MANONMANIAM SUNDARANAR UNIVERSITY
TIRUNELVELI

UG COURSES – AFFILIATED COLLEGE
B.Sc. Chemistry

(Choice Based Credit System)
(With effect from the academic year 2017 -2018)

1. Objectives

- To impart theoretical and practical skills that underpins the various branches of the Science of Chemistry
- To enable the students to have a thorough understanding and knowledge of different branches of Chemistry
- To make the students to develop the ability to think analytically and solve problems.
- To facilitate the students of B.Sc Chemistry to join PG courses which in turn offer them job opportunities and research pursuits.
- To apply the skills and knowledge gained through the subject to real life situations and face competitive examinations with confidence at National level.
- To create an awareness to ecofriendly microscale experiments in practical courses.

2. Eligibility for Admission

The minimum eligibility conditions for admission to the **B.Sc Chemistry** program are given below.

The candidates for admission into the first semester of the **B.Sc Chemistry** course will be required to have qualified the Higher Secondary Examination conducted by the Board of Higher Secondary Education, Government of Tamil Nadu or any other Examinations accepted by the syndicate of the Manonmaniam Sundaranar University as equivalent there to in Science subject.

3. Duration of the Course

The students shall undergo the prescribed course of study for a period of not less than three academic years (Six semesters). The semester contains 90 working days.

4. Scheme of the Course

Sem	Pt	Sub No	Subject Status	Subject Title	Con Tact Hrs/ Wk	L Hrs/ wk	T Hrs/ wk	P Hrs/ wk	Credits
III	I	17	Language	Tamil/Other Languages	6	6	0	0	4
	II	18	Language	English	6	6	0	0	4
	III	19	Core – Paper V	Organic Chemistry - II	4	4	0	0	4
	III	20	Major Practical III	Inorganic Qualitative Analysis	2	0	0	2	1
	III	21	Allied - II	Allied Chemistry – I	4	2	2	0	3
	III	22	Allied Practical II	Allied Chemistry Practical- I	2	0	0	2	1
	III	23	Skill Based- I Core	Agro Chemistry/ Food Chemistry	4	4	0	0	4
	IV	24	Non-Major Elective -I	Food Chemistry /Water Management	2	2	0	0	2
	IV	25	Common	Yoga	2	2	0	0	2
				Subtotal	**30+2**	**24+2**	**2**	**4**	**25**

IV	I	26	Language	Tamil/Other Languages	6	6	0	0	4
	II	27	Language	English	6	6	0	0	4
	III	28	Core – Paper VI	Physical Chemistry - II	4	4	0	0	4
	III	29	Major Practical IV	Inorganic Preparation and Physical Constant Determination	2	0	0	2	1
	III	30	Allied - II	Allied Chemistry - II	4	2	2	0	3
	III	31	Allied Practical II	Allied Chemistry Practical- II	2	0	0	2	1
	IV	32	Skilled Based II Core	Chemistry in Medicine/ Industrial Chemistry	4	4	0	0	4
	IV	33	Non-Major Elective - II	Dairy Chemistry / Applied Chemistry	2	2	0	0	2
	IV	34	Common	Computers for Digital Era	2	2	0	0	2
	V	35	Extension Activity	NCC/NSS/YRC/YWF	-	-		-	1
				Subtotal	**30+2**	**24+2**	**2**	**4**	**26**

V	III	36	Core – Paper VII	Organic Chemistry - III	6	6	0	0	4
	III	37	Core – Paper VIII	Physical Chemistry - III	6	6	0	0	4
	III	38	Major Elective-I	Polymer Chemistry / Bio Inorganic Chemistry	4	4	0	0	4
	III	39	Major Elective - II	Analytical Chemistry / Pharmaceutical Chemistry	4	4	0	0	4
	III	40	Major Practical V	Organic Analysis	8	0	0	8	4
	III	41	Major Practical VI	Physical Chemistry Experiments					
	IV	42	Skill Based Common	Personality Development/ Effective Communication/ Youth Leadership	2	2	0	0	2
				Subtotal	**30**	**22**	**0**	**8**	**22**
VI	III	43	Core Paper IX	Inorganic Chemistry – III	5	5	0	0	4
	III	44	Core Paper X	Organic Chemistry - IV	5	5	0	0	4
	III	45	Core Paper XI	Physical Chemistry – IV	5	5	0	0	4
	III	46	Major Elective – III	Green Chemistry/ Nano Chemistry	4	4	0	0	4
	III	47	Major Practical VII	Gravimetric Estimation & Organic Preparation	4	0	0	4	2
	III	48	Major Project	Major Project	7	0	0	7	7
Subtotal					**30**	**19**	**0**	**11**	**25**
Grand Total					**180+4**	**137+4**	**8**	**35**	**144**

5. Elective Subject

One among the two given subjects will be selected.

6. Extension Program for the Department

Apart from the curriculum, to enrich the skill development of the students following courses in their premises are conducted.

Effective Communication

Personality development

Youth development.

7. Internal Assessment

There is a separate passing minimum for the external and overall components.

Distribution of marks between External and Internal Assessment is

- For Theory 75 : 25
- For Practical 50 : 50

Pass minimum of 40% for external and overall components.

Internal Marks for **Theory** shall be allotted in the following

The average of the best two from three compulsory tests. Each test is of one hour duration	20 Marks
Assignment	05 Marks
TOTAL	**25 Marks**

Distribution of marks between External and Internal Assessment for skill based elective - 75 : 25

The average of the best two from three compulsory tests. Each test is of one hour duration	20 Marks
Assignment	05 Marks
TOTAL	**25 Marks**

Internal Marks for **Practical** shall be allotted in the following manner

Experimental Work	25 Marks
Regularity	25 Marks
TOTAL	**50 Marks**

8. Grading System

The performance of the students is indicated by the seven point scale grading system as per the UGC norms given below.

Grade	Grade Point	Percentage of Marks	Performance
O	**9.5 and above**	**95 – 100**	**Outstanding**
E	**8.5 and above**	**85 – 94**	**Excellent**
D	**7.5 and above**	**75 – 84**	**Distinction**
A	**6.0 and above**	**60 – 74**	**Very Good**
B	**5.0 and above**	**50 – 59**	**Good**
C	**4.0 and above**	**40 – 49**	**Average**
RA	**0**	**Upto 39**	**Re-Appear**

The overall performance level of the candidates will be assessed by the following formulae :

$$\text{Cumulative weighted average of marks} = \frac{\sum(\text{Marks x Credits})}{\sum \text{Credits}}$$

$$\text{Cumulative weighted average Grade Points} = \frac{\sum(\text{Grade Point x Credits})}{\sum \text{Credits}}$$

9. Question Pattern

Section	Type of Question	No. of Question	Marks
Part A	Objective Type Questions (Two questions from each unit)	5 x 2 = 10	10 x 1 = 10
Part B	Internal Choice Questions (One question from each unit)	5 x 1 = 5	5 x 5 = 25
Part C	Internal Choice Questions (One question from each unit)	5 x 1 = 5	5 x 8 = 40
	TOTAL		75 marks

PAPER-V : ORGANIC CHEMISTRY- II

L	T	P	C
4	0	0	4

Objectives

To learn about carbonyl compounds

To understand the impotance of active methylene, organometallic and organosulphur compounds

To study alicyclic compounds and tautomerism

UNIT - I ALDEHYDES AND KETONES (13 Hrs)

Structure and reactivity of carbonyl group – relative reactivities of aldehydes and ketones – mechanism of nucleophilic addition reaction (HCN, $NaHSO_3$, Grignard reagent) –mechanism of aldol condensation, crossed aldol condensation, Knoevenagal reaction. Study of the following reactions – Wolff-Kishner reduction, Wittig reaction, Meerwein Ponndorf Verley reduction.

Preparation, properties and uses of chloral, acrolein, crotonaldehyde and succinaldehyde.

UNIT-II CARBOXYLIC ACIDS & ACID DERIVATIVES (12 Hrs)

Structure of carboxylic acid and carboxylate anion – relative strengths of monocarboxylic acids – effect of substituents on acidity – Hell – Volhard – Zelinsky reaction- action of heat on hydroxy acids- preparation, properties and uses of lactic acid and citric acid–dicarboxylic acids: action of heat on dicarboxylic acids - preparation, properties and uses of oxalic acid and succinic acid

Acid anhydrides – Amides –Preparation, properties and structure of urea –Esters-mechanism of esterification and ester hydrolysis.

UNIT-III ORGANOMETALLIC COMPOUNDS AND ORGANO SULPHUR COMPOUNDS (11 Hrs)

Preparation, structure and synthetic uses of Grignard reagent-preparation and reactions of methyl lithium, diethyl zinc and tetraethyl lead-Reformatsky reaction

Preparation and properties of thioalcohols and thioethers – sulphonal-mustard gas and sulphones

UNIT –IV REACTIVE METHYLENE COMPOUNDS & TAUTOMERISM (11 Hrs)

Reactivity of methylene groups – preparation and synthetic uses of diethyl malonate and ethyl acetoacetate. Tautomerism – definition – various types, keto – enol, amido – imido, nitro – acinitro and oxime – nitrosotautomerism.

UNIT-V ALICYCLIC COMPOUNDS (13 Hrs)

Nomenclature -general methods of preparation – spectroscopic properties – chemical properties – relative stabilities of cyclo alkanes – Baeyer's strain theory –Sachse-Mohr theory – Coulson and Moffit's concept – conformations of cyclohexane and monosubstitutedcyclohexanes - largering compounds – synthesis and structure of civetone and muscone (structure elucidation not necessary).

Text Books

1. K.S. Tewari, N.K. Vishil, S.N. Mehotra – A text book of org. chem – 1st edition, Vikas Publishing House Pvt Ltd., 2001, New Delhi.
2. P.L. Soni, Text Book of Organic chemistry, Sultans chand, 1991, New Delhi,

Reference Books

1. Bahl and ArunBahl, Organic Chemistry, S. Chand and Sons, New Delhi, 2005.
2. M.K. Jain and S. C. Sharma, Modern Organic Chemistry
3.Organic Chemistry - R.T.Morrison and Boyd - Prentice Hall
4.Advanced General Organic Chemistry - SachinK.Ghosh - Books and Allied (P) Ltd
5. Organic Chemistry – Bhupinder Mehta and Manju Mehta - PHI Learning Pvt Ltd.

INORGANIC QUALITATIVE ANALYSIS

L	T	P	C
0	0	2	1

Objectives

- ❖ To enable the students to understand various procedures in salt analysis.
- ❖ To create an awareness on ecofriendly approach in salt analysis

Qualitative analysis of inorganic salt mixtures containing two acidic radicals (one should be an interfering radical) and two basic radicals

.Acidic radicals

Simple acidic radicals:

Carbonate, Nitrate, Sulphate and Chloride

Interfering acidic radicals:

Borate, Fluoride, Oxalate and Phosphate.

1. Basic radicals

Group I : Lead
Group II : Copper, Cadmium, Bismuth.
Group IV : Cobalt, Nickel, Manganese
Group V : Barium, Strontium
Group VI : Magnesium, Ammonium.

Internal – 50 marks

25 marks - Regularity
25 marks – Average of best four salt mixtures in regular class work

External -50 marks

20 marks – Record (atleast 4 salt mixtures)*

30 marks – Analysis (10 marks for each radical)

*Experiments done in the class alone should be recorded

(Students having a bonafide record only should be permitted to appear for the practical examination)

Reference books:

1. V.V. Ramanujam, Inorganic Semi Micro Qualitative Analysis, 3rd edition, The National Publishing Company, Chennai, 1974.
2. Vogel's Text Book of Inorganic Qualitative Analysis, 4th edition, ELBS, London, 1974.

ALLIED CHEMISTRY - I

Objective

To learn about atomic structure and bonding.
To learn the principles of reactions of organic compounds.
To study about photochemical reactions.
To learn about the importance of polymers and polymer science.
To study about lubricants and some cosmetics in the modern world.

Unit I – Inorganic chemistry

Atomic structure : electronic configuration - Aufbau principle - Pauli's exclusion principle- Hund's rule. Bonding : electrovalent, covalent, hydrogen bonds-orbital overlap - s-s, s-p. Hybridization and VESPR theory - CH_4, C_2H_4, C_2H_2- $BeCl_2$, BF_3, NH_3, H_2O, PCl_5, IF_5, IF_7.

Unit II - Organic chemistry – Principles of reactions

Heterolytic and homolytic cleavage - nucleophiles and electrophiles-reaction intermediates – preparation and properties of carbonium ions, carbanions and free radicals - type of reactions - substitution, addition, elimination and polymerisation reactions.

Unit III-Physical chemistry - Photochemistry

Definition-comparision between thermal and photochemical reactions-Laws of photochemistry-Beer Lambert's law-Grothus Draper law-Einstein's law-Quantum yield-low and high quantum yield-determination of quantum yield-fluorescence, phosphorescence, thermoluminescence, chemiluminescence and bioluminescence-definition with examples-photosensitisation.

Unit IV-Polymer Chemistry

Definition- Monomers, Oligomers and Polymers - Classification of polymers- natural, synthetic- linear, cross linked and network- plastics, elastomers, fibres- homopolymers and co-polymers

Thermoplastics: polyethylene, polypropylene, polystyrene, polyacrylonitrile, poly vinyl
chloride, nylon and polyester - Thermosetting Plastics : phenol formaldehyde and epoxide resin-Elastomers: natural rubber and synthetic rubber - Buna - N, Buna-S and neoprene.

Unit V-Applied Chemistry

Lubricants-classification-criteria of good lubricating oils-synthetic lubricating oils-poly glycols and poly alkene oxides-greases or semi solid lubricants-examples-solid lubricants-graphite

Prepration and uses of shampoo, nail polish, sun screens, tooth powder, tooth paste, boot polish, moth ball and chalk piece.

Reference Books

1. B. R. Puri, L. R. Sharma and K. C. Kalia, Principles of Inorganic Chemistry
2. P. L. Soni, Text Book of Inorganic Chemistry
3. K. S. Tewari and N. K. Vishnoi, A Text Book of Organic Chemistry.
4. Arun Bahl and B.S. Bahl, Advanced Organic Chemistry, S. Chand and Sons.
5. M.K. Jain and S. C. Sharma, Modern Organic Chemistry
6. K.K.Rohatgi Mukherjee, Fundamentals of photochemistry , Wiley Eastern Ltd.
7. B.R. Puri and L.R. Sharma, Principles of Physical Chemistry, Chand & Co.
8. Malcom P. Stevens, Polymer Chemistry – An Introduction
9. V.R. Gowariker, Polymer Science, Wiley Eastern, 1995.
10. Sawyer.W, Experimental cosmetics, Dover publishers, New york, 2000.

MSU / 2017-18 / UG-Colleges / Part-III (B.Sc. Chemistry) /Semester – III / Allied Practical -I

Inorganic Quantitative Analysis

Objective:

To enable the students to acquire the quantitative skills in volumetric analysis.

Acidimetry and alkalimetry

1. Estimation of oxalic acid – Std. oxalic acid
2. Estimation of Na_2CO_3 – Std. Na_2CO_3
3. Estimation of hydrochloric acid – Std. oxalic acid

Permanganometry

4. Estimation of ferrous ammonium sulphate – Std. ferrous ammonium sulphate
5. Estimation of oxalic acid – Std. oxalic acid
6. Estimation of ferrous sulphate – Std. oxalic acid

Internal –50 marks

25 marks - Regularity

25 marks – Average of best four estimations in regular class work

External -50 marks

10 marks – Record (atleast 4 volumetric estimations)*

10 marks – Procedure

30 marks – Result

*Experiments done in the class alone should be recorded

(Students having a bonafide record only should be permitted to appear for the practical examination)

SKILL BASED COURSE - AGROCHEMISTRY

L	T	P	C
4	0	0	4

Objectives

To learn about fertilizers and pesticides

To study the origin, characterisation and testing of soils

UNIT – I Fertilizers (14 Hrs)

Classification, macronutrients -role of nitrogen, potassium and phosphorus on plant growth – manufacture of urea, muriate potash and triple superphosphate. Complex fertilizers, mixed fertilizers & biofertilizers – their composition. Micronutrients – their role in plants.

Manures : Bulky organic manures – Farm yard manure - oil cakes - blood meal – fish manures - Composting process – handling and storage

UNIT – II Pesticides (14 Hrs)

Definition - Classification of Pesticides based on the use and chemical composition – examples - general methods of application – Benefits of pesticides - Potential hazards. Safety measures -first aid.

Insecticides : Plant products – Nicotine, pyrethrin – Inorganic pesticides – borates. Organic pesticides – D.D.T. and BHC.

Fungicide : Sulphur compounds, Copper compounds, Bordeaux mixture.

Herbicides : Acaricides – Rodenticides. Attractants – Repellants.

UNIT –III Soil (10 Hrs)

Origin of soil - definition of soil - rock system - weathering of rocks and minerals- main components of soil - organic, inorganic constituents - soil formation - factors favouring soil formation.

UNIT –IV Characteristics of soil (10 Hrs)

Physical aspects - soil texture - pore space - bulk density, particle density - soil colour - surface area - soil colloids - plasticity, shrinkage - flocculation and deflocculation,soil air, soil temperature and their importance in plant growth. Acid, alkaline and saline soils – diagnosis - Methods of reclamation and after care.

UNIT –V Soil testing (12 Hrs)

Concept and objectives – soil sampling , tools, collection, processing, dispatch of soil sample. Estimation of total organic compound, available nitrogen and phosphorus in the soil sample. Determination of pH, EC, moisture content, bulk density and particle density of the soil sample.

Text books:

1. A text book of Soil Science – Daji.A, Asia Publishing House, Madras 1970.
2. Textbook of soil Chemical Analysis – Hesse,P.R.A John Murray Newyork,1971

Reference books:

1. Textbook of Soil Science - Biswas,T.D and Mukherjee,S.K.Second edition, Tata McGraw-Hill Education
2. Chemistry for Agriculture and Ecology-Y.Mido M.Satake, Discovery Publishing House.
3. Soil Fertility & Fertilisers – Samuel L.Tisdale,Werner L.Nelson, James D.Beaton, John L. Havlin. Fifth edition, Macmillan
4. Nature and properties of soils-Harry, O Buckman N Yle C. Brandy, Macmillan
5. Insecticides, Pesticides and Agro based Industries – R.C.Paliwal, K.Goel, R.K.Gupta, Small Business Publications

SKILL BASED COURSE - FOOD CHEMISTRY

L	T	P	C
4	0	0	4

Objectives:

To acquire the basic knowledge of food chemistry

UNIT - I CONSTITUTION OF FOOD (11 Hrs)

Food - definition - classification of food - energy requirements of individuals - source, classification and function of carbohydrates, proteins, lipids, vitamins and minerals - calorific values of food - rice, wheat, milk, fish, vegetables, fruits and cereals.

UNIT - II FOOD ADDITIVES AND PRESERVATIVES (13 Hrs)

Food additives: Definition - permitted food additives, characteristics and their role: antioxidants, stabilizers, flavours, sweeteners, emulsifiers, thickeners, food colourants.

Preservatives: Definition – methods of food preservation - heat, cold, deep-freezing, radiation.

UNIT - III FOOD ADULTERATIONS (12 Hrs)

Definition - adulterant, adulteration - types of adulterants - common adulterants and their determination in milk, oils, ghee, honey, chilly powder, coriander powder, turmeric powder, coffee powder, tea dust, asafoetida - food poisoning and its prevention – Prevention of Food Adulteration Act- food laboratories and their functions.

UNIT - IV QUALITY STANDARDS (11 Hrs)

Quality control - specification and standards - FA, FDA, WHO standards - ISI specifications, packing and labeling of foods - Essential Commodities Act, Consumer Protection Act - AGMARK.

UNIT - V LABORATORY WORK (13 Hrs)

1. Determination of fat, protein and carbohydrate in food stuff.
2. Analysis of fats and oils - iodine value, acid value and RM value.
3. Estimation of glucose by Bertranel method
4. Analysis of starch in foods
5. Isolation of casein from milk

Text books:

1. Sivasankar B, Food Processing and Preservation, Prentice Hall of India Pvt. Ltd, New Delhi, 2002.
2. Swaminathan M. Textbook on Food Chemistry, Printing and Publishing Co, Ltd, Bangalore 1993.

Reference books:

1. N. S. Gnanaprakasam, G. Ramamurthy, Organic Chemistry, Lab Manual, S. Viswanathan Printers and Publishers Ltd.
2. Food Science – III Edition – B. Sri Lakshmi, New Age International Publisher, 2005.
3. Fundamentals of Foods and Nutrition – Mudambi. R. Sumathi, and Rajagopal, M.V. Willey Eastern Ltd, Madras.

FOOD SCIENCE

L	T	P	C
2	0	0	2

Objectives:

To acquire the basic knowledge of food science

UNIT – I INTRODUCTION (6 Hrs)

Food : sources and classification – food as a source of energy - functions and biological importance of carbohydrates, protein, fat, vitamins and minerals - calorific value of food – energy requirements of individuals - balanced diet.

UNIT - II FOOD ADDITIVES (6 Hrs)

Definition, food colourants : natural and artificial - antioxidants, stabilizers, flavours, bleaching and maturing agents – leavening agents.

UNIT - III FOOD PRESERVATIVES (5 Hrs)

Definition - classification - methods of food preservation and processing by heat, cold, radiation, drying and deep freezing.

UNIT - IV FOOD ADULTERATION (6 Hrs)

Definition – types – detection and analysis of adulterants in foods: milk, chilli powder, coffee powder, turmeric powder, ghee, oil and pulses.

UNIT -V QUALITY STANDARDS (7 Hrs)

Quality control - specification and standards - FA, WHO standards – packing and labeling of foods, Essential Commodities Act - Consumer Protection Act - AGMARK.

Text books:

1. Sivasankar B, Food Processing and Preservation, Prentice Hall of India Pvt. Ltd, New Delhi, 2002.
2. Swaminathan M. Textbook on Food Chemistry, Printing and Publishing Co, Ltd, Bangalore 1993.

Reference books:

1. Food Science – III Edition – Sri Lakshmi B, New Age International Publisher, 2005.
2. Fundamentals of Foods and Nutrition – Mudambi. R. Sumathi, and Rajagopal, M.V. - Willey Eastern Ltd, Madras.

WATER MANAGEMENT

L	T	P	C
2	0	0	2

Objectives:

To realize the importance of quality water in day to day life

UNIT I - WATER POLLUTION (6 Hrs)

Definition-sources of water pollution-types of water pollutants: sewage and domestic wastes, industrial effluents, agricultural discharges, detergents, disease causing agents and radioactive materials. Eutrophication and its effects.

UNIT II - WATER QUALITY PARAMETERS (7 Hrs)

Physical, chemical and biological water quality parameters-water quality standards for drinking water –BIS and WHO. Determination of pH, Total hardness, DO, BOD and COD.

UNIT III - WATER PURIFICATION (6 Hrs)

Purification of water for drinking purposes: Sedimentation, filtration and disinfection-Desalination: reverse osmosis-Purification of water for industrial purposes: water softening-permutit process and ion-exchange process.

UNIT IV - WASTE WATER TREATMENT (7 Hrs)

Elementary ideas of waste water treatment: pre-treatment-primary treatment-secondary treatment: aerobic and anaerobic processes –tertiary treatment: evaporation adsorption – chemical precipitation.

UNIT V - RESTORATION AND MANAGEMENT (4 Hrs)

Importance of lakes and rivers-stresses on the Indian rivers and their effects –A restoration case study: Ganga Action Plan: objectives implementation and drawbacks. Rain water harvesting –water recycling- The water Prevention and control of Pollution Act 1974.

Text books :

1. A. K. De, Environmental Chemistry, Wiley Eastern Ltd., New Delhi.
2. B. K. Sharma, Environmental Chemistry, Goel Publishing House, Meerut.

Reference books :

1.R. K. Trivedy and P. K. Goel, Chemical and biological methods for water pollution studies, Environmental Publications, Karad, India.

2.BIS 1991, Specification for drinking water, Bureau of Indian Standards, New Delhi

3.WHO 1992, International standards for drinking water, World Health Organisation, Geneva.

PHYSICAL CHEMISTRY –II

L	T	P	C
4	0	0	4

Objectives

To learn about basic concepts and I and II law of thermodynamics

To understand chemical equilibrium and electrochemistry

To study solutions

UNIT -I THERMODYNAMICS-I (12 Hrs)

Basic concepts - system, surroundings - types of systems - extensive and intensive properties - state functions and path functions - types of processes - . Exact and inexact differentials - Zeroth law of thermodynamics. Statements of first law - definition of internal energy and enthalpy - heat capacities at constant volume (C_v) and at constant pressure (C_p), relationship between C_p and C_v - calculation of work, heat, internal energy change and enthalpy change for the expansion of an ideal gas under reversible isothermal and adiabatic conditions. Joule-Thomson effect – Joule-Thomson coefficient and its significance - derivation of the expression for Joule-Thomson coefficient - inversion temperature. Kirchoff's equation and its applications - numerical problems.

UNIT II: THERMODYNAMICS-II (12 Hrs)

Introduction to second law of thermodynamics - spontaneous processes - statement of second law of thermodynamics.

Entropy: Definition –entropy a state function - Trouton's rule. -entropy change in reversible and irreversible processes- Clausius inequality- entropy as function of T and V - entropy as a function of T and P - entropy change in isothermal transformation - entropy change accompanying change of phase-– entropy of mixing of ideal gases -physical significance of entropy.

Free energy: Work and free energy functions – definition-general conditions of equilibrium and spontaneity – -physical significance of dA and dG. Temperature and pressure dependence of G - variation of G during isothermal change -Gibbs Helmholtz equation

UNIT III: CHEMICAL EQUILIBRIUM (11 Hrs)

Reversible and irreversible reactions-nature of chemical equilibrium-Law of mass action-equilibrium constants- K_p, and K_c Thermodynamic derivations- -Relations between K_p & K_c Temperature dependence of equilibrium constant-properties of equilibrium constant –- Pressure dependence of equilibrium constant- Application of law of mass action to homogenous and Heterogenous equilibrium-Le-Chatelier principle-application of Le-Chatelier principle to homogenous equilibrium and heterogenous equilibrium –effect of inert gas on equilibrium

UNIT IV : SOLUTIONS (12 Hrs)

Kinds of solutions –- methods for expressing concentration – Molarity, molality, mole fraction, normality, mass fraction, parts per million -solutions of gases in liquid -Solubility of gases in liquids – Henry's law – statement and limitations.

Solutions of liquid in liquid– Binary liquid mixture - Ideal and non ideal solutions – Raoult's law. - deviation from ideal behavior – pressure – composition and temperature – Composition diagrams for completely miscible binary solutions-Fractional distillation –Azeotropic distillation—nature of azeotropic mixtures-partially miscible liquids—consolute temperature-critical solution temperature-system with upper CST, lower CST and upper and lower CST – Liquid crystals, Nematic,Semetic and cholestic types and their applications

UNIT-V ELECTROCHEMISTRY-I (13 Hrs)

Metallic and electrolytic conductance – Definitions of specific, equivalent and molar conductances – Relations between them – measurement of conductance and cell constant. Variation of conductance with dilution – Qualitative explanation– Strong and weak electrolytes. Migration of ions – transport number – determination by Hittorf and moving boundary methods – Kohlrausch‘s law – applications – calculation of equivalent conductance for weak electrolytes and determination of transport number. Ionic mobilities and Ionic conductances. Diffusion and ionic mobility- molar ionic conductance and viscosity- Walden rule-Applications of conductance measurements – Degree of dissociation of weak electrolytes – Determination of Ionic product of water – Determination of solubility of sparingly soluble salts – conductometric titrations- Theory of strong electrolytes – Debye – Huckel – Onsager theory-verification of Onsager equation – Wein and Debye –Falkenhagen effect.

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Text books:

1. Principles of physical chemistry - Puri, Sharma and Pathania, Millennium Edition, Vishal Publishing Co
2. Text Book of physical chemistry - P.L. Soni - Sultan Chand.

Reference books:

1. Atkins' Physical chemistry, 9th Edition, Oxford University Press.
2. Advanced Physical Chemistry - Gurdeep Raj, Goel Publishing House.
3. Physical Chemistry, G.M.Barrow, Tata McGraw Hill.
4. Thermodynamics for chemist S.Glasstor
5. Physical chemistry P.K.Sharma and L.K.Sharma.

INORGANIC PREPARATIONS & DETERMINATION OF PHYSICAL CONSTANTS

L	T	P	C
0	0	2	1

Objectives

❖ To make the students thorough in inorganic complex preparations

Inorganic preparations

1. Preparation of potash alum
2. Preparation of chrome alum
3. Preparation of Prussian blue
4. Preparation of sodium ferrioxalate
5. Preparation of tetrammine copper(II) sulphate
6. Preparation of tristhiourea copper(I)chloridedihydrate
7. Preparation of potassium trisoxalatoferrate(III)
8. Preparation of hexathiourea lead(II) nitrate

Internal – 50 marks

25 marks - Regularity

20 marks – Average of best (preparation-4) four experiments in regular class work

5 marks - Average of 2 physical constant determinations

External -50 marks

20 marks – Record (atleast four experiments preparation-3 and phy. cont. detmn.-2)*

20 marks – Procedure-5 and preparation-15)

10 marks – phy. cont. detmn

*Experiments done in the class alone should be recorded

(Students having a bonafide record only should be permitted to appear for the practical examination)

Reference books:

1. Sundaram, Krishnan, Raghavan, Practical Chemistry (Part III), S. Viswanathan Co. Pvt.,
1996.

2. Vogel's Text Book of Quantitative Chemical Analysis. 5th Edi., ELBS/Longman England,
1989.

3. O.P. Pandey, D.N Bajpai, S. Gini, Practical Chemistry, for I, II & III BSc. Students. S.Chand & Company Ltd reprint 2009.

4. V.K.Ahluwalia, Sunitha Dhingra, Adarsh Gulate College Practical Chemistry, Universities Press (India) Pvt Ltd 2008 (reprint)

ALLIED CHEMISTRY - II

L	T	P	C
2	2	0	3

Objective

To learn the chemistry of basic aromatic compounds.
To understand the nuclear particles and few nuclear reactions
To know about carbohydrates, amino acids, proteins and nucleic acid.
To study about fuels, fertilizers, cement and glass.
To know about some common diseases and the drugs used.

UNIT 1 ORGANIC CHEMISTRY (11 Hrs)

Aromatic compounds

General characteristics of aromatic compounds - aromaticity – Huckel's rule with examples- non – benzenoid aromatic compounds (definition and examples only)

Preparation, properties and structure of benzene, naphthalene and anthracene.

UNIT 2 PHYSICAL CHEMISTRY (13 Hrs)

Nuclear chemistry

Nuclear stability – n/p ratio – packing fraction – mass defect – binding energy - isotopes, isobars, isotones with examples. Separation of isotopes by diffusion method – group displacement law - radioactive series - Nuclear fission, fusion - Application of radio isotopes (radio diagnosis and therapy, C-14 dating).

UNIT 3 BIO CHEMISTRY (11 Hrs)

Carbohydrates –definition and classification – artificial synthetic sweeteners. Amino acids - classification – amphoteric nature – isoelectric point. Proteins - classification according to composition, solubility and shape - colour reactions - biological action . Nucleic acids – purines, pyrimidines, nucleocides, nucleotides – DNA – structure of DNA – RNA - different types of RNA

UNIT 4 INDUSTRIAL CHEMISTRY (13 Hrs)

Fuel gases – Water gas, Producer gas, L.P.G, Gobar gas and Natural gas. Fertilizers – N.P.K and mixed fertilizers. Soaps and detergents – an elementary idea of soaps and detergents. Cleansing action of soaps and detergents. Cement and glass: Portland cement-manufacture only. Manufacture of glass- types and uses borosilicates -photochromic and safety glass.

UNIT-5: PHARMACEUTICAL CHEMISTRY (12 Hrs)

Common diseases – infective diseases – insect borne –air borne – water borne – hereditary diseases. Definition and examples of analgesics, antipyretics, sulpha drugs, antimalarials and, antibiotics. Diabetes – causes – hyper and hypoglycemic drugs. Indian medicinal plants – tulsi, neem, keezhanelli- their importance

Text Books

1. Puri, Sharma & Kalia, Principles of Inorganic Chemistry, Milestone Publishers and Distributors, 2008.
2. P.L. Soni, Text book of Inorganic Chemistry, Sultan Chand and Sons, 2007.

Reference Books

1. Bahl and Arun Bahl, Organic Chemistry, S. Chand and Sons, New Delhi , 2005.
2. Morrison & Boyd, Organic Chemistry, VIth ed, Prentice Hall of India Pvt. Ltd., New Delhi, 1998.
3. P. L. Soni, Text book of Organic Chemistry, S. Chand and Company Ltd., New Delhi .
4. J. L. Jain, Sunjay Jain and Nitin Jain, Fundamentals of Biochemistry, S. Chand and Company Ltd.,New Delhi, 2005.
5. S. Lakshmi, Pharmaceutical Chemistry, S. Chand and Sons, New Delhi , 1995.

INORGANIC QUALITATIVE ANALYSIS

1. Inorganic simple salt containing one acidic radical (interfering radical) and one basic radical
2. Acidic radical

   Interfering acidic radicals:

   Borate, Fluoride, Oxalate and Phosphate.
3. Basic radicals

   Group I : Lead

   Group II : Copper, Cadmium

   Group III : Ferric iron

   Group IV : Cobalt, Nickel

   Group V : Barium

   Group VI : Magnesium, Ammonium.

Internal –50 marks

25 marks - Regularity

25 marks – Average of four experiments in regular class work

External -50 marks

10 marks – Record (atleast 4 experiments)*

10 marks – Procedure

30 marks – Result

*Experiments done in the class alone should be recorded

(Students having a bonafide record only should be permitted to appear for the practical examination)

CHEMISTRY IN MEDICINE

L	T	P	C
4	0	0	4

Objectives

To have knowledge of first aid and the important rules.

To know the common chemicals in medicine

To have awareness of common diseases

To learn the diagnostic tests and to know the importance of vitamins.

Unit- I: FIRST AID (12 HRS)

First Aid for accidents-important rules-first aid kit ,First aid for cuts, bruises, bleeding, fractures, burns, fainting and poisonous bites.

Common poisons-Acid poisoning-antidote, Alkali poisoning-antidote, Poisoning by disinfectant- symptoms-antidote, Alkaloid poisoning-symptoms-antidote, alcohol poisoning-symptoms-antidote, Mercury poisoning-antidote and Salicylate poisoning-antidote.

Unit-II: CHEMICALS IN MEDICINE (13 HRS)

(Preparations and chemical equations not required) Alum-properties and uses- Aluminium hydroxide gel-uses-Dried Aluminium hydroxide gel-uses-Aluminium acetate-uses-Ferrous fumarate-uses-Ferrric ammonium citrate-uses.Ferrous gluconate-uses,Ferrous sulphate.

Biological importance of sodium, potassium, calcium ,Iodine and copper.

Unit-III: CAUSES AND TREATMENT OF SOME COMMON DISEASES: (12 HRS)

Insect borne diseases – malaria and filariasis Prevention and treatment. Air borne diseases – diphtheria, whooping cough, influenza, measles, mumps, common cold, tuberculosis and leprosy- Prevention and treatment. Water borne – cholera, typhoid and diarrhoeal diseases - Prevention and treatment. Respiratory disorder – Prevention and treatment of asthma .Nervous disorder – epilepsy—Prevention and treatment - other diseases – Peptic ulcer-treatment.

Unit- IV: CLINICAL CHEMISTRY

(12 HRS)

Clinical chemistry – Composition of blood – blood grouping - determination of blood groups and matching – blood pressure – hypertension – determination.

Determination of glucose in serum – Folin and Wu's method - determination of serum cholesterol – Sackett's method – tests for cholesterol. Estimation of glucose in urine – Diagnostic test for sugar in urine- Benedict's test-Clinistix-strip test Diagnostic test for salts in urine and serum. Detection of diabetes ,detection of anaemia.

Estimation of hemoglobin(Hb concentration) – estimation of red blood cells Normal RBC count in adults.

Unit V : HEALTH CARE MEDICINES (11 HRS)

Vitamins-Classification of Vitamins-Sources- deficiency diseases of Vitamins A, D, E, K, B_1, B_2, Bc, B_6, B_{12} and C –Therapeutic uses. Treatment of ulcers and skin diseases.

Text Books

1. Practical Biochemistry – David Plummer – 2005, Tata McGraw-Hills Publishing Company.

2. Text Book of Pharmaceutical Chemistry – Jeyashree Gosh – 2003, S.Chand and Company, New Dehi.

Reference Books.

1. Medicinal Chemistry – G.R.Chatwal, 2002, Himalaya Publishing House, New Delhi.

L	T	P	C
4	0	0	4

INDUSTRIAL CHEMISTRY

Objectives:

To gain knowledge about systems of units and conversion factor

To understand utilities in chemical industries

To know the severity of corrosion and methods of preventing it

To study the industrial process of silicate industry

To acquire the knowledge about the unit process

UNIT I - UNITS AND DIMENSIONS, MATERIAL BALANCE (12 Hrs)

Fundamental and derived quantities – System of unit – significance of dimensional analysis – forces – weight – volume – pressure – work – energy – power. Basic chemical calculations: Atomic mass – Molar mass – concept of mole, gmol, comparison of liquid mixtures and gaseous mixtures, percentage of mass, volume and mol – ideal gas laws – Dalton's law, Amagat's law and Henry's law – density and pressure measurements.

Material balance without chemical reaction: Material balance equation – transient and steady state – simple material balance with and without recycle and bypass or chemical engineering operations such as evaporation, drying, filtration, extraction and crystallization.

UNIT II - FUELS AND FURNACES (13 Hrs)

Fuels – types of fuels – calorific values – ignition point – pyrometric effect – explosives range – Flue gas analysis by Orsat's method – explosives – classifications – low explosives – initiating explosives – high explosives – rocket propellants – nuclear fuels.

Furnaces – types of furnaces – Kilns – Blast furnace, reverberatory furnace – muffle furnace – electric furnace – regenerative furnace, open hearth furnace – Bessemer converter – vertical retort furnace.

UNIT III - CORROSION AND PROTECTIVE COATING (11 Hrs)

Introduction – severity of corrosion – chemical and electrochemical corrosion – mechanism – factors influencing corrosion – control of corrosion – cathodic and anodic protection.

Paints – characteristics of paint – constituents of paints - pigments – vehicles – thinners – driers – fillers – plasticizers – anti skinning agents – their function and properties.

Metallic coating – removal of surface contamination – removal of superficial corrosion products – polishing – galvanizing – tinning – electroplating.

UNIT IV - SILICATE INDUSTRY (12 Hrs)

Refractories – requirements of refractories – properties of refractories – solid refractories – fire clay refractories – magnesite refractories, dolomite bricks, graphite refractories, zirconia refractories, silicon carbide.

Abrasives – classifications – natural (diamond, corundum, emery, garnet, quartz and flint) and artificial (carborundum, alundum, boron carbide, metallic abrasives). Uses of abrasives – cement manufacture – setting and hardening of cements – gypsum – plaster of Paris – manufacture – setting and hardening – uses. White wares manufacture – types – glazing.

UNIT V - UNIT PROCESSES IN ORGANIC MANUFACTURE (12 Hrs)

Sulphonation – uses and applications of sulphonates and sulphates – sulphonating agents – sulphur trioxide – organic complexes – chemical and physical factors in sulphonation – commercial sulphonation of benzene – batch vs continuous sulphonation. Hydrolysis – hydrolyzing agents – mechanism of hydrolysis.

Oxidiation – types of oxidation reactions – oxidizing agents – permanganate and dichromate – liquid phase oxidation – vapour phase oxidation – commercial manufacture of acetic acid. Hydrogenation – catalysts for hydrogenation - hydrogenation of vegetable oils.

Reference books:

1.Industrial Chemistry, B. K. Sharma, Goel Publishing House, Meerut.

2.Industrial Chemistry, B. N. Chakrabarthy, Oxford & IBH Publishing Co. Pvt. Ltd. Calcutta.

Reference books:

1. Unit Operations I & II K. A. Gavhane, Nirali Prakashan, Pune.
2. Unit Processes in Organic Synthesis, P. H. Groggins, Tata McGraw-Hill Publishing Company limited, New Delhi.
3. Stoichiometry – B. Z. Bhatt and S. M. Vora.
4. Engineering Chemistry, Jain and Jain.

DAIRY CHEMISTRY

L	T	P	C
2	0	0	2

Objectives:

To learn the composition and properties of milk

To understand the chemical composition of milk and milk processing.

To know the chemistry of cream and butter

To study to fermented milk products

To know the condensed milk and dairy detergents

UNIT-I PROPERTIES OF MILK (5 Hrs)

Definition, Composition, Milk lipids, Milk proteins, vitamins and minerals. Factors affecting the composition of milk - adulterants, preservatives, and neutralizer - examples and their detection.

UNIT-II PROCESSING OF MILK (6 Hrs)

Destruction of microorganisms in milk – physicochemical changes during processing – boiling, pasteurization – pasteurization types – bottle pasteurization –batch pasteurization – HTST (High Temperature Short Time) – vacuum pasteurization –(UHT) Ultra High Temperature Pasteurisation.

UNIT-III MILK PRODUCTS-I (7 Hrs)

Milk Products: Cream - definition, classification – manufacturing - chemistry of creaming process - physico–chemical properties – separation of cream , estimation of fat in cream , Butter - definition, classification, composition, theory of churning, desibutter, salted butter. Ghee - major constituents, common adulterants and their detection.

UNIT-IV MILK PRODUCTS-II (6 Hrs)

Fermented milk products - fermentation of milk - definition and conditions. Ice creams - definition, composition, types, manufacture of ice - cream, stabilizers, emulsifiers, and their role, milk powder - definition, process of making milk powder.

UNIT –V CONDENSED MILK AND DAIRY DETERGENTS (6 Hrs)

Condensed milk – definition, classification and differences between condensed milk and skim – condensed milk – sanitation - pasteurization – nutritive value of milk – difference between cow milk and bauffalo milk- milk enzymes. Dairy Detergents : Definition-characteristics-classification-washing procedure (modern method) sterilization-chloramin-T and hypochlorite solution.

Text books :

1. Applied Chemistry-K.Bagavathi Sundari MJP Publishers Chennai. 2006.

2. Principles of dairy technology - Robert Jenness, Wiley, New York

Reference books :

1. Indian Dairy Products - Rangappa and Acharya, K.T. Asia Publishing House, Bombay, India.

2. Fundamentals of Dairy chemistry - Wond. F.P. Springer.

3. Outlines of Dairy Technology - Sukumar De. – Oxford University Press.

4. Applied chemistry for home science & allied science - T.Jacob, Mcmillan.

APPLIED CHEMISTRY

L	T	P	C
2	0	0	2

Objectives:

To acquire knowledge about the chemicals used in day to day life

UNIT I - SOAPS AND DETERGENTS (5 Hrs)

Soaps: Definition-classification-raw materials used in the manufacture of soap –manufacture of toilet soap.

Detergents: Definition –various types with examples- advantages of detergents over soaps – cleansing action of soap.

UNIT II- FERTILIZERS (6 Hrs)

Definition-characteristics of a good fertilizer- role of nitrogen, potassium and phosphorous in plant growth – natural fertilizers- chemical fertilizers: urea, muriate of potash and triple superphosphate - mixed fertilizers - biofertilizers – advantages of biofertilizers.

UNIT III - POLYMERS (7 Hrs)

Fibers: Classification –uses of terylene, nylon and orlon.

Resins: Natural resins- synthetic resins-type-uses of fevicol, quick fix, araldite, glyptal and Bakelite.

Plastics: classification- differences between thermoplasts and thermosets. Advantages of plastics-uses of polythene, PVC, polystyrene, Teflon and thermocole.

Rubber: Types-defects in natural rubber-vulcanization-synthetic rubbers- uses of neoprene, thiocol, butyl rubber, silicone rubber and foam rubber.

UNIT IV - CHEMICALS IN PHARMACY (7 Hrs)

Definition and therapeutic uses of the following (an elementary study only)

Antiseptics: alum, boric acid

Mouth washes: Hydrogen peroxide

Antacids: Aluminium hydroxide

Analgesics: Aspirin, paracetamol

Antibiotics: Penicillins, tetracyclines

Haematinics: Ferrous fumerate, ferrous gluconate

Laxatives: Epsom salt, milk of magnesia

Sedatives: Diazepam

UNIT V - CHEMICALS IN DAY-TO-DAY LIFE (5 Hrs)

An outline of the preparation and uses of the following articles.

Tooth powder, tooth paste, writing inks, gum paste, boot polish, talcum powder, chalk crayons, agar battis, phenyl and moth balls.

Text books:

1. B. K. Sharma, Industrial Chemistry, Goel Publishing House, Meerut.
2. Jeyashree Gosh, A text book of Pharmaceutical Chemistry, S. Chand and Company, NewDelhi.

Reference books:

1.B. N. Chakrabarty, Industrial Chemistry, Oxford and IBH Publishing Co. Pvt.Ltd., Calcutta.

ORGANIC CHEMISTRY-III

L	T	P	C
6	0	0	4

Objectives

To learn about stereochemistry

To understand aromaticity

To study dyes

UNIT - I OPTICAL ISOMERISM (20 Hrs)

Representation of molecules in saw horse, Fischer, flying-wedge and Newman formulae and their inter translations.

Symmetry elements - chirality – asymmetric molecules and molecular dissymmetry-pseudo asymmetry.

Optical rotation – specific rotation –optical purity – racemisation (through cationic and anionic and radicalintermediates), resolution of acids, bases and alcohols via diastereomeric salt formation.

Optical isomers - enantiomers – diastereomers – epimers - notation of optical isomers - Cahn-Ingold-Prelog rules, R and S notations for optical isomers with one and two asymmetric carbon atoms - erythro and threo representations - D and L representations

Optical activity in compounds without asymmetric carbon atoms namely biphenyls, allenes and spiranes. Stereo selectivity – stereo specificity – partial asymmetric synthesis.

point,dipolemoment – chemical method – dehydration and cyclisation.

UNIT -II GEOMETRICAL & CONFORMATIONAL ISOMERISM (20 Hrs)

Geometrical isomerism – nomenclature of geometrical isomers – cis – trans ,E-Z notation and syn-anti for C=C,C=N compounds. Methods to assign configurations.
Stability of geometrical isomers and heats of hydrogenation.

Conformation: Conformational nomenclature - eclipsed, staggered, gauche and anti; dihedral angle, torsion angle, energy barrier of rotation – potential energy diagram. Relative stability of conformers on the basis of steric effect, dipole-dipole interaction, H-bonding;
Conformational analysis of ethane, propane, n-butane, haloethane, 1,2-dihaloethane, 1,2-glycol and 1,2-halohydrin, cyclopentane, cyclohexane and mono substituted cyclohexanes.

UNIT - III AROMATICITY & AROMATIC SUBSTITUTION (18 Hrs)

Aromaticity – definition – Huckel's rule – consequence of aromaticity – stability, carbon-carbon bond lengths of benzene, resonance energy and participation of substitution vs addition – examples.Non-benzenoid aromatic compounds

Aromatic electrophilic substitution – general pattern of the mechanism, role of σ and π complexes, Mechanism of nitration, halogenation, sulphonation and Friedel-Crafts reaction. Activating and deactivating substituents, orientation in mono substituted benzenes, ortho/para ratio- Orientation- Korner's absolute method, dipole moment method – direct influence of substituents – rules of orientation - Aromatic Nucleophilic substitutions- unimolecular, bimolecular and benzyne mechanisms

UNIT – IV HETEROCYCLIC COMPOUNDS (18 Hrs)

Molecular orbital picture and aromatic characteristics of pyrrole,furan, thiophene and pyridine. Comparison of basicity of pyridine, piperidine and pyrrole.

Methods of synthesis and chemical reactions with particular emphasis on the mechanism of electrophilic substitution and mechanism of nucleophilic substitution reaction in pyridine derivatives.

Preparation and reactions of indole, quinoline and isoquinoline with special reference to Fisher indole synthesis, Skraup synthesis and Bischler-Nepieralski synthesis, mechanism of electrophilc substitution reactions of indole, quinoline and isoquinoline.

UNIT – V DYES & POLYNUCLEAR HYDROCARBONS (14 Hrs)

Dyes - theory of color and constitution - chromophore, auxochrome, classification according to application and structure - preparation and uses of azo dyes - methyl orange, triphenyl methane dyes -malachite green, indigo dyes - Indigotin, anthraquinone dyes - alizarin, phthalein dyes –Phenolphthalein-Synthesis reactions & Structure of Naphthalene & Anthracene

Text Books

1. Textbook of Organic Chemistry - P.L.Soni - Sultan Chand
2. Advanced organic Chemistry - B.S.Bahl - S. Chand

Reference Books

1. Principles of Organic Chemistry - A.K.Bansal - New Age
2. A Textbook of Organic Chemistry - A.K.Bansal - New Age
3. Organic Chemistry - I.L.Finar - Volume I & II - Addision **Welsey**
4. Organic Chemistry - R.T.Morrison and Boyd - Prentice Hall
5. Stereochemistry of Organic Compounds - D.Nasipuri - New Age
6. Stereochemistry, Conformation and Mechanisms - Kalsi New Age
7. Advanced General Organic Chemistry - Sachin K.Ghosh - Books and Allied (P) Ltd
8. Textbook of Organic Chemistry - P.S.Kalsi – Macmillan
9. Organic Chemistry – Bhupinder Mehta and Manju Mehta - PHI Learning (P) Ltd.

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Physical chemistry-III

L	T	P	C
6	0	0	4

Objectives

To learn about thermodynamics, electrochemistry and surface chemistry
To understand group theory and spectrochemistry

UNIT I: THERMODYNAMICS-III (20 Hrs)

Van't Hoff isotherm and isochore - Clapeyron equation-Clapeyron-Clausius equation-Applications of Clapeyron-Clausius equation.

Third law of thermodynamics: Nernst heat theorem- statement of III law and itsapplications. Exception to third law- experimental verification of the law-residual entropy-Evaluation of absolute entropy from heat capacity measurements.

Partial molar properties: Partial molar free energy. The concept of chemical potential – variation of chemical potential with T and P- Gibbs Duhem equation- concept of fugacity and activity- activity coefficient- standard states.

UNIT – II ELECTROCHEMISTRY –II (18 Hrs)

Galvanic cells – Reversible and Irreversible cells – EMF and its measurement – Weston Standard cell – types of reversible single electrodes – standard Hydrogen electrode – calomel electrode –Derivation of Nernst equation both for emf of cells and single electrode potentials – Nernst theory for single electrode potential –standard reduction potentials – electro chemical series –significance.Application of emf measurements – Application of Gibbs –Helmholtz equation to galvanic cells – calculation of thermodyamic quantities – pH using hydrogen, quinhydrone and glass electrodes – potentiometric titrations. Concentration cells – electrode concentration cells- electrolyte concentration cells- concentratoion cells with and without transference – LJP expression –polarization – over voltage- decomposition voltage.

UNIT - III SURFACE CHEMISTR (16 Hrs)

Adsorption - physisorption and chemisorptions - adsorption of gases by solids - adsorption isotherms - Freundlich adsorption isotherm - derivation of Langmuir adsorption isotherm, statement and explanation of BET isotherm - applications of adsorption - determination of surface area – adsorption indicators.

General characteristics of catalytic reactions – phase transfer catalysis - acid base catalysis - enzyme catalysis - mechanism and kinetics of enzyme catalyzed reactions - Michaelis-Menten equation.

UNIT - IV GROUP THEORY (16 Hrs)

Concept of symmetry in chemistry - symmetry operations and symmetry elements - rotational axis of symmetry and types of rotational axes - planes of symmetry and types of planes - improper rotational axis of symmetry - identity element - groups and their basic properties – Abelian and cyclic groups - classification of molecules into point groups - the symmetry operations of a molecule form a group – $H_2O$and NH_3point groups - group multiplication tables.

UNIT – V SPECTROSCOPY- I (20 Hrs)

Introduction - various types of molecular spectra - electronic, vibrational and rotational energy levels - Born-Oppenheimer approximation.
Rotation spectra of diatomic molecules - determination of bond length and moment of inertia from rotational spectra - numerical problems - selection rule, effect of isotopic substitution.
UV-visible spectroscopy: theory - types of transitions in molecules - selection rules for electronic spectra - factors affecting absorption maximum and intensity – applications.
IR spectroscopy : theory - stretching and bending vibrations - factors affecting vibrational frequencies - important spectral regions for the characterization of functional groups - finger print region - determination of force constant - qualitative relation of force constant to bond energies - selection rules - modes of vibrations in polyatomic molecules - vibrational modes of H_2O and CO_2 – applications - numerical problems.

Text books :

1. B.R. Puri, L.R. Sharma & M.S. Pathania, Principles of Physical Chemistry, Vishal Publishing Co., Jalandhar.
2. P.L. Soni, O.P. Dharmarha & U.N. Dash, Text book of Physical Chemistry, 22ndEdn., Sultan Chand & Sons, New Delhi

Reference books :

1. Essentials of Physical Chemistry– B.S.Bahl, Arun Bahl, G.D.Tuli, Reprint 2006,S.Chand & Company Ltd., New Delhi-110055.
2. Physical Chemistry volumes I & II- S.Pahari, 2004, New Central Book Agency,Kolkotha.
3. Physical Chemistry-G.M.Barrow, 2005, Tata McGraw Hill Publishing Company, New Delhi.
4. Physical Chemistry-G.K.Vemulapalli, 2004, Prentice Hall of India.
5. Kemp, W. Organic Spectroscopy
6. Jag Mohan Organic Spectroscopy
7. Group theory and its Chemical Applications - P.K.Bhattacharya - Himalaya publishing House.

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POLYMER CHEMISTRY

L	T	P	C
4	0	0	4

Objectives:

To know the concept of polymerization and types of polymers

To understand the characteristics of polymers

To acquire knowledge about the polymerization techniques and polymer processing

To know the chemistry of individual polymers

To have an idea about the recent advances in polymer sciences

UNIT I - INTRODUCTION TO POLYMERS (14 Hrs)

Definition - Monomer, polymer and polymerisation - classification of polymers on the basis of (i) origin - Natural, semi synthetic, synthetic,

(ii) Physical properties and applications - Rubbers, plastic, fibres

(iii) Thermal response - thermoplastics, thermosetting

(iv) Structure - Homopolymers (linear, branched, cross link or network), Copolymers (Random, Alternate, Block, Graft)

(v) Crystallinity - non-crystalline (amorphous), semi-crystalline

(vi) Mode of formation - Addition, Condensation Polymerisation (definition and examples only)

(vii) Methods of polymerization - Bulk, Solution, Suspension Polymerisation (definition and examples only)

Chemistry of polymerization: Chain polymerization, free radical, ionic, co-ordination, step polymerization, polyaddition and polycondensaion, miscellaneous ring opening and group transfer polymerizations.

UNIT II - CHARACTERISTICS OF POLYMERS (11 Hrs)

Glass transition temperature (Tg) - definition – Factors affecting Tg – relationships between Tg and molecular weight and melting point. Importance of Tg. Molecular weight of polymers. Number average, weight average (problems), sedimentation and viscosity average molecular weights. Molecular weights and degree of polymerization - chemical reaction - hydrolysis - hydrogenation - addition - substitution – cross-linking, vulcanisation and

cyclisation reactions. Polymer degradation - basic idea of thermal, photo and oxidative degradation of polymers.

UNIT III - POLYMERIZATION TECHNIQUES AND PROCESSING (11 Hrs)

Bulk, solution, suspension, emulsion, melt condensation and interfacial poly condensation polymerizations. polymer processing - calendaring - die-casting, rotational casting - compression moulding - injection moulding - blow moulding - extrusion moulding and reinforcing.

UNIT IV - CHEMISTRY OF SOME COMMERCIAL POLYMERS (12 Hrs)

Preparation, properties and uses of the following polymers. Thermoplastics, polyethylene, polypropylene, polystyrene, polyacrylonitrile, polyvinyl chloride, nylon, polyester.

Thermosetting plastics: Phenol formaldehyde resin, urea formaldehyde resin, melamine formaldehyde, epoxy resin, polycarbonate.

Elastomers: Natural rubber and synthetic rubber, Styrene and neoprene rubber.

UNIT V - ADVANCES IN POLYMER (12 Hrs)

Biopolymers - Biomedical polymers - contact lens, dental polymers, artificial heart, kidney, skin and blood cells - High temperature and fire resistant polymers - silicones - conducting polymers - (elementary idea) - polysulphur nitrile, polyphenylene, polypyrrole and polyacetylene. Polymer industry in India.

Text books:

1. V.R. Gowarikar, N.V. Viswanathan and J. Sreedhar. Polymer Science, Wiley Eastern, 1995.
2. F.N. Billmeyer, Textbook of Polymer Science, Wiley Interscience, 1971.

References books:

1.Material Science II edition, P.K. Palanisamy SCITECH Publications India Pvt., Ltd., Chennai-600001.

2.Engineering Chemistry, V Srinivasan, S.D. Uma Maheshwari, M. Meena. SCITECH Publications India Pvt., Ltd., Chennai-600001.

3. Introduction to Organic Chemistry. John McMurry Brooks/cole Cenage Learning India Private Limited. First Reprint 2008.
4. Modern Chemistry, David. W. Oxtoby, H.P. Gills, Alan Campion Brooks/cole Cenage Learning India Private Limited. First Reprint 2008.

Bioinoganic chemistry

L	T	P	C
4	0	0	4

Objectives

To study the significance of metal ions' transport and storage,

To study a few metallo enzymes,

To study electron transfer proteins,

To study oxygen transport and activation proteins,

To study the fundamentals of supramolecular chemistry

Unit I Metal ions in biology (13 Hrs)

Metal ions in biology- Essential and trace elements in biological system – biological importance and toxicity of elements such as Fe , Cu , Zn , Co , Mo , W , V , Mn , and Cr in biological system and their vital role in the active site- Ion transport mechanism in cell membrane – Na and K pumps- Ionophores.

Unit II Metallo porphyrins (13 Hrs)

Chlorophyll – photosynthetic electron transport sequence – biological electron carriers : iron-sulphur proteins-ferredoxin, rubridoxin and cytochromes , cytochromes and blue copper proteins – oxygen carriers: haemoglobin and myoglobin dioxygen binding - co-operativity in haemoglobin - the Bohr effect -, Vitamin B12 and cytochrome P450-mechanism of action

Unit III Metallo enzymes (11 Hrs)

Role of Zinc in enzyme chemistry-Zinc finger, Zinc twist and zinc cluster Structure and functions of Metallo proteins and enzymes - superoxide dismutase, carbonic anhydrase carboxypeptidase A, Catalase, LADH, and Peroxidase.

Unit IV Metals and Health **(11 Hrs)**

Application of therapeutic chelating agents- Metal-based drugs cis-platin, carboplatin, platinum anti-cancer drugs, gadolinium MRI contrast agents, Gold and arithritic agents – auranofin,solganol,myochristin, Toxicity of metals–Cd,Hg and Cr-bio metyhylation of mercury

Unit V Supramolecular chemistry **(12 Hrs)**

Concepts of supramolecular chemistry. – Host-Guest concept- Various types of non-covalent interactions. Hydrogen bonds, C-H…X interactions, Halogen bonds. $\pi - \pi$ interactions,non – bonded interactions. Various types of molecular recognition- Cations, Anions and Neutral guests – Supramolecular Devices and Sensors: Various types of supramolecular devices – an overview

Text Books:

1. Lippard, S.J. & Berg, J.M., Principles of Bioinorganic Chemistry Panima Publishing Company 1994. Cotton, F.A., Wilkinson, G., & Gaus, P.L. Basic Inorganic Chemistry 3 rd Ed.; Wiley India,
2. Huheey, J. E.; Keiter, E.A. & Keiter, R.L. Inorganic Chemistry, Principles of Structure and Reactivity 4 th Ed., Harper Collins 1993, Pearson,2006.

Reference Books:

1.Sharpe, A.G. Inorganic Chemistry, 4 th Indian Reprint (Pearson Education) 2005

2.Douglas, B. E.; McDaniel, D.H. & Alexander, J.J. Concepts and Models in Inorganic Chemistry3rd Ed., John Wiley and Sons, NY, 1994.

3. Greenwood, N.N. & Earnshaw, A. Chemistry of the Elements 2 nd Ed, Elsevier, 1997 (Ziegler Natta Catalyst and Equilibria in Grignard Solution).
4. JW Steed and JL Atwood Supramolecular Chemistry 2nd Ed. Wiley 2011
   P D Beer, P A Gale and D K Smith Supramolecular Chemistry OUP, 1999
   J-M Lehn Supramolecular Chemistry VCH, 1995
5. Lee, J.D. Concise Inorganic Chemistry 5 th Ed., John Wiley and sons 2008.
6. Powell, P. Principles of Organometallic Chemistry, Chapman and Hall, 1988.
7. Shriver, D.D., Atkins, P. and Langford, C.H., Inorganic Chemistry 2 nd Ed., Oxford University Press, 1994.
8. David E Fenton, Bio coordination chemistry, oxford science publications. 1995
9. Asim K. Das, Bioinorganic Chemistry, Books and allied (P) Ltd. 2007.

ANALYTICAL CHEMISTRY

L	T	P	C
4	0	0	4

Objective :

To know the importance of analytical chemistry and to study about the different types of analytical techniques

UNIT I - ERRORS AND DATA ANALYSIS (13 Hrs)

Definition and explanation with examples of the terms – mean, median, mode, range, deviation, mean deviation, relative mean deviation, standard deviation, coefficient of variation and variance – accuracy and precision – types of errors – random and systematic errors – methods of detection and elimination of systematic errors – student's t-test – confidence levels – Q-test for rejection of result – curve fitting – method of least squares – significant figures and computational rules.

UNIT II - WATER ANALYSIS (12 Hrs)

Sampling and preservation of water samples – physical examination of water : color, odour, turbidity, taste and electrical conductivity – chemical characterisation : pH, acidity, alkalinity, TDS, total, temporary, permanent, calcium and magnesium hardness, chloride, fluoride, BOD, COD, detergents and pesticides – residual chlorine and chlorine demand – Bacteriological examination : total and faecal coliforms.

UNIT III - FUEL ANALYSIS (12 Hrs)

Solid fuels : coal – classification – proximate analysis : moisture content, ash content, volatile matter and fixed carbon – ultimate analysis : carbon, hydrogen, nitrogen, sulphur and oxygen – heating values – grading of coal – comparison of coal and coke – liquid fuels : flash point, aniline point, octane number and carbon residues – gaseous fuels : producer gas and water gas – calorific values.

UNIT IV - ELECTROANALYTICAL TECHNIQUES (11 Hrs)

Electrogravimetry : principle, instrumentation and applications. Coulometry : constant current coulometry – coulometric titrations – applications – potentiostatic coulometry – Polarography : principle – experimental assembly – working – advantages and disadvantages of DME – applications to qualitative and quantitative analysis. Amperometric titrations : theory – apparatus – general procedures – applications – advantages.

UNIT V - SPECTROANALYTICAL AND THERMOANALYTICAL METHODS (12 Hrs)

Spectroanalytical methods : principle, instrumentation and applications of colorimetry, spectrophotometry and fluorimetry – light scattering techniques: nephelometry and turbidimetry.

Thermo analytical methods : principle, instrumentation and applications of TGA and DTA – characteristic features of TGA and DTA curves – factors affecting TGA and DTA curves – simultaneous DTA - TGA curves – thermometric titrations.

Text books:

1) D.A.Skoog, D.M.West and Holler, *Analytical Chemistry : An introduction*, 6th Ed., Saunders College Publising.
2) Gary D. Christian, *Analytical Chemistr*y, 6th Ed., John Wiley & Sons.

Reference books:

1) S.M.Khopkar, Environmental Pollution Analysis, 1st Ed., Wiley Eastern Ltd.,
2) APHA, *Standard Methods for Estimation of Water and Waste water*, 19th Ed., American Public Health Association.
3) O.P.Vermani and A.K. Narula, *Applied Chemistry*, 2nd Ed., New Age International Publishers.
4) A.K.Shaha, *Combustion Engineering and Fuel Technology*, Oxford & IBH Publising Company.
5) D.A.Skoog, Holler and Nieman, *Principles of Instrumental Analysis,* 5th Ed., Saunders College publishing.
6) Hobart H.Willard, Lynne L.Merritt, John A.Dean and Frank A. Settle, *Instrumental Methods of Analysis*, 7th Ed., CBS Publishers & Distributors Pvt. Ltd.,

PHARMACEUTICAL CHEMISTRY

L	T	P	C
4	0	0	4

Objectives

i. To understand the concepts and terminologies of pharmaceutical chemistry
ii. To know the mechanism of action and metabolism of drugs
iii. To study the functions of various drugs
iv. To know the important diseases and their treatment
v. To study the common diseases and important disorders of human beings and the drugs used in the treatment.

UNIT-I IMPORTANT TERMINOLOGIES, CLASSIFICATION AND ASSAY (12 Hrs)

Important terminologies - pharmacology, molecular pharmacology, pharmacophore , metabolites, antimetabolites, virus, bacteria, fungi, actinomycetes, mutation, pharmacognosy, pharmacotherapeutics, toxicology, chemotherapy – classification of drugs – nomenclature of drugs – nonproprietary names – sources of drugs – assay of drugs (biological, chemical, immunological)

UNIT-II MECHANISMS, METABOLISMS AND MEDICINAL PLANTS (12 Hrs)

Mechanism of drug action – absorption, drug delivery, drug excretion –Metabolism of drugs –chemical pathways of drug metabolism – phase – I (oxidative, reductive and hydrolytic reactions) and phase - II (conjugate reactions). Physiological effects of different functional groups in drugs –biological role of Na, K, Ca, Cu, Zn and iodine.

Indian medicinal plants – Tulsi, neem, Keezhanelli, adathode, thoothuvalai

UNIT- III DRUGS AND FUNCTIONS (13 Hrs)

Analgesics- narcotic analgesics- analgesic action, uses and structure activity of morphine. Non-narcotic analgesics –aspirin and paracetamol. Anaesthetics- local anaesthetics –procaine- General anaesthetics- chloroform and halothane. Antibiotics – Therapeutical values of penicillin, tetracyclines, chloramphenicol and streptomycin. Sulpha drugs – sulphanilide, sulphadiazine and cotrimoxazole. Antiseptics and disinfectants – phenols, chloramines and organicmercurials. Antidepressants – barbiturates – mechanism of action and uses.Antipsychotic drugs – piperazine and benzamides.

UNIT-IV DISEASES AND TREATMENT (12 Hrs)

Composition of blood – blood grouping and matching – Rh factor. Blood pressure – causes, control and treatment- antihypertension drugs- antianginal agents cardiovascular drugs, cardiacglycosides, vasodilators (one example for each). Aneaemia – causes and control – antianemic drugs. Diabetes – causes and control – hypoglycemic drugs – insulin – oral hypoglycemic drugs (tolubutamide and chlorpropamide). Cancer- causes and treatment – cobalt therapy - antineoplastic drugs (chlorambucil, methotrexate, plant products and hormones).

UNIT- V COMMON DISEASES AND HEALTH CARE MEDICINES (11 Hrs)

Common diseases – causes and treatment of insect borne diseases (Malaria and Filariasis), Airborne diseases (Diptheria, Whooping cough, Influenza, common cold, TB) and Water borne diseases (Cholera, Typhoid and Dysentery). Digestive disorder – Jaundice. Respiratory disorder –Asthma . Nervous system disorder – epilepsy. Other diseases – Leprosy.

Health care medicines – Sources and deficiency diseases of Vitamins A, B complex, C , D, E and K.

Reference books:

1. A text book of pharmaceutical chemistry, Jayashree ghosh, S. Chand, 2003.
2. Pharmaceutical Chemistry by S. Lakshmi, Sultan Chand & Sons, 3rd edition (2004).

Reference books:

1.Medicinal Chemistry, Ashutosh kar, New Age International, 1992

2.Pharmaceutical chemistry – G.R. Chatwal

3. Pharmacology and Pharmatherapeutics – R.S. Satoskar and S.D. Bhandarkar.
4. Drugs , G.L.D. Krupadanam, D.V. Prasad, K.V.Rao, K.L.N.Reddy and C.Sudhakar,Tata McGraw- Hill Publishing Company,New Delhi.
5. Medicinal chemistry, G.R.Chatwal, Himalaya Publishing House, New Delhi (2002)

INORGANIC CHEMISTRY – III

L	T	P	C
5	0	0	4

Objectives

To study the theories in coordination chemistry

To study the chemistry of metal carbonyls

To understand the role of metal ions in biological systems

To study the basic principles of photoinorganic chemistry

UNIT - I COORDINATION CHEMISTRY-I (15 Hrs)

Introduction: IUPAC nomenclature, Ligands- monodentate, bidentate, and polydentate ligands; coordination sphere; coordination number; nomenclature of mononuclear and dinuclear complexes. Structural and stereoisomerism in tetrahedral, square planar and octahedral complexes.Valance Bond theory – applications of valance bond theory to tetrahedral, square planar and octahedral complexes- Merits and limitations of VB theory.

UNIT – II COORDINATION CHEMISTRY II (16 Hrs)

Crystal field theory - splitting of d-orbitals in octahedral and tetrahedral complexes - factors affecting the magnitude of crystal field splitting - effects of crystal field splitting - spectrochemical series - applications of CFT - magnetic properties and spectra of transition metal complexes - crystal field stabilization energy and their uses - limitations of CFT - effective atomic number rule - stability of complexes - step-wise and overall stability constants - factors affecting the stability of complexes - determination of stability constants.

UNIT – III CO-ORDINATION CHEMISTRY III (14 Hrs)

Labile and inert complexes - ligand substitution reactions in octahadral complexes: aquation, base hydrolysis and anation reactions - substitution reactions in square planner complexes - Trans effect - theories of trans effect - mechanism of substitution reactions - redox reactions: inner-sphere and outer-sphere electron transfer reactions.

UNIT - IV ORGANOMETALLIC CHEMISTRY (14 Hrs)

Introduction–History, Nomenclature of organometallic compounds, EAN rule and 18 electron rule. Structure and nature of M-L bond in metal carbonyls - metal nitrosyls. preparation of organo metallic compounds of Mg, Zn, Li, Cu, P, B, Ti, Fe and Co

Wilkinson's catalyst and alkene hydrogenation, hydroformylation, Mansanto acetic acid process, Ziegler – Natta catalyst and polymerization of olefins.

UNIT - V Inorganic photochemistry (16 Hrs)

Electronic transitions in metal complexes : selection rules - metal-centered and charge-transfer transitions - properties of excited states - bimolecular quenching and energy transfer - photochemical pathways : substitutional, reduction-oxidation and isomerisation processes - photosubsitution reactions of Cr(III) complexes - Adamson's rules - photoredox reactions of Co(III) complexes - photoismerisation in Pt(II) complexes. Photochemical conversion and storage of solar energy : photolytic cleavage of water into H_2 and O_2 - photoelectrochemical devices : photogalvanic cells and semiconductor based photovoltaic cells.

Text books :

1. J.D. Lee, *Concise Inorganic Chemistry* 5th Ed., Blackwell Science Ltd.,
2. James E. Huheey, Elien A. Keiter and Richard L. Keiter, *Inorganic Chemistry : Principles Structure and Reactivity,* 4th Ed., Harper College Publisher.

Reference books :

1.F. Albert Cotton, Geoffrey Wilkinson, Carlos A. Marilo and Manfred Bochman, *Advanced Inorganic Chemistry*, 6th Ed., Wiley Interscience Publication.

2.Fred Basolo and Ralph G. Pearson, *Mechanisms of Inorganic Reactions : A study of metal complexes in solution,* 2nd Ed., John wiley and sons, Inc.,

3. David E. Fenton, *Biocoordination Chemistry,* Ist Ed., Oxford Science Publications.
4. Ivano Bertini, Harry B Gray, Stephen J Lippard, Joan Selverstone Valentine, *Bioinorganic Chemistry,* 1st Ed., Viva Books Pvt. Ltd.,
5. J.K. Rohatgi - Mukherjee, *Fundamentals of Photochemistry* - Wiley Eastern Revised Ed.,
6. *Journal of Chemical Education,* Vol.60, No.10, October 1983.
7. A.W. Adamson and P.D. Fleischauer, (Editors) *Concepts of Inorganic photochemistry,* John wiley and sons, New York, 1975.

ORGANIC CHEMISTRY - IV

L	T	P	C
5	0	0	4

Objectives

To learn about natural products

To understand chemistry of aromatic compounds

To study spectroscopy

UNIT-I CARBOHYDARATES (16 Hrs)

Classification-Monosaccharides- constitution of glucose and fructose. Reactions of glucose and fructose – Osazone formation, Mutarotation and its mechanism, cyclic structure, pyronose and furanose forms. Epimerisation-Chain lengthening and shortening of aldoses. Interconversions of aldoses and ketoses.

Disaccharides- sucrose- reactions and structure.

Polysaccharides – starch and cellulose (elucidation of structure not necessary).

UNIT-II PHENOLS, AROMATIC ALDEHYDES, KETONES AND ACIDS (16 Hrs)

Phenols

Acidic character of phenols- effect of substituents on acidity of phenols - Mechanisms of Kolbe's reaction and Riemer-Tiemen reaction. Preparation of cresols, catechol, resorcinol, quinol and euginol.

Aldehydes and ketones

Preparation and uses of cinnamaldehyde. Coumarin, vanillin, Michler's ketone, p-benzoquinone-Quinone mono oxime tautomerism. Mechanism of Cannizaro reaction, benzoin condensation, Perkin reaction, Claisen reaction, Knovenagel reaction,Gattermann aldehyde synthesis and Houben –Hoesch synthesis.

Aromatic acids

Ortho effect, preparation of mandelic acid, cinnamic acid and anthranilic acid. Preparation and uses of benzene-1,2- dicarboxylic acid, benzene-1,3- dicarboxylic acid and 1,4- dicarboxylic acid.

UNIT III REARRANGEMENTS (14 Hrs)

Rearrangement to electron-deficient carbon – 1,2 shift (Wagner-Meerwein rearrangement, pinacol rearrangement,Wolff rearrangement in Arndt-Eistert synthesis, benzil-benzilic acid rearrangement).

Aromatic rearrangements from oxygen to ring carbon (Fries rearrangement, Claisen rearrangement and benzidine rearrangement).

Rearrangement to electron-deficient nitrogen (Beckmann rearrangement, Schmidt rearrangement, Hofmann rearrangement, Curtius rearrangement).

Rearrangement to electron-deficient oxygen (Baeyer-Villiger oxidation, hydroperoxide rearrangement,cumene hydroperoxide-phenol rearrangement), Dakin reaction.

UNIT IV TERPENOIDS AND ALKALOIDS (14 Hrs)

Terpenes and terpenoids - classification - isoprene rule.

Elucidation of structure and synthesis of citral , limonene, menthol, α-terpineol and camphor.

Alkaloids: Introduction, classification and general methods for the determination of structure.

Structural elucidation and synthesis of conine,piperine and nicotine

UNIT-V ORGANIC SPECTROSCOPY (15 Hrs)

UV spectroscopy - chromophore – auxochrome – blue shift, red shift – hypochromic shift, hyperchromic shift – applications for studying functional groups,cis-trans isomerism and nature of double bonds- Woodward-Fischer rules as applied to conjugated enes and alpha and beta unsaturated ketones.

IR spectroscopy–characteristics of IR absorption frequencies – intermolecular and intramolecular hydrogen bonding – functional group detection.

NMR Spectroscopy - interpretation of NMR spectra of simple organic compounds such as acetone, anisole, benzaldehyde, isobutene, mesitylene, 1-chloropropane, ethyl methyl ketone, benzyl alcohol, and propionic acid.

Text Books

1. K.S. Tewari, N.K. Vishil, S.N. Mehotra – A text book of org. chem – 1st edition, Vikas Publishing House Pvt Ltd., 2001, New Delhi.

2. P.L. Soni, Text Book of Organic chemistry, Sultans Chand, 1991, New Delhi,

Reference Books

1. Bahl and Arun Bahl, Organic Chemistry, S. Chand and Sons, New Delhi, 2005.

2. Gurdeep Chatwal, Reaction mechanisms and reagents in organic chemistry

3. O. P. Agarwal, Chemistry of Organic Natural Products, Vol 1 and 2, Goel Pub. House,2002.

4. Gurdeep Chatwal, Chemistry of Organic Natural Products, Vol 1 and 2, Goel Pub. House,2002

5. Y.R. Sharma, O.P. Vig, Elementary organic absorption spectroscopy – 1st edition, Goel Pulishers, 1997, Meerut

6. R. T. Morrison and R. N. Boyd, Organic Chemistry, 6th Edition, PHI Limited, New Delhi, 1992.

7. Jerry March, Advanced Organic Chemistry, 4th Edition, John Wiley and Sons, New York,1992.

8. S. H. Pine, Organic Chemistry, 5th Edition, McGraw Hill International Edition, Chemistry Series, New York, 1987.

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Physical chemistry –IV

L	T	P	C
5	0	0	4

Objectives

To learn about basic concepts in spectroscopy

To understand chemical equilibrium and phase equilibrium

To study nano chemistry

UNIT - I SPECTROSCOPY -II (16 Hrs)

Raman spectroscopy: Principle - Rayleigh and Raman scattering - Stokes and Anti-stokes lines - differences between IR and Raman spectroscopy - mutual exclusion principle – selection rule - applications.

NMR spectroscopy: Theory of NMR, modes of nuclear spin-relaxation process - shielding effect, hyperfine splitting, coupling constants, - chemical shift - factors affecting chemical shift - internal standard, δ and τ scale - applications of NMR and limitations of NMR.

ESR spectroscopy: principle - energy level splitting - presentation of ESR spectrum for methyl and benzene radicals, deuterium - applications

Mass spectroscopy: basic principles of mass spectrum - molecular peak - base peak - isotopic peak - meta stable peak - types of fragmentation - factors influencing the fragmentation - Mc-Lefferty rearrangement - applications

UNIT – II CHEMICAL KINETICS (15 Hrs)

Rate of reaction-Measuring rates of reaction-expressing reaction rates- factors influencing rate-rate constant-Rate laws, Stoichiometry, order and molecularity of reactions- First order, second order, third order and zero order reactions and example. Characteristics of I,II,III and Zero order reactions. Determination of order of reactions-expression for rate constant of first and second order reaction-derivation. Effect of temperature on rate constant. The activation energy - determination of Arrhenius frequency factor and energy of activation-The collision theory of reaction rates and its limitation. Lindemann theory of unimolecular reactions-The theory of Absolute reaction rates. Comparison of the collision theory with the Absolute reaction rate theory.

UNIT – III IONIC EQUILIBRIA (16 Hrs)

The Ostwald's dilution law-experimental verification-limitations-acids and bases-Lewis concept-dissociation of weak acids and weak bases-dissociation of water-pH scale-common ion effect- its applications-buffer solution-different types-calculation of pH value of buffer solution. Hydrolysis of salts - salts of weak acids & strong base, salts of weak base and strong acids, salts of weak acid and weak base - determination of degree of hydrolysis. Acid-base indicators- acid-base titration and use of indicators. Solubility product - Application of solubility product principle

UNIT-IV PHASE EQUILIBRIA (14 Hrs)

Phase rule - phase, component, degree of freedom - thermodynamic derivation of phase rule, One-component system: Phase diagrams of Water and sulphur systems.

Two component system: (i) Simple eutectic: Lead-silver system and potassium iodide-water system. (ii) Formation of compound with congruent melting point: Magnesium – zinc system and ferric chloride – water system. Distribution Law-Statement and thermodynamic derivation-association of the solute in one of the solvents- dissociation of the solute in one of the solvents-applications of the distribution law-solvent extraction.

UNIT - V NANOCHEMISTRY (14 Hrs)

Definition - size dependent properties: magnetic, electrical and optical properties – quantum dots – metal oxides and metal nano particles - ceramic nano particles

Synthesis of nanomaterials - bottom-up and top-down approaches - thin film deposition - catalytic assisted growth - chemical vapour deposition - sol gel method - chemical reduction

Fullerenes - carbon nanotubes - single walled and multi walled nano tubes – structures - carbon nanofibre – nanocomposites.

Applications of nanoscience and nanotechnology.

Text books :

1. Principles of Physical Chemistry - B.R. Puri and Sharma - Shobanlal Nagin Chand & Co.,
2. Text Book of Physical Chemistry - P.L. Soni - Sultan Chand.

Reference books :

1. Elements of physical chemistry - Glasstone and Lewis - Macmillan.
2. Physical chemistry - G.W. Castellan - Narosa publishing house.
3. Universal General Chemistry, C.N.R. Rao, Macmillan.
4. Nano: The Essentials Understanding Nano Science and Nanotechnology. T. Pradeep -. Tata Mc Graw-Hill Publishing Company Ltd. New Dehli.
5. Introduction to Nano technology, Charles P Poole Jr. & Frank J Owens, Wiley Interscience
6. Kemp, W. Organic Spectroscopy
7. Jag Mohan Organic Spectroscopy
8. Chemical Kinetics-K. J. Laidler, Tata McGraw Hill Publishing Company, NewDelhi

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GREEN CHEMISTRY

L	T	P	C
4	0	0	4

Objectives

To introduce the basics and need for Green Chemistry

To understand the principles and designing a green synthesis of selected compounds

To make the students familiar with the usage of green solvents and green catalysts in chemical reactions.

To learn the principles of the microwave and ultrasound assisted reactions.

UNIT- I Introduction to green chemistry (13 Hrs)

Definition – need for green chemistry – scope of green chemistry.

Concept of atom economy – yield – mass intensity and atom economy.

Calculation of atom economy, mass intensity, mass productivity and carbon efficiency.

Different types of reactions and atom economy - addition, substitution, elimination and rearrangements.

Concept of selectivity – enantioselectivity, chemoselectivity, regioselectivity and diasterioselectivity.

UNIT- II Green solvent (13 Hrs)

Super critical fluids – Introduction – extraction of super critical fluids – solvents of super critical fluid– advantages and applications.

Carbondioxide as a super critical fluid – features of technique for using super critical carbondioxide - advantages and applications.

Chemical reactions in supercritical water and Near – Critical Water (NCW)- Region.

Extracting natural products, dry cleaning, supercritical polymerization, hydrogenation and hydroformylation

lonic liquid as green solvent : Introduction – synthesis of ionic liquids - acidic ionic liquid and neutral ionic liquids – applications in organic synthesis.

Green reagents : Dimethyl carbonate and Polymer supported reagents.

UNIT- III Green catalyst (11 Hrs)

Catalysis over view : acid catalyst - basic catalyst – oxidation catalyst – polymer supported catalyst- photosensitized super acid catalyst and Tetra Amido Macrocylic Ligand (TAML) catalyst.

Biocatalyst : microbial oxidation, microbial reduction, enzyme catalyzed hydrolytic process, per fluorinated catalyst and modified biocatalyst.

Development of mesoporous supports by liquid crystal templating – neutral templating methods- heterogeneous catalyst – solid supported catalyst.

UNIT- IV Green synthesis (13 Hrs)

Green synthesis of the following compounds -Adipic acid, Catechol, Benzoyl bromide, Acetaldehyde, Citral, Ibruprofen and Paracetamol

Microwave assisted reactions in water – Hoffmann Elimination, Hydrolysis of benzyl chloride and methyl benzoate – oxidation of toluene and alcohols

Microwave assisted reactions in organic solvents – Esterification, Fries rearrangement, Clasien Rearrangement, Diels-Alder Reaction and Decarboxylation. Ultra sound assisted reactions – Esterification, Saponification, alkylation , oxidation, reduction, coupling reactions and Cannizaro reactions.

UNIT -V Green reactions invloving basic principle of green chemistry. (10 Hrs)

Twleve principle of green chemistry – choice of starting materials – biomimitic, multifunctional reagents – materials reagents.

Combinatorial green chemistry – green chemistry in sustainable developments.

Importance of Green chemistry in day to day life, versatile bleaching agents and analgeric drugs.

Text Books

1. V.K.Ahluwallia &M.R Kidwai "New Trends in Green Chemistry", Anamalaya Publishers (2005)

2. P.T.Anaster &J.K.Warnerr " Oxford Green Chemistry,Theory and Practical",University Press(1998)

Reference Books

1. A.S. Matlack,'' Introduction to Green Chemistry"-Marcel Deckkar (2001)

2. V.K.Ahhluwallia,"GreenChemistryEnvironnmentallyBenign Reaction"Ane Books Pvt.Ltd. New Delhi (2009)

3 Rashmi Sannghi &MM Srivastava, "Green Chemistry Environment Friendly Alternatives." Narosa Publishing House Pvt Ltd, New Delhi (2009)

NANO CHEMISTRY

L	T	P	C
4	0	0	4

Objectives

To give an insight into the basics of nanochemistry.

To understand the difference between bulk material and nanomaterial and learn the synthesis, application and fabrication of nanostructure.

To study the importance of nanocatalyst, nanocomposites and fibers.

To make the students familiar with the characterization and applications of nanomaterials.

UNIT- I Introduction to Nano chemistry. (12 Hrs)

Definition: nanoscience – nanotechnology – nanochemistry – significance of nanoscale - factors responsible for special properties of nanomaterials.

Nanomaterials: Different types of nanomaterials and structures- quantum wells – quantum wires – quantum dots – nanoclusters – nanocrystals – nanowires and nanotubes.

Feynman's Prophecy– manufacturing of nanomateris - top-down and bottom-up approaches.

UNIT-II Synthesis of nano particles. (13 Hrs)

Introduction – orientation of nanoparticles – synthesis of nanoparticles.

Physical methods: laser ablation, physical vapour deposition (PVD) and solvated metal atom dispersion (SMAD).

Chemical methods: thermolysis, sonochemical method, reduction methods, phase-transfer processes and biosynthesis of nanoparticles.

Synthesis of nanosized semiconductors: precipitation methods and thermal decomposition of complex precursors.

Synthesis of ceramics: physical methods, gas condensation method, laser method, chemical methods and sol-gel synthesis.

UNIT –III Nanocatalyst and carbon based nanomaterials `(12 Hrs)

Inroduction – fundamentals of catalysis – adsorption of a molecule on a catalyst surface, adsorption theory- Langmuir adsorption isotherm.

Surface reactions – synthesis – synthesis requirements, example of a conventional synthetic technique, non traditional methods for preparing nanocatalyst.

Characterization of nanocatalyst : overview - bulk characterization technique and surface characterization technique

Carbon nanomaterials : structure and properties of graphite, diamond and fullerenes.

UNIT-IV Nanocomposites and fibers. (12 Hrs)

Introduction - Background - types of composite materials - The nano perspective.

Physical and chemical properties of materials – mechanical properties, thermal properties, electronic properties and chemical properties.

Natural nanocomposities - Skin of the sea cucumber and hard natural nanocomposites.

Carbon fibers and nanotubes – Types of fibers, Whiskers and nanotubes – synthesis of fibers and nanotubes - chemical modification and applications of carbon nanotube.

Metal and Ceramic nanocomposites - Metal nanocomposites, inorganic nanofibers and concrete.

Clay nanocomposite materials -polypropylene clay nanocomposite , mont morillonite clay nanocomposite and halloysite nanotube claycomposites.

UNIT-V Characterization and applications of nanomaterials. (11 Hrs)

Types of characterization methods – Electron probe method- Scanning electron microscopy – Transmission electron microscopy,

Spectroscopyic Methods, - UV – Visible adsorption and emission spectroscopy, Infra Red and Raman spectroscopy and X-ray diffraction methods.

Current applications: sunscreens and cosmetics – nano medicine, drug delivery and cancer drugs – food and drinks, textiles, chemical industry and electronic devices.

Short term applications - paints – fuel cells – displays – batteries – fuel additives and catalysts.

Long term applications- composites – lubricants – magnetic materials – medical implants – machinable ceramics – water purification and military battle suits.

Text Books

1. Geoffrey A. Ozin and Andre C. Arsenault, “Nanochemistry: A chemical approach to nanomaterials”, RSC publishing, (2005), U.K.
2. Hari Singh Nalwa, “Nanostructured Materials and Nanotechnology”, Academic Press, New York,(2002).

Reference Books

1.C.N.R. Rao, A. Muller and A.K. Cheetham, “The Chemistry of Nanomaterials, Volume I & II”, Wiley-VCH Verlag GmbH & Co. KGaA, Weinheim, (2004).

2.Kenneth J. Klabunde, “Nanoscale Materials in Chemistry”, Wiley-Interscience”, New York,(2001).

3. Gabor L.Hornyak, Harry F. Tibbals, Joydeep Dutta and John J Moore . “Inroduction to Nanoscience and Nanotechnology” CRC Press ,Taylor and Francis group London Newyork.