



Department of Chemistry School of Basic Sciences

M.Sc Industrial Chemistry

Program Specific Outcome

After completion of this program the candidate will be :

PSO1: To equip the chemistry graduates to be placed in various sectors of different industries having chemistry background.

PSO2: To facilitate the students to be an entrepreneur for small industries

PSO3: To make the students know various technical skills in IC.

PSO4: To understand managerial skills simultaneously with IC skills.

PSO5: To learn supply chain management of manufacturer end to customer end.

PSO6: To learn the basic principles of human resource management and marketing management.

PSO7: To learn various parameters of quality control and quality assurance in the chemical industrial.

PSO8: To learn the in depth concepts of paint chemistry and fibre, Dye, fuel and other allied synthetic products.

PSO9: To understand the overall background of chemical industries.

PSO10: To create a post graduate of job giving rather than job seeking.



M.Sc
Industrial Chemistry

Curriculum and Syllabus
(Based on Choice based credit system)
2016 – 2017

Department of Chemistry
School of Basic Sciences

MSC INDUSTRIAL CHEMISTRY CURRICULUM Total No. of credits: 90

Category	Code	Course	Hour/Week			Actual Credits
			Lecture	Tutorial	Practical	
SEMESTER-I						
CORE	16CMIC11	Dye Chemistry	5	0	0	4
CORE	16CMIC12	Chemistry of fuels	5	0	0	4
CORE	16CMIC13	Organic name reactions and synthesis of reagents	5	0	0	4
DSE		Discipline Specific Elective- I	4	0	0	3
DSE		Discipline Specific Elective- II	4	0	0	3
GE	16SPGE11	Soft skill - I	1	1	0	2
CORE	16PMIC11	Practical-I Organic Chemistry	0	0	5	3
			24	1	5	23
SEMESTER – II						
CORE	16CMIC21	General Chemistry	4	0	0	3
CORE	16CMIC22	Chemistry of Fibres	4	0	0	3
CORE	16CMIC23	Quantitative methods in Business	4	0	0	3
DSE	16DMIC21	Human Resource management	4	0	0	3
GE	16SPGE21	Soft skill - II	1	1	0	2
GE	16PGE501	Generic Elective -III	2	0	0	2
CORE	16PMIC21	Practical-II Inorganic chemistry	0	0	5	3
CORE	16PMIC22	Practical-III Industrial chemistry	0	0	5	3
CORE		Internship	0	0	0	2
			19	1	10	24
SEMESTER – III						
CORE		Paint Chemistry	5	0	0	4
CORE		Analytical Techniques	5	0	0	4
CORE		Operations Management	4	0	0	4
DSE		Discipline Specific Elective- IV	4	0	0	3
DSE		Discipline Specific Elective- V	4	0	0	3
GE		Generic Elective - IV	2	0	0	2
CORE		Practical III Physical Chemistry	0	0	6	3
			24	0	6	23
SEMESTER – IV						
CORE		Synthetic Organic Chemistry	5	0	0	4
DSE		Discipline Specific Elective- VI	5	0	0	4
CORE		Project	0	0	24	12
			10	0	24	20
TOTAL			77	2	45	90

List of Discipline Specific Elective Courses

SL.No.	Subject Code	Title of the Paper
1.	16DMIC11	Principles of Management
2.	16DMIC12	Management Information System
3.	16DMIC21	Human Resource Management
4.	16DMIC31	Polymer Chemistry
5.	16DMIC32	Marketing Management
6.		Natural products
7.		Nuclear and photochemistry
8.		Organometallic Chemistry and Photochemistry
9.		Stereochemistry and Reaction Mechanism
10.		Novel materials and green industrial catalysis
11.		Electrochemistry and Group Theory
12.		Inorganic Chemistry
13.		Pharmaceutical Formulation Technology
14.		Strategic Management of Pharma Industry.
15.		

List of Generic Elective Courses

SL.No.	Title of the Paper
1.	Soft skills – I
2.	Soft skills - II
3.	Green Chemistry
4.	Chem informatics
5.	Introduction to nanoscience and nanotechnology
6.	Food Chemistry and Adulteration

16CMIC11

DYE CHEMISTRY**Objectives:**

To study the history of dye, synthesis of dyes, classification of dyes and colouring of dyes.

Unit 1 History and classification of Dye**15**

History of dye stuff-role of color-indigo-purple of the ancient natural mordant dye-era of synthetic dyes- diazotization - reactive dyes -colour and constitution-chromophores-auxochromes-bathochromic groups- hypochromic group- V B approach of colours - steric effect and color.

Classification of dyes according to constitution to applications - classification of textile chemicals - surface active agents, non-surface active agents – Dye stuff intermediates. Basic chemicals – induction of different substitute – sulfanilic acids – naphthalene mono and disulphanilic acid – nature of compounds – reduced and halogenated compounds – alkali function, Diazotisation.

Unit II Synthesis of Dyes**15**

Synthesis of the following dyes – Methyl orange II – Naphthol blue, Bismark brown, para red, Malachite green – Magenta , phenol red, eosin, saframine, acridine yellow, quinoline blue, alizarin, copper pathalocyanin. General properties of dye stuff - Linearity – co-planarity – Fastness properties

Direct cotton dyes (substantive dyes) – properties – structure of direct dyes – mechanism of dyeing – fibre bond – effect of electrolyte – effect of temperature – classification of direct cotton dyes, dissolution of direct dyes – after treatment of dyeing – development of dye fixing agents-treatment with copper salts treatment with chromium compounds - topping with basic dye - absorption of basic dyes with cellulose .

Unit III Characterization of Dyes**15**

Acid dyes – classification - chemical constitution of some dyes - molecularly - split acid dyes - aggregated acid dyes - leveling dyes - milling dyes - characteristics and trade names - mechanism of dyeing effect of electrolyte and temperature - bath assistants. Basic dyes - characteristics - dissolution - chemical class - nature of affinity on cellulose and protein fibres, Mordants etheno mordants Mordant dyes - formation of chromium complexes - trade names - methods of application - chrome processes – chromosol processes - metal complexes dyes – constitution of ingrain dyes - dyeing mechanism - stripping.

Unit IV Dyes type -I

15

Azoic colours - Azoic coupling – combination shades with azoics – protective colloids – electrolytes stabilisation of diazonium salts – complex salts of diazonium compounds – established diazo compounds – anti diazoamine compounds stabilizers – diazomine compounds - mono sulphonic acids.

Vat dyes – indigo fermentation of vat – zinc lime vat - hydrosulphite vat – commercial vat dyes – properties – trade names – particle size – reduction potential – effect of pH on colour under different conditions.

Sulphur dyes – general methods of manufacture – chemical nature – classification.

Unit V Dyes type-II

15

Disperse dyes – ion amines – disperse acetate dyes – chemical structure – dispersion process – function of the dispersing agents – dyeing processes – fibres swelling in dyeing – uses of carriers – heat energy in dyeing properties of carriers and trade names.

Reactive dyes - reactive systems – constitutional aspects – acrylamide dyes – reactive mordant – evidence of chemical bond - the site of reaction – solubility of fiber linkage – main and side reaction .

Miscellaneous dyes – oxidation colours – fluorescent brightening agents – application on cellulose fibres – polyamide fibres – polyester fibres – acrylic fibres – toxicity of fluorescent brighteners.

Non textile use of dye stuff – leather dyeing – paper dyeing – food colour – solvent dyes – hair dyes – miscellaneous – face powder – lipstick.

Total: 75 hours

Outcomes:

- To know about history of dyes
- To familize about types of dyes
- To learn about synthesis of various dyes
- To study about the mechanism and treatment of dyeing
- To understand the types, Characteristics of acid and basic dyes
- To know the Mordant dye and studies related to chromium complexes
- To study on Azo compound dyes
- To understand the fundamental and properties Vat dyes
- To learn about nature and types of sulphur dyes
- To know the structure, properties and function of Disperse dyes
- To learn the reactivity and bonding of Reactive dyes
- To study the fibers and various industrial dyeing process

Reference Books:

1. V.A. Shenai – Principles of Dyeing & Technology of Dyeing - Sevak publication.
2. C.L. Bard – Theory & Practice of Wool dyeing - SDC – Yorkshire.
3. K.V.Datye – Processing of synthetic fibres – John Wiley

4. E.R. Trotmann – Dyeing & Chemicals Technology of Textile fibres. Charles Griffins.
5. S.R. Cockett - Dyeing & printing - Pitman publishers

L T P C

16CMIC12

CHEMISTRY OF FUELS

5 0 0 4

Objectives:

To study of fuels, classification of fuels, refining of gasoline and analysis of gases by gas chromatography

Unit I Classification of fuels

15

Classification of fuels – Solid, liquid and gaseous fuels - sampling procedure- Type of fuels - Characteristic of a good fuels, Types of fossil fuels. Solid fuels, origin - classification of coal by rank - Analysis of coal-Ultimate and Proximate analysis-Volatility - ash content-Moisture content (Dean and Stark Method) - significance of these parameters for industrial applications-Metallurgical/Boiler/Thermal power plants. Calorific value of solid fuels by bomb calorimeter.

Unit II Liquid fuels

15

Liquid fuels-petroleum-origin of petroleum-classification-refining of crude oil-cracking-thermal & catalytic cracking-process. Details and advantages - fractional distillation - extraction & azeotropic distillation-products-gasoline-kerosene, diesel and waxes-various grades of gasoline-aviation fuel-jet fuels and their uses.

Unit III Characteristics of Fuels

15

Refining of gasoline-octane number-improvement of antiknock properties-diesel oil- cetane number-significance-kerosene as a fuel-liquid fuels-characterisation-determination of viscosity by redwood viscometer, Saybolt viscometer - flash point, fire point, aniline point, pour point, cloud point, carbon residue - determination of these characteristics and their significance in assessing the quality of liquid fuels - calorific value-determination

Unit IV Gaseous fuels

15

Gaseous fuels-producer gas, water gas, coal gas, LPG, bottled gas, bio gas, Gobar gas, composition, production and uses- determination of calorific value- gas analysis -chemical analysis of constituents - Hempel and Orsat methods - portable kits - brief description.

Unit V Analysis of Fuels

15

Analysis of gases, petrol, kerosene by gas chromatography - IR study- a brief description (introductory level).

Total: 75hours

Outcomes:

- To study the different classification of fuel
- To learn the various analysis methods namely Ultimate and Proximate
- To understand the various types of refining process
- To learn the different grades of gasoline
- To familiarize the various properties of liquid fuel
- To learn the determination of calorific value of liquid fuel
- To understand the various types of gaseous fuel
- To know the various properties of gaseous fuel
- To learn the determination of calorific value of gaseous fuel by Hempel and Orsat method
- To learn the spectral analysis of different fuels by IR and Gas chromatography

Reference Books:

1. An introduction to the study of fuel by J.C. Macrae, Elsevier publishing company, 1966.
2. Fuels and fuel burners by Kalman Steiner, First edition, 1946.
3. Fuel-solid-liquid and gaseous by J.S.S.Brame, J.G.King sixth edition, revised by Dr. J.G. King.
4. Fuels and their combustion by Haslam of Russell, 1925.
5. Chemistry of petroleum hydrocarbons by Brooks- BT et-al, Vol.1, 1954.
6. Modern petroleum technology, third edition, published by the institute of petroleum, 1962.
7. Methods of analysis for petro chemicals by Littmann (ER) edition.
8. IP standards for petroleum and its products part-1- Methods for analysis and testing, 34th edition, 1975.
9. Petroleum refinery distillation, II edition by R.N. Watkins
10. Fuel and Fuel technology by Francis (W)
11. Technical gas and fuel analysis by Alfred H. white, II edition, McGraw-Hill Book company, INC, 1920.
12. Encyclopedia of Industrial chemical analysis, Vol. II, edited by Foster Dee Snell and Elifford L. Hilton, Interscience publishers, 1966.

16CMIC13 ORGANIC NAME REACTIONS AND SYNTHESIS OF REAGENTS 5 0 0 4**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, Hilman's 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: 60 hours

Outcomes:

- To learn Aldol, Cannizzaro, Claisen ester condensation reactions
- To understand Dieckmann, Dakin, HVZ, Stephen reactions
- To study about Organic reaction and its oxidation process
- To familize Organic reactions and its reduction process
- To gain knowledge related to synthesis of various organic reagents
- To know Organic reagents and its applications

- To learn Organic synthesis using various organic reagents
- To understand studies on functional group transformations

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

16PMIC11 PRACTICAL - I ORGANIC CHEMISTRY

0 0 5 3

Objectives:

To study the qualitative analysis and estimation of simple organic compounds.

I. QUALITATIVE ANALYSIS OF SIMPLE ORGANIC COMPOUNDS

1. Identification of carboxylic acids,
2. Esters,
3. Phenols,
4. Amines,
5. Nitro compounds,
6. Ketones,
7. Aldehydes,
8. Carbohydrates,
9. Urea,
10. Thiourea.

II. ESTIMATION OF ORGANIC COMPOUNDS

1. Estimation of Phenol
2. Estimation of aniline
3. Estimation of glucose
4. Estimation of methyl ketone
5. Estimation of aldehydes / ketone
6. Estimation of vinegar
7. Estimation of vitamin -C

Total: 60 hours

Outcomes:

- To understand different functional groups
- To identify organic compounds based on appearance and odour
- To introduce various reagents and their respective reactions in identify functional groups
- To distinguish one functional group from other
- To acquire professional skills in identifying functional groups
- To learn quantitative methods of organic compounds
- To introduce back titration in estimation of analyte
- To equip with apparatus handling in estimation

Text Book:

1. Gnanaprakasam, Ramamurthy, "Organic Chemistry Lab Manual" S. Viswanathan Pvt. Ltd. 3rd edition **2011**

Reference Book:

1. Vogel's – "Textbook of qualitative organic Analysis", Longmann, 12th edition, **2011**

16CMIC21**GENERAL CHEMISTRY****L T P C
5 0 0 4****Objectives:**

To study the chemical kinetics, photochemistry and atomic structure. To know the common drugs used in the home, prevention and control of adverse reactions from drugs.

Unit I Chemical Kinetics**15**

Expression for rate of reaction – rate constant, order and molecularity of a reaction- differential and integrated forms of rate expressions for first, second and zero order reactions- examples- time for half change for first and second order reactions- Experimental methods of determining order of reactions- pseudo unimolecular reactions- examples- Experimental determination of rate constants of inversion of cane sugar and alkaline hydrolysis of esters

Unit II PhotoChemistry**15**

Beer- Lambert's law, Stark- Einstein's law- Primary and secondary processes- Quantum yield- Experimental determination of quantum yield- Kinetics of decomposition of HI, combination of H₂ and Cl₂ – Photochemical equilibrium- Jablonsky diagrams- Fluorescence- phosphorescence- thermo luminescence – chemiluminescence- photosensitization.

Unit III Atomic Structure 15

Structure of the atom- Dalton's theory- Rutherford's model- Bohr's model-mass number- Sommerfeld's extension of Bohr's theory-Heisenberg's uncertainty principle- Dual character of electron- Debroglie wave equation- Quantum numbers. The periodic table- the long form of the periodic table- electronic configurations of element- division of element into s,p,d,f blocks. Atomic properties.

Unit IV Metals and metallurgy 15

Metals and metallurgy: Various steps involved in metallurgy Nuclear Chemistry: The nature of the nucleus, nuclear forces, packing fraction, mass defect, nuclear fission- fusion reactions. Experimental evidences. Calculation of Q values. Artificial radio activity.

Unit V Pharmaceutical Chemistry 15

Common drugs and medicines used in the home: Antibiotics -sulpha drugs - antiseptics - disinfectants - analgesics -hypnotics -sedatives - tranquillizers remedies for common cold, influenza and other viral diseases - laxatives - burn preparations - indigenous drugs - drugs in combination - prevention and control of adverse reactions from drugs.

Total: 75 hours

Outcomes:

- To determine the factors that affect the rate of chemical reactions using collision theory
- To understand the concept of reaction mechanism and the rate law for the reaction
- To learn about different laws of photochemistry.
- To understand the kinetics of decomposition
- To familiarize with the structure of the atom and its atomic properties
- To learn the periodic table and detailed study of the elements present in it
- To understand the nuclear fusion and fission mechanism
- To learn the different kinds of drug and its control and adverse effects

Reference Books:

1. J. Rajaram and J.C. Kuriacose, Kinetics and mechanism of chemical transformations, Macmillan India Ltd. 1993.
2. K.J. Laidler, Chemical Kinetics, Harper and Row, New York, 1987.
3. K.L. Kapoor, a Text Book of Physical Chemistry, Macmillan India Ltd., 2001
4. K.K. Rohatgi Mukherjee, 1978, Fundamentals of photo Chemistry, Wiley Eastern Ltd.
5. N.J. Turro, 1978, Modern Molecular Photochemistry, Benjamin, Cummings, Menlo

Park, California.

6. J.E. Huheey, Inorganic Chemistry – Principles, Structure and Reactivity: Harper Collins, New York, IV Edition (1993)
7. F.A. Cotton and G. Wilkinson, Advanced Inorganic Chemistry- A Comprehensive Text, John Wiley and Sons V Edition (1998)
8. K. F. Purcell and J.C. Kot, Inorganic Chemistry-WB Saunders Co., USA 1977
9. Agarwal, Chemistry of Organic Natural Products, Goel Publishing House.
10. L. Stryer, Biochemistry, W.H.Freeman and Co., New York.

L T P C

16CMIC22

CHEMISTRY OF FIBRES

5 0 0 4

Objectives:

To study the general and structural aspects of cellulose and cotton fibers. To know the classification, properties, uses and identification of different kinds of synthetic fibers. To learn the various processes and printing machinery of textile chemistry.

Unit 1 Introduction

15

General aspects, cellulose & cotton fibres – classification of fibres – properties, count, denier tex, staple length, spinning properties, strength, elasticity and creep.

Cellulose – structural aspects – main structure – nature of the side way links – characteristics of cellulose fibre.

Cotton fibre – ginning machines – general properties – ferromagnetic cotton – accelerated oxidation of cotton, cellulose. Identification tests for cellulose and cotton fibres.

Unit II Types of Fibres

15

Wool, silk & Bast fibres. Wool, formation of wool, macromolecules – formation of Keratin in animals – general properties. Silk – life cycle of silk worm – formation of silk fibre – waste silk – silk proteins – types of silk, general methods, properties. Bast fibres – Linen – retting and general properties – Hemp, retting and properties –Jute – harvesting , retting and properties. Identification tests for wool, silk and bast fibres. Rayons - Viscose rayons – chemistry of viscose process – manufacture, purification, conditioning stepping, shredding, ageing, mining, ripening and spinning processes – properties – fibre manufacture – yarn properties. Cuprammonium rayon – Chemistry of cuprammonium process – manufacture of cuprammonium rayon, properties – hydro and oxycellulose, identification tests for rayon fibres.

Unit III Synthetic fibres-I

15

Synthetic fibres – polyamide fibres and polyester fibres, polymerization, condensation – addition polymerization – molecular weight – linear symmetry – orientation, intermolecular, cohesive forces,

molecular rigidity. Polyamide fibre-chemical nature-manufacture, properties and spinning of nylon 6, nylon 66 – other polyamide–antistatic nylon – copolyamide - nylon degradation.

Unit IV Synthetic fibres-II

15

Polyester –chemical nature, preparation of polyester fibre, spinning properties – basic dyeable polyesters – antistatic polyester –spinning without spinnerette – polyester degradation – surface modification – polyester decolourization, identification tests for polyamide and polyester fibres.

Unit V Textile Chemistry

15

Textile printing general consideration and printing machinery – distinction between dyeing and printing – stages of printing –actual printing methods – post treatment. Printing paste and ageing and steaming. Dyestuffs used in printing paste – fastness properties – wetting agent – dispersing agents – other additives – thickness – rheological behavior of gums. Starch and types of gums used in printing paste. Ageing – steaming methods – mechanism of steaming – steamers.

Total: 75hours

Outcomes:

- To understand the durability and quality of fibers
- To differentiate cellulose and cotton fibers
- To classify different kinds of fibers in terms of their strength
- To know the manufacturing of fibers from natural resources
- To familiarize with the synthesis and properties of synthetic fibers
- To learn the methodology and mechanism of printing and painting in textiles
- To understand the stages of printing and dyeing in textile industries
- To learn various processes like steaming, ageing involved in textile industries

Reference Books:

1. V.A. Sheani – Textile fibres – Sevak publications.
2. B.K. Kesavan and Mishra – Fibre Science – SSMIIT.
3. K.P. Hess – Textile fibres and Textile printing – Mahajan publications.
4. R.S. Prayag – Technology of Textile printing – Prayag & Co., Dharwad.
5. H.A. Shah – Technology and Management of Printing BITRA.

Objectives:

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

1. Qualitative analysis of simple inorganic compounds

Identification of simple anions:

Chloride, Sulphate, phosphate, carbonate, bromide, iodide, nitrate, sulphide, nitrite, Fluoride.

Identification of cations :

Ca, Mg, Ba, Co, Ni, Zn, Mn, Fe, Cr, V, U, Cu, Cd, Hg, As, Sb, Bi.

2. Estimation of the following:

- (i) Total hardness in water of EDTA
- (ii) Estimation of Ca, Mg, and chloride in water.
- (iii) Estimation of purity of washing soda.
- (iv) Estimation of available chloride in bleaching powder.
- (v) Estimation of calcium in egg shell.

Total: 60 hours

Outcomes:

- To identify the simple anions
- To identify the simple cations
- To analysis the simple Inorganic compounds
- To estimate the total hardness of water in EDTA
- To estimate the ions in water
- To determine calcium in egg shells
- To determine washing soda purity
- To determine the chloride in bleaching powder

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

16PMIC22

PRACTICAL - III INDUSTRIAL CHEMISTRY

0 0 5 3

Objectives:

To obtain the knowledge in different instrumental analysis and to know the determination of various inorganic elements by different methods.

1. Determination of lead in red lead
2. Determination of BaSO₄ content.
3. Determination of ZnS content in lithophone.
4. Determination of moisture and silica content in cement.
5. Determination of mixed oxide content in cement.
6. Determination of calcium oxide content in cement.
7. Estimation of active calcium oxide in lime.
8. Determination of flash point and fire point for fuels.
9. Determination of pour point and cloud point for lubricants.
10. Determination of moisture in coal/coke by distillation method (Dean and stark method)
11. Determination of carbon by Conrad son method.
12. Determination of viscosity of engine oil by Redwood viscometer.
13. Determination of calorific value of solid and liquid fuels by Bomb calorimeter.
14. Analysis of CO, CO₂ and NO_x in exhaust gases.
15. Determination of BOD and COD of municipal sewage and industrial wastewater.
16. Determination of organics, suspended and total solids in wastewater.
17. Determination of phosphate in a fertilizer.

Total: 60 hours

Outcomes:

- To determine lead in red lead
- To determine barium sulphate content
- To analysis CO, CO₂ and NO_x the simple Inorganic compounds
- To determination of flash point and fire point for fuels
- To determination of moisture in coal/coke by distillation method
- To determine BOD and COD of municipal sewage and industrial wastewater
- To determine organics, suspended and total solids in wastewater
- To determine phosphate in a fertilizer.

REFERENCE BOOKS:

1. APHA-AWWA-WPCF, standard methods for the examination of water and wastewater, 19th edition, APHA, Washington DD, 1975
2. Vogel's Text book of qualitative analysis, ELBS
3. Vogel's Text book of quantitative analysis, ELBS, 1994
4. Snell, F.D and Biffen, F.N., Commercial methods of analysis, chemical publishing Co., 2nd edition.
5. . Vogel's Text book of Organic analysis, ELBS

16CMIC31**PAINT CHEMISTRY****L T P C
5 0 0 4****Objectives:**

To study the classification and drying mechanism of paints. To know paint additives, emulsion paint, resins, thermosetting alkyd and water based epoxy coatings.

Unit I**15**

Principles – ingredient – application dry film properties, mechanism of drying of paints. Pigmentation – pigment properties – types of pigments – selection of – dispersion – colour matching. Solvents – solvent properties – solvent viscosity – theory - boiling point and evaporation rates – flash point – chemical nature – toxicity and smell.

Unit II**15**

Paint additives affecting viscosity – pigment volume – silica and silicates – residual thickness- choice of additive affecting viscosity – additives affecting surface and interfacial tension – surfactants – additives affecting gloss – additives affecting chemical reactions.

Unit III

15

Lacquers and emulsion paints- non-aqueous dispersions- cellulose polymers – acrylic polymers – lacquer film formers – hot spray-emulsion paints – oil and alkyd paints – oxidative drying – drying mechanism – conjugated and non-conjugated oils – driers – bodied oils.

Oil paints and varnishes – petroleum resins, indene resins, phenolic resins, alkyd resins – ingredients – alkyd finishes – stoving finish – wood primers.

Unit IV

15

Poly urethanes – one pack paints – urethane oils and alkyd finishes – moisture curing pre-polymers, isocyanate stoving finishes – pack paint- activated polymer – polyhydroxylic resins – solventless finishes – yellowing – toxicity.

Unit V

15

Thermosetting alkyds – polyester and acrylic paints based on nitrogen resin – urea formaldehyde resins – melamine formaldehyde resins – acrylic nitrogen resins.

Paints based on nitrogen resins – UF & MF finishes – stoving finishes – cold curing finishes – finishes based on acrylic nitrogen resin. Epoxy coatings, epoxy resins – polyols, alkyd containing cross link powder coatings- cationic self polymerization, UV curing finishes – cured by polyamines – solventless finishes – water based epoxy coatings.

Total: 75hours

Outcomes:

- To understand what is paint
- To know the various ingredients present in paint
- To learn the different mechanism of drying of paints
- To know various additives used in paint and their properties
- To learn what is laqurers and emulsion paint
- To know oil paint and varnishers
- To understand the concept of alkyd finishes
- To learn poly urethane and one pack paints
- To understand the various paints based on nitrogen resin
- To master the advanced level of different finishes namely UV curing finishes and solventless finishes

Reference Books:

1. V.A. Shenai – Technology of Bleaching Sevak publications.
2. E.R. Trotman – Textile scouring and bleaching – Charles Griffins Co.,

3. A.J. Hall – Textile finishing – BI publications..
4. V.A. Shenai – Textile finishing – Sevak publications.
5. JT Marsh – Textile finishing Textile Institute, Manchester.

L T P C

16CMIC32

ANALYTICAL TECHNIQUES

5 0 0 4

Objectives:

To learn the theory, instrumentation and application of potentiometry, Conductometry, Biamperometry, Nephelometry, Fluorimetry, Polarimetry, Refractometry, Flame Photometry, and Atomic Absorption Spectroscopy. To understand radio analytical techniques and thermal methods.

Unit I

15

Potentiometry, Conductometry, Biamperometry –Theory, Instrumentation and Applications.

Unit II

15

Nephelometry, Fluorimetry, Polarimetry, Refractometry - Theory, Instrumentation and Applications.

Unit III

15

Flame Photometry, and Atomic Absorption Spectroscopy - Theory, Instrumentation and Applications.

Unit IV

15

Radio analytical Techniques, Isotope dilution analysis, Radioimmunoassay, Radiochromatography and Radio electrophoresis, Activation analysis.

Unit V

15

Thermal methods - Thermogravimetric and differential thermal analysis, thermometric titrations, differential scanning calorimetry – basic instrumentation and applications.

Total: 75hours

Outcomes:

- To learn the various instrumental methods, potentiometry, conductometric, biamperometry
- To learn what is nephelometry, fluorimetry, polarimetry, refractometry
- To understand what is flame photometry and atomic absorption spectroscopy
- To learn what is radio analytical techniques
- To learn the concept, what is thermal methods and their types
- To know the application of flame photometry and atomic absorption spectroscopy
- To know the application of nephelometry, fluorimetry, polarimetry, refractometry
- To understand the application of TGA, DTA, DSC and their titration

Reference Books:

1. Fundamentals of analytical chemistry- Skoog and West.
2. Instrumental methods of analysis – Willard, Merritt, Dean and Settle.
3. Analytical chemistry – G.Dick.
4. Quantitative chemical analysis – Saunders and Toppan.

16CMIC33**L T P C****OPERATIONS MANAGEMENT****3 0 0 3****Objectives:**

The course is to understand the strategic role of operations management in creating and enhancing a firm's competitive advantages and to understand the concepts of layout, planning, maintenance, quality and inventory control, material and store management.

UNIT – I INTRODUCTION TO OPERATIONS MANAGEMENT 12

Concept of Operations – Functions & Responsibilities of a Production Manager – Relationship with other departments – Production Systems – Plant Location – Factors influencing location – Site selection – Plant Layout – Objective – Principles and criteria of Plant Layout – Types of Layout – Assembly Line Balancing.

UNIT – II CAPACITY PLANNING 12

Capacity Planning – Measurement of Capacity – Capacity change – Make or Buy decision – Production Planning – Meaning – Elements – Importance – Procedure – Process Planning – Routing & scheduling – Production Control – Objectives – Functions involved.

UNIT – III MAINTENANCE MANAGEMENT & QUALITY CONTROL 12

Maintenance Management – Advantages – Policies – Types of Maintenance – Failure Analysis – Total Productive Maintenance – Quality Control – Definition – principles – Statistical Quality Control – Benefits – Control Charts.

UNIT – IV TIME & WORK STUDY 12

Work Study – Objectives – Major components importance – Procedure – Method Study – Scope – Procedure – Micro Motion Study – Work Measurement – Definition – Techniques – Time Study – Ergonomics.

UNIT – V VENDOR DEVELOPMENT & STORES LOCATION

12

Vendor Development – Stages in source selection and evaluation – Vendor Rating – Rating criteria. – Store Keeping – Functions – Responsibilities of Store Keeper – Stores Location.

Total: 60 hours

Outcomes:

- To understand about the fundamental production and operations concepts.
- To analyze the product layout using Line Balancing
- To gain knowledge on calculation of capacity
- To understand the various planning concepts.
- To analyze the failure for maintenance.
- To understand the implementation of quality tools.
- To understand the implementation of time and motion.
- To understand the various risk factors of ergonomics.
- To evaluate the selection of vendor.
- To evaluate the classification of inventory

TEXT BOOKS:

1. Stevenson J. William, Operations Management, 9th Edition, TMH, 2007
2. Hanna, D.Mark & Rocky Newman, Integrated Operations Management-Adding value for Customers, PHI, 2001.
3. Aswathappa K. and Sridhara Bhat, Production and Operations Management, Himalaya Pub. House, 2003.

REFERENCES:

1. Lee J. Krajewski and Larry P. Ritzman, 2007, Operations Management strategy and analysis, 9th Edition, Pearson Education / Prentice Hall of India, 2007.
2. Everett Adam, Jr. and Ronald J. Elbert, Production and Operations Management Concepts, Models and Behaviour, 5th Edition, PHI. 2003.
3. Edward M. Knod and Richard J. Schonberger, 2001, Operations Management meeting customers demands, Mc Graw hill international, 7th Edition, 2001.
4. Kanishka Bedi, 2005, Production and Operations Management, Oxford University Press, 2005.
5. Chary, S.N, Production and Operations Management, Tata McGrawhill, 2nd Edition, 2003.
6. Heizer Jay & Render Barry, Operations Management, Pearson Education, 8th Edition, 2007.

Objectives:

To determine the molecular weight of the given compound by viscosity and Rast Cryoscopic method. To verify Debye – Huckel – Onsagar equation and Lambert – Beer’s law. To understand the techniques of polarimetry, conductivity and potentiometry method.

1. Study of inversion of cane sugar in the presence of acid using polarimeter.
2. Determination of molecular weight of a polymer by viscosity method.
3. To study refractive index- concentration relationship for solutions.
4. Determination of dissociation constant of weak electrolyte by conductivity method.
5. (i) Determination of cells constant
(ii) Verification of Debye – Huckel – Onsagar equation for strong electrolytes.
(iii) Determination of pKa of a weak acid using Henderson equation.
6. Potentiometric titration of Cl^- vs Ag^+
7. Construction of phase diagram of two component systems forming simple eutectic.
8. Molecular weight determination by Rast Cryoscopic method.
9. Verification of Lambert – Beer’s law.
10. Determination of rate constant for the acid catalysed hydrolysis of esters.
11. Determination of second order rate constant for peroxydisulphate –iodide reactions in the presence and absence of added neutral salt.
12. Determination of molecular weight by depression of transition temperature method.
13. Determination of equilibrium constant for $\text{I}_2 + \text{I}^-$
14. Determination of concentration of KI

Total: 60 hours

Outcomes:

- To enhance the knowledge of experimental techniques in physical chemistry
- To know the study of inversion of cane sugar in the presence of acid
- To learn the determination of molecular weight of polymer
- To study the refractive index and concentration relationship for solution
- To determine the molecular weight of sample by different method
- To equip the knowledge of the students in rate constant determination
- To know the determination of equilibrium constant
- To improve the knowledge of construction of phase diagram
- To enhance the determination of the cell constant value
- To equip the knowledge of students in potentiometric titration

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.

Outcomes:

- To enhance the knowledge of management studies.
- To learn about planning process.
- To learn about organising process.
- To learn about directing process.
- To know the controlling process.
- To learn about the globalization and liberalization.

TEXT BOOKS:

1. Harold Kooritz & Heinz Weihrich, Essentials of Management, Tata McGraw-Hill, 1998.
2. Joseph L Massie, Essentials of Management, Prentice Hall of India, (Pearson) Fourth Edition, 2003.

REFERENCES:

1. Tripathy PC And Reddy PN, Principles of Management, Tata McGraw-Hill, 1999.
2. Decenzo David, Robbin Stephen A, Personnel and Human Reasons Management, Prentice Hall of India, 1996.
3. JAF Stomer, Freeman R. E and Daniel R Gilbert, Management, Pearson Education, Sixth Edition, 2004.
4. Fraidoon Mazda, Engineering Management, Addison Wesley, 2000.

L T PC**16DMIC12****MANAGEMENT INFORMATION SYSTEM****4 0 0 3**

Objectives: The course is to understand the management and information system, functions of management, accounting, financial and personnel information system.

UNIT I

Introduction – Establishing the frame work – Business models – Evolution of information system – System Development Life cycle. **12**

UNIT II

Requirement Analysis – Structured methodologies – Designing Computer based methods. **12**

UNIT III

Functional management information system: Production information system – marketing information system. 12

UNIT IV

Accounting information system – Financial information system - Personnel information system- Interrelationship of functional management information systems. 12

UNIT V

Hardware, software acquisition, Ergonomic factors to be considered, cost – benefit analysis- Quality Assurance – System security – Training strategies.

General Characteristics of computer – CPU, I/O devices – Operating Systems – Programming language – application software. 12

Total: 60 hours

Outcomes:

- To enhance the knowledge of management studies.
- To learn about Evolution of information system .
- To learn about Requirement Analysis.
- To learn about Hardware, software acquisition.
- To know the Operating Systems.

BOOKS FOR REFERENCE

1. Steven Alter, Information Systems – A Management Perspective Addison Wesley 1999.
2. James A O’Brein Management Information System, Tata McGraw Hill New Delhi, 1999.
3. Kenneth C. Laudon and Jane Price Laudon management Information Systems – Managing the digital firm, Pearson Education, Asia 2002 PHI
4. Gordon B. Davis Management Information System: Conceptual Foundations, Structure and Development, McGraw Hill 1974.
5. Turban Mc Lean and Wetherbe, Information technology for Management making connections for strategic advantage, John Wiley 1999.

6. Ralph M. Stair and George W. Reynolds, Principles of Information systems - A Managerial Approach, Thomson Learning 2001.
7. Kendall and Kendall Systems Analysis and Design, Prentice Hall of India, 5th edition, New Delhi.
8. S. Sadagopan Management Information systems- Prentice Hall of India, New Delhi, 2002.
9. Murdich & Ron, Information system for Modern management , PHI 2002.
10. Goyal DP, Management Information Systems, MacMillian, 2000

16DMIC21

L T P C
4 0 0 3

HUMAN RESOURCE MANAGEMENT

Objectives: The course is to understand the Importance of Human Resources and functions of HR management, evaluation information methods, labours law and managerial practices.

UNIT – I Introduction of human resource management:

Definition, Importance of Human Resources, Objectives of Human Resource Management, Qualities of a good personnel manager – Evolution and growth of Personnel Management in India.

Human Resource Policies: Need, type and scope – Human Resource policies and work culture.

Human Resource planning: Long and short term planning, Job analysis, skills inventory, job description and job specification.

12

UNIT-II Function of HR Management

Recruitment and selection: purposes, types and methods of recruitment and selection, relative merits and demerit of the different methods; personnel search, selection instruments, reduction of recruitment costs.

Functions of human resources management from procurement to separation: placement, induction, transfers, promotions, disciplinary actions, termination of services: Resignation, dismissal, retrenchment and voluntary retirement schemes, exit, interview, prevention of employee turnover.

UNIT-III Evaluation Methods**12**

Performance evaluation: Ranking, rating scales, critical incident method, removing subjectivity from evaluation, MBO as a method of appraisal, Job evaluation, criteria for promotions and job enrichment.

UNIT-IV Labors Law**12**

Wage and salary administration: meanings, calculations of wage, salary, perquisites, compensation package, cost of living index and calculation of dearness allowance, rewards and incentive: financial and non-financial incentives, productivity-linked bonus, compensation Criteria.

UNIT – V Managerial Practice**12**

Personnel Office Management: Functions of the office, correspondence, O 7 M in personnel departments, Maintenance of Personnel records.

Time Management: Importance of Time factor, Time waster, Prioritizing Work Scheduling, Functions of the Time Office, Flexible Work arrangements.

Total: 60 hours**Outcomes:**

- To enhance the knowledge of Human Resource management studies.
- To learn about evaluation methods.
- To learn about HR management.
- To know the labors law.
- To learn about managerial practice.

BOOKS FOR REFERENCES

1. Luis R. Gomez - Mejia David B.Bakin and Robert L. Cardy. Managing Human
2. Beardwell and Cen Holder, Human resource Management Macmillan India Ltd.,
3. Straus and Sayles, Managing Human Resources - Prentice Hall Inc, (1977)
4. Graham H.T., & R.Bennet, Human Resources Management - Pitman, London, (1985)
5. Edwin Flippo, Principles of Personnel Management - McGraw Hill.

Objectives:

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

Unit I**12**

Basic concepts of polymers. Monomer, Repeat unit, degree of polymerization. Classification of polymers, Stereochemistry of polymer, nomenclature of stereo regular polymers.

Chain polymerization, free radical polymerization, ionic polymerization and coordination polymerization; Ziegler Natta catalyst. Step polymerization, ring opening polymerization. Co polymerization, random, block and graft co polymers- preparation.

Unit II**12**

Polymerisation techniques; bulk, solution, suspension and emulsion polymerization.

Kinetics of polymerization; General kinetics and mechanism of polymerization - free radical, step growth, ionic and poly condensation polymerization.

Measurement of molecular weight and size; number average and weight average molecular weights, polydispersity and molecular weight distribution in polymers, the practical significance of polymer molecular weight and size of polymers.

Unit III**12**

Glass transition temperature, concepts of glass transition temperature and associated properties, glassy solids and glass transition, factors influencing glass transition temperature (T_g).

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

Unit IV**12**

Processing: Calendering, die casting, film casting, compression, moulding, injection moulding, blow moulding, extrusion moulding, thermoforming, foaming and reinforcing techniques.

Unit V**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: 60 hours

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.

Reference Books:

1. Text Book of Polymer Science, Billmeyer.
2. Polymer Science, Gowariker.
3. First course in Polymer Chemistry, Strepikheye *et al.*

16DMIC32

L T P C

MARKETING MANAGEMENT

4 0 0 3

Objectives:

The course is to understand marketing, importance, market segmentation, market research and control, industrial markets, product positioning, sampling techniques, online marketing and promotion mix.

Unit I Introduction 12

Understanding the term Marketing - Importance of Marketing-Scope of Marketing-Core Concepts-Company Orientation toward marketplace-Marketing and Customer Value-Marketing Environment-Micro and Macro Environment.

Unit II Consumer markets 12

Model of Consumer Behavior, Seven Os Structure, Factors Affecting Consumer Behavior, Stages in the Adoption Process, Industrial Markets - Characteristics, Industrial Buyer Behavior, Service Marketing-Characteristics-Marketing Strategy.

Unit III Market segmentation 12

Levels and Bases for Segmentation, Segmenting Consumer Markets, Business Markets, Market Targeting -Evaluating Market Segments -Product Positioning, Positioning Strategies.

Unit IV Marketing programme 12

Decisions Involved in Product, Branding, Packaging, Product Line and Product Mix Decisions, New Product Development, Product Life Cycle. Pricing Products, Strategies, Distribution -Channels, Channel Management Decisions, Returns Management and Reverse Logistics. Promotion Mix - Advertising, Sales Promotion, Public Relations, Personal Selling.

Unit V Marketing research and control 12

Marketing Research – Objectives & Scope – Research designs – research procedure – data types & sources, sampling techniques, analysis & reporting. Demand Measurement and Sales Forecasting Methods, Estimating Current and Future Demand. Annual Plan Control, Efficiency Control, Profitability Control and Strategic Control, Marketing Audit, Online Marketing.

Total: 60 hours

Outcomes:

- To understand about the marketing and its importance
- To analyze the Micro and Macro Environment.
- To gain knowledge on Consumer Behavior
- To understand the various characteristics of industrial markets
- To analyze the various Levels and Bases for Segmentation
- To understand the implementation of Returns Management.
- To understand the implementation of Public Relations, Personal Selling
- To understand the various data types & sources, sampling techniques
- To evaluate the Current and Future Demand
- To evaluate the Marketing Audit, Online Marketing.

Text Books:

1. Kotler Philip, Keller, Koshy and Jha, Marketing Management , 13th Edition, Pearson Education / Prentice Hall of India, 2008

Reference Books:

1. Lamb, Hair and Mc Daniel, Marketing, 8th Edition, Thomson Learning, 2005.
2. RajanSaxena, Marketing management, TMH, 2006.
3. Keith Blois, Marketing, Oxford University Press, 2005.
4. Ramaswamy V.S. Namakumari S, 2006, Marketing Management - The Indian Context, Macmillan India Ltd., 2006.

- 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.
1. 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.

NUCLEAR AND PHOTOCHEMISTRY

L T P C
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. Shriver, P.W. Atkins and C.H. Langford, Inorganic Chemistry, CH Langford, 1990
2. N.N. Greenwood and Earnshaw, Chemistry of the Elements, Pergamon Press New York, 1984.

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.
- 3.

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.

STEREOCHEMISTRY AND REACTION MECHANISM

L T P C
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 – Transition 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 retrosynthetic 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

Outcome:

- 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 retrosynthetic analysis.
- To understand the important functional group interconversions
- To know about the concept of green chemistry

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

NOVEL MATERIALS AND GREEN INDUSTRIAL CATALYSIS

4 0 0 3

Objectives: To learn about some important functional materials and novel materials, properties of metallic clusters, characterization techniques, catalysts in chemical transformation of functional and novel materials.

Unit 1 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

12

Supported metallic clusters, Catalysts preparation method, physical and chemical properties. Catalysis mechanism uses and synthetic applications

Unit III Characterization

12

Tools for Structural Characterization of novel materials by UV-Visible spectroscopy, Infrared spectroscopy, Nuclear magnetic resonance spectroscopy and mass spectrum

Unit IV Metal Oxides **12**
Various types of Metal oxides and basic concept of metal oxides, Supported metal oxides.

Unit V Catalysts in chemical transformation **12**
Industrial catalysis (Synthesis Gas and Hydrogen). Ammonia Synthesis, Methanol and Fischer –
Tropsch Synthesis, Hydrocarbon Transformations, Environmental Catalysis.

Total: 60 hours

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 Book:

1. Harry R. Allcock, Introduction to Materials Chemistry, Wiley Interscience Publisher.

Reference Book:

1. Bradley D. Fahlman, Materials Chemistry 2nd ed. Springer Publisher, 2011.

ELECTROCHEMISTRY AND GROUP THEORY **L T P C**
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 equilibria. 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 C_{2v} and C_{3v} point group.

- To determine the IR and Raman activity of vibrational modes in non-linear 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 McGrawHill,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.

INORGANIC CHEMISTRY

L T P C
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 splittings, 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.
- To 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.
- To 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**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.

STRATEGIC MANAGEMENT OF PHARMA INDUSTRY

L T P C

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

SOFT SKILL I

L T P C
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, “Personality 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

SOFT SKILL II

L T P C

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
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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

GREEN CHEMISTRY

L T P C
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 CO₂ - 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. Jung, "The Role of Catalyst for Green Chemistry", Chemworld, Vol. 44 (8), 38, 2004.

- 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

**INTRODUCTION TO NANOSCIENCE
AND NANOTECHNOLOGY**

**L T P C
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

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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.

FOOD CHEMISTRY AND ADULTERATION

L T P C
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, cyclamate, aspartame – 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: 40hrs**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.

PROJECT WORK/REVIEW

L T P C
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: 22hrs

Outcomes:

- To identify the topic with the consideration feasibility.
- To learn the procedure of literature survey of the concerned 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 functionalities 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 laboratory and its nature of work and R & D laboratory of research institute 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.