.
- To understand how to invest in R and D and its return on investment.
- To familiarize the evaluation of project.
- To know the role of IP protection in knowledge era.
- To understand the expiry of patents, generic drugs marketing and issues in IP.
- To know the strategy involved in business.

TEXT BOOKS:

1. Technology Strategy For Managers And Entrepreneurs-Scott Shane, Ind .ed. Dorling Kindersley India Pvt. Ltd. , 2009.
2. Entrepreneurship and Small Business Management-C.B.Gupta and S.S.Khanka, Sultan Chand & Sons, New Delhi, 2012.

REFERENCE BOOK:

1. Jean Michel Peny, Pharma Market insight and strategy, Smart Pharma Consulting, First edition, 2013.

Syllabus

Generic Elective Courses

		L	T	P	C
15SSK151	**SOFT SKILL I**	**1**	**0**	**1**	**2**

Objectives:

The ability to create an open environment for communication
An understanding of other people communication styles and needs
To create an environment for open discussion and ongoing dialogue is crucial for communication success.

UNIT–I: Reading Comprehension and Vocabulary **08**

Definitions of reading - types of reading - oral reading – silent reading - reading process - classification of reading - nature of reading - Filling in the blanks - Close Exercises - Vocabulary building - Reading and answering question

UNIT-II: Listening and Answering Question **08**

Listening process – speaker – hearer - types of listening - transitional listening -critical listening - recreational listening - listening for appreciation - selective listening - intensive listening- extensive listening - listening and sequencing sentences - filling in the blanks – listening and answering questions

UNIT-III: Group Discussion **08**

Introduction - Why GD Part of a selection process - Structure of a GD-Strategies in GD - Team work – body language - Debating various points of views - interaction with peers.

UNIT-IV: Conversations **08**

Introducing oneself and others, narrating events - making telephonic conversation - Giving instruction - Giving instruction- Expressing purposes and functions- obligation and preferences, Accepting offers and Counselling Face to face Conversations

UNIT-V: Self – Introduction and Role Play **08**

Introduction self and greetings- asking for information- offerings- requisitions- inviting –vocabulary building- asking for description

Total : 40hours

Outcomes:

- Cloze exercises provide support to build vocabulary
- Sense of logic develops from sequencing sentences
- Group discussion infuses team spirit and sense of competition
- Face to face and telephone conversation builds up self confidence
- Self introduction and role play facilitate cultivation firmness of mind and empathy
- Comprehension enhances creative skills
- Listening regenerates transformation empathetically
- Implementation of assertive thoughts can be acquired through writing skills
- Body language enhances personality grooming
- Reading enhances stylish accent productivity

TEXT BOOKS:

1. Barun K. Mitra, “Personality Development and Soft Skills”. Oxford University Press. New Delhi. 2011.
2. S.P. Sharma, “Personalilty Development”, Pustaq Mahal. New Delhi. 2010.

REFERENCE BOOKS:

1. Meenakshi Raman and Sangeetha Sharma, “Technical Communication”, Oxford University Press. New Delhi, 2009.
2. A.S. Hornby: "Oxford Advanced Learner's Dictionary of Current English", Oxford University Press, 2007

L T P C

15SSK152 SOFT SKILL II 1 0 1 2

Objectives:

To provide basic information about presentation skill and train the students for letter writing, creation of resume and develop the interview skills.

To provide information about the Process, types and patterns of communication

UNIT I: Presentation Skills 08

General presentation methods and developing presentation skill

UNIT II: Soft skills (Time Management, Stress Management and Body Language) 08

Time management: Importance, Plan and Execution, Default reason and rectification methods

Stress Management: Stress Impacts over Efficiency and how to manage.

Body Language: Its importance and need

UNIT III: Resume / Report / Letter Writing 08

Resume: Basic components of a resume, Preparation of a resume, Types of resume

Report: How to prepare reports, reports components and structure

Letter writing: types of letters, framing letters, basic structure, how to draft a letter

UNIT IV: Frequently asked Questions 08

UNIT V: Interview Skills 08

Aims of Interview expectations and how to fulfill, developing skills

TOTAL: 40hours

Outcomes:

- Self introduction and role play facilitate cultivation firmness of mind and empathy
- Group discussion infuses team spirit and sense of competition
- Listening regenerates transformation empathetically
- Cloze exercises provide support to build vocabulary
- Implementation of assertive thoughts can be acquired through writing skills

- Body language enhances personality grooming
- Reading enhances stylish accent productivity
- Face to face and telephone conversation builds up self confidence
- Sense of logic develops from sequencing sentences
- Comprehension enhances creative skills

TEXT BOOKS:

1. Barun K. Mitra, "Personality Development and Soft Skills". Oxford University Press. New Delhi. 2011.
2. S.P. Sharma, "Personalilty Development", Pustaq Mahal. New Delhi. 2010.

REFERENCE BOOKS:

1. Meenakshi Raman and Sangeetha Sharma, "Technical Communication", Oxford University Press. New Delhi, 2009.
2. A.S. Hornby: "Oxford Advanced Learner's Dictionary of Current English" Oxford University Press, 2007

		L	T	P	C
15MGC151	**GREEN CHEMISTRY**	**2**	**0**	**0**	**2**

Objectives:

To train the students to use eco-friendly approaches in synthesizing agro-based chemicals viz. insecticides, fungicides, herbicides, bactericides acaricides, weedicides
To emphasize green chemistry approach in crop protection which help to reduce global warming.

UNIT- I Introduction **08**

Current status of chemistry and the Environment-Evolution of the Environmental movement: Public awareness - Dilution is the solution to pollution-Pollution prevention

UNIT- II Green Chemistry **08**

Definition – Principles of Green Chemistry - Why is this new area of Chemistry getting to much attention - Why should chemist pursue the Goals of Green Chemistry - The roots of innovation – Limitations

UNIT- III Green Chemistry using Bio Catalytic Reactions 08

Introduction - Fermentation and Bio transformations - Production of Bulk and fine chemicals by microbial fermentation- Antibiotics – Vitamins - Bio catalyses synthesis of industrial chemicals by bacterial constructs - Future Tends.

UNIT-IV Green House Effect and Global Warming 08

Introduction - How the green house effect is produced - Major sources of green house gases - Emissions of CO_2 - Impact of green house effect on global climate - Control and remedial measures of green house effect - Global warming a serious threat - Important points

UNIT-V Future Trends in Green Chemistry 08

Green analytical methods, Redox reagents, Green catalysts; Green nano-synthesis, Green polymer chemistry, Exploring nature, Biomimetic, Proliferation of solvent-less reactions; Non-covalent derivatization, Biomass conversion, emission control.

TOTAL: 40hours

Outcomes:

- To understand the connection between common atoms and complex molecules
- To explain and analysing simple chemical reactions
- To distinguishing between recyclable and non-recyclable materials
- To assessing the potential impact of chemical reactions to environment and human health
- To understand the connection at the chemical level between all matter and will develop your inquiry based activities to explore best practices related to organic farming and resource management.
- To about the advance technology in green chemistry
- How they impact the human body, to develop your particular interests on the topic.
- To describe how Green chemistry and sustainability developments affect society, the environment,and economic development
- To explain how Green chemistry and sustainability relates to problems of societal concern

TEXT BOOKS:

1. M. Lancaster, "Green Chemistry: an Introductory Text", RSC, 2002
2. Sheldon, Arends, Hanefeld, "Green Chemistry and Catalysis", Wiley, New York, 2007.

REFERENCE BOOKS:

1. Anastas & Warner, Green Chemistry : Theory & Practice ,Oxford Univ. Press,New York, 1998.
2. S. E. Park, J. S. Chang, S. H. Jhung, "The Role of Catalyst for Green Chemistry", Chemworld, Vol. 44 (8), 38, 2004.

		L	T	P	C
15MGC152	**CHEMINFORMATICS**	**2**	**0**	**0**	**2**

Objectives:

Students completing this paper should be able to understand concepts of molecular chemistry that are basic to cheminformatics.
This course will train the students to use QSAR, docking etc.

UNIT- I Mathematics Process 08

Graph theory and molecular numerology; Logic, sets and functions; Algorithms, integers and matrices; Mathematical reasoning, induction and recursion; Counting; graphs, trees and sets, basic probability and statistics; Markov processes

UNIT- II Basics of Stereochemistry 08

Basic Stereochemistry, Amino acids and Proteins and Properties; pKa, pH and ionization of acids and bases; Protein structure - Primary structure, Secondary structure - helix & sheet; Tertiary structure; Quaternary structure; covalent and non-covalent forces that maintain structures.

UNIT- III Chem Information 08

History of scientific information communication-chemical literature-chemical information-chemical information search-chemical information sources-chemical name and formula searching-analytical chemistry-chemical history-biography-directories and industry sources

UNIT- IV Biological Databases 08

Introduction; Experimental sources of biological data; Publicly available databases; Gene expression monitoring; Genomics and Proteomics; Metabolomics; Visualisation of sequence data; Visualization of structures using Rasmol or SPDB Viewer or CHIME; Genetic basis of disease; Personalised medicine and gene-based diagnostics.

UNIT- V Drug Design 08

Introduction to drugs, structure-based drug design. QSAR and 3D-QSAR Methods. Pharmacophore Design, Ligand-Based Design and *De Novo* Drug Design Virtual screening/docking of ligands. Protein structure, Drug action & enzymes. Drug action &

receptors. Prediction of Binding Modes, Protein–Ligand binding free energies, Fragment-Based Drug Design, ADMET prediction.

TOTAL: 40hours

Outcome:

- To understand basis of group theory and its applications
- To study Logics, sets and functions
- To get a clear idea on the principles and theories of algorithms, induction Basics and process of photosynthesis
- To understand the Basics of stereochemistry and structure of proteins
- To study History of science and chemical information
- To discuss the biological database and Gene expression
- To visualize the structure of different biological structures
- To understand the genetic basis of diseases
- To get a clear knowledge about drugs and their structure and functions
- To study drug actions and enzymes

TEXT BOOKS:

1. P. Shanmughavel, “Principles of Bioinformatics”, Pointer publishers, 2005.
2. Arfken, "Mathematical Methods for Physicists" Academic Press, 1985
3.

REFERENCE BOOKS:

1. P. Shanmughavel, “Trends in Bioinformatics”, Pointer publishers, 2006
2. Francis A. Carey and Richard J. Sundberg, “Advanced Organic Chemistry-Part A & B” Third Edition, 1990

		L	T	P	C
15MGC153	**INTRODUCTION TO NANOSCIENCE AND NANOTECHNOLOGY**	**2**	**0**	**0**	**2**

Objectives:

Impart the basic knowledge on nanoscience and technology.
Understand the various process techniques available for the processing of nanostructured materials.
Impart knowledge on the exotic properties of nanostructured materials at their nanoscale lengths.
Acquire the knowledge above the various nanoparticles process methods and their skills.
Study the reactive merits of various process techniques.

UNIT-I Introduction 08

Definition of a nano system – Basic concepts of nanoscience and technology - Scientific revolutions of nanotechnology - atomic & molecular size – Time and length at nanoscale - Scope of nanoscience and technology – Commercial Applications of Nanotechnology.

UNIT-II Nanostructures and Dimensions 08

Definition of Nanostructure materials - Classification of nanostructures - zero, one, two and three dimensional nanostructures. Size Dependency in Nanostructures -quantum size effects in nanostructures.

UNIT-III Nanomaterial Synthesis 08

Synthesis of nanomaterials - top down and bottom up approach -Method of nanomaterials preparation – Physical methods – Inert gas condensation and evaporation, chemical synthesis - sol-gel and chemical reduction – Biological methods – nanoparticles using plant extracts, bacteria, fungi etc.

UNIT-IV Nanomaterial Properties 08

Surface properties of nanoparticles - Surface to volume ratio- mechanical - optical, - electronic – magnetic - thermal and chemical properties of nanomaterials. Size dependent properties-size dependent absorption spectra - self-assembly in nanotechnology - Types of SAMs, Methods of self-assembly, Applications of self assembled monolayers

UNIT-V Applications of Nanomaterials 08

Applications of metal nanoparticles in technologically imperative fields like sensors,- - Nanomaterials for energy storage - Batteries and fuel cells - photovoltaic devices -solar cells - optical memory devices - Quantum nanoelectronic devices -quantum computing.

TOTAL: 40hours

Outcomes:

- To learn about the definition of a nano system and the basic concepts of nanoscience and technology
- To understand the Scientific revolutions of nanotechnology.
- To know about the Scope of nanoscience and technology and commercial applications of Nanotechnology
- To familiarize the Classification of nanostructures, Size Dependency in Nanostructures and quantum size effects in nanostructures.
- To learn about the Synthesis of nanomaterials
- To learn the surface properties of nanoparticles
- To know about the Methods of self-assembly and applications of self assembled monolayers.
- To know the detail study of Applications of metal nanoparticles in technologically imperative fields

TEXT BOOKS:

1. C. P. Poole and J.F. Owens, "Introduction to Nanotechnology", Wiley Interscience, 2003.
2. M. A. Ratner. and D. Ratner, "Nanotechnology: A Gentle Introduction to the Next Big Idea", Prentice Hall PTR, First Edition, 2002.
3. T. Pradeep, "Nano: The Essential Nanoscience and Nanotechnology", Tata McGraw hill, 2007.

REFERENCE BOOKS:

1. G. Cao, "Nanostructures & Nanomaterials: Synthesis, Properties &Applications", Imperial College Press, 2004
2. C. N. R. Rao, A. Muller and A. K. Cheetham, "The Chemistry of nanomaterials: Synthesis, Properties and Applications", Wiley-VCH verlag GmBH & Co.KGA, 2004.

		L	T	P	C
15MGC154	**FOOD CHEMISTRY AND ADULTERATION**	**2**	**0**	**0**	**2**

Objectives:

To understand the basic information of food chemistry and adulteration.
To appreciate the importance of food additives and pesticide control.
To provide an information about food preservatives

UNIT-I Introduction 08

Food: source, functions of food – food groups – food guide – basic five food groups, usage of the food guide – food in relation to health – objectives of cooking.
Water: Purification processes – Ion exchangers, reverse osmosis, activated charcoal treatment - Use of chlorination, ozone, and UV light disinfection. Specification of drinking water.

UNIT-II Constituents of Foods 08

Carbohydrates: Classification, Principles involved in the analysis of carbohydrates – estimation of carbohydrates.

Proteins: amino acids – peptides - Analysis of proteins – Separation of amino acids by paper chromatography.

Minerals and vitamins: Sources, functions, deficiency of the following minerals (calcium, iron, iodine, fluorine, sodium and potassium (elementary treatment). Vitamins - classification, sources, Vitamins – A, D, E and K, C, B Complex, - B6 & B12.

UNIT-III Food Additives 08

Artificial sweeteners – saccharin, cyclomate, asparatame – food flavours – esters, aldehydes and heterocyclic compounds. Antioxidants. Food colours – changes in cooking..Restricted use. Spurious colours. Emulsifying agents, preservatives – leavening agents. Baking powder – Yeast. Taste enhancers – MSG-vinegar

UNIT-IV Pesticides Control 08

Spoilage of foods by insects and pests, loss in food quantity and quality Various pesticides used in agriculture and post-harvest storage, uses of pesticides for food grain application.

UNIT-V Food Adulteration 08

Common adulterants in different foods – milk and milk products, vegetable oils, and fats, spices and condiments, cereals, pulses, sweetening agents and beverages. Contamination with toxic chemicals – pesticides and insecticides. .

TOTAL: 40hours

Outcomes:

- To know about the basic criteria of food and water standards for consumption
- To get a basic idea about the chemical constituents of food
- To learn about the various food additives, their chemical composition and their permissible level of usage in foods.

- To know about the various organisms which spoil the crops pre and post harvest and their control using pesticides
- To know about the various food adulterants for different types of food and methods to detect those adulteration.

TEXT BOOKS:

1. Owen.R. Fennema, Food Chemistry, Marcel Decker Inc., New York. 1996.
2. M. Swaminathan, Text Book on Food chemistry, Printing and Publishing CO., Ltd., 1993.

REFERENCE BOOKS:

1. B. Siva Sankar, Food Processing and Preservation, Prentice – Hall of India Pvt. Ltd., New Delhi, 2002.
2. S. Ramakrishnan, K. G. Prasannam, R. Rajan, Principles - Text book of medical biochemistry, Orient Longman Ltd., Third Edition, 2001.

		L	T	P	C
15MGC016	**PROJECT WORK/REVIEW**	**0**	**0**	**22**	**12**

Objectives:

To learn about the basic concept of project work. To know about designing new experiments and carry out the experiments. To know about the various characterization techniques used to characterize the synthesized compounds. To know about the necessities of literature survey and to learn about writing dissertation of project work.

NOTE

1. Review of Chemical literature and documentation.

2. During the fourth semester the project work may be carried out either in industries/ National laboratories/R & D centers/in the university lab.

TOTAL: 22hours

Outcomes:

- To identify the topic with the consideration feasibility.
- To learn the procedure of literature survey of the concered topic.
- To derive a plan for executing the work in the stipulated time with maximum efficiency and success.
- The intensive exposure to industry as a first time experience.
- Understanding different sectors of an industry and the functionaries of each sector.
- The importance of R&D section and the key role
- Understanding and learning various technical and safety aspects of the concerned topic related work.
- To learn the difference between conventional department laporatory and its nature of work and R & D laboratory of research instistitue or industry.
- To learn, adapt, and practice the extensive bench work in a research laboratory or industry.
- To prepare a dissertation report with complete follow up of research methodology.