THIRUVALLUVAR UNIVERSITY
MASTER OF SCIENCE
M.Sc. CHEMISTRY
DEGREE COURSE
UNDER CBCS
With effect from 2020-2021

The Course of Study and the Scheme of Examinations

S. No.	Study Components		Ins. Hrs/ week	Credit	Title of the Paper	Maximum Marks		
	Course Title							
1ST YEAR- SEMESTTER I						CIA	Uni. Exam	Total
1	MAIN	Paper-1	4	4	Organic Chemistry- I	25	75	100
2	MAIN	Paper-2	4	3	Inorganic Chemistry- I	25	75	100
3	MAIN	Paper-3	4	3	Physical Chemistry- I	25	75	100
4	MAIN PRACTICAL	Paper-1	4	0	Organic Chemistry Practical- I	-	-	-
5	MAIN PRACTICAL	Paper-2	4	0	Inorganic Chemistry Practical- I	-	-	-
6	MAIN PRACTICAL	Paper-3	4	0	Physical Chemistry Practical- I	-	-	-
7	ELECTIVE	Paper-1	3	3	(to choose 1 out of 3) A. Advanced Polymer Chemistry B. Heterocyclic Chemistry C. Materials Chemistry	25	75	100
8	OPEN ELECTIVE (Non-Major)	Paper-I	3	3	(to choose 1 out of 3) A.Chemistry in Agriculture B. Food Chemistry C. Industrial chemistry-I	25	75	100
			30	**16**		**125**	**375**	**500**

1ST YEAR- SEMESTER II						CIA	Uni. Exam	Total
9	MAIN	Paper-4	3	3	Organic Chemistry- II	25	75	100
10	MAIN	Paper-5	3	4	Inorganic Chemistry- II	25	75	100
11	MAIN	Paper-6	3	3	Physical Chemistry- II	25	75	100
12	MAIN PRACTICAL	Paper-1	5	3	Organic Chemistry Practical- I	25	75	100
13	MAIN PRACTICAL	Paper-2	5	3	Inorganic Chemistry Practical- I	25	75	100
14	MAIN PRACTICAL	Paper-3	5	3	Physical Chemistry Practical- I	25	75	100

15	Compulsory paper		2	2	Human Rights	25	75	100
16	ELECTIVE	Paper-2	2	3	(to choose 1 out of 3) A. Green Chemistry B. Supramolecular and Nanochemistry C. Modern Separation Techniques	25	75	100
17	OPEN ELECTIVE (Non-Major)	Paper-II	2	3	(to choose 1 out of 3) A. Medicinal Chemistry B. Textile chemistry C. Diary Chemistry	25	75	100
18	Field Study		**-**	2				**100**
			30	**29**				**1000**

*** Field Study**

There will be field study which is compulsory in the first semester of all PG courses with 2 credits. This field study should be related to the subject concerned with social impact. Field and Topic should be registered by the students in the first semester of their study along with the name of a mentor before the end of the month of August. The report with problem identification and proposed solution should be written in not less than 25 pages in a standard format and it should be submitted at the end of second semester. The period for undergoing the field study is 30 hours beyond the instructional hours of the respective programme. Students shall consult their mentors within campus and experts outside the campus for selecting the field and topic of the field study. The following members may be nominated for confirming the topic and evaluating the field study report.

(i). Head of the respective department

(ii). Mentor

(iii). One faculty from other department

SYLLABUS
UNDER CBCS
(with effect from 2020-2021)

FIRST YEAR

SEMESTER I
PAPER - 1
ORGANIC CHEMISTRY – I

OBJECTIVES:

To make the students learn and understand the concept of stereochemistry, conformational analysis and their application in the determination of reaction mechanism. To understand the mechanism of nucleophilic and electrophilic substitution reactions. To learn the importance of kinetics in organic reactions.

OUTCOMES:

The student will be able to

- *Describe the concept of Stereochemistry*
- *Illustrate the importance of Conformation*
- *Analyze the mechanism of Aliphatic and Aromatic Substitution reactions*
- *Acquire knowledge on the various concepts of reaction kinetics and mechanism*

UNIT-I: STEREOCHEMISTRY

Optical activity and chirality, classification of chiral molecules as asymmetric and dissymmetric. Topicity – Homotopic, enantiotopic and diastereotopic ligands and faces. A brief study of dissymmetry of allenes, biphenyls, spiro compounds, trans-cyclooctene and molecules with helical structures. Absolute configuration - R, S notation of biphenyls and allenes. Fischer projection. Inter conversion of Sawhorse, Newman and Fischer projections. Erythro and threo nomenclature, E and Z nomenclature - Asymmetric synthesis - Cram's rule. Stereospecific and stereoselective reactions.

UNIT-II: CONFORMATIONAL ANALYSIS

Conformational analysis of disubstituted cyclohexane and their stereochemical features (geometrical and optical isomerism (if shown) by these derivatives). Conformation and reactivity of substituted cyclohexanol (oxidation and acylation), cyclohexanone (reduction) and cyclohexane carboxylic acid derivatives (esterification and hydrolysis). Conformation and stereochemistry of cis and trans-decalin and 9 - methyldecalin.

UNIT-III: ALIPHATIC SUBSTITUTION REACTIONS

Nucleophilic substitution reactions: SN1, SN2 and SNi mechanisms - Neighbouring group participation – Reactivity - structural and solvent effects - substitution in norbornyl and bridgehead systems - substitution at allylic and vinylic carbons - substitution by ambident nucleophiles - substitution at carbon doubly bonded to oxygen and nitrogen - alkylation and acylation of amines, halogen exchange, Von-Braun reaction, alkylation and acylation of active methylene carbon compounds, hydrolysis of esters, Claisen and Dieckmann condensation.
Electrophilic substitution reactions: SE1, SE2 and SEi mechanism, double bond shift - Reactivity. Migration of double bond, keto-enol interconversion, Stork- Enamine reaction, halogenation of aldehydes and ketones and decarboxylation of aliphatic acids.

UNIT-IV: AROMATIC SUBSTITUTION REACTIONS

Electrophilic substitution reactions: The arenium ion mechanism. Orientation and reactivity (ortho, meta and para directing groups). Typical reactions including Reimer - Tiemann reaction, Vilsmeyer - Hack, Gattermann, Gattermann - Koch reaction and Kolbe reaction. Synthesis of di and tri substituted benzene (symmetrical tribromo benzene, 2-amino-5-methyl phenol, 3-nitro-4-bromobenzoic acid, 3, 4- dibromonitrobenzene and 1, 2, 3 - trimethylbenzene) starting from benzene or any monosubstituted benzene.
Nucleophilic substitution reactions: Mechanisms: SNAr and Benzyne mechanisms. Methods for the generation of benzyne intermediate and reactions of aryne intermediate. Nucleophilic substitution involving diazonium ions. Aromatic nucleophilic substitution of activated halides, Ziegler alkylation and Chichibabin reaction.

UNIT – V QUANTITATIVE TREATMENT OF ORGANIC REACTIONS

Kinetic and Non-kinetic methods of determining reaction mechanisms. Isotope effects. Effect of structure on reactivity: Hammett and Taft equation. Partial rate factor. Significance of □ and □□□Simple problems

Recommended Books

1. Jerry March, Advanced organic chemistry, 4th edition, John wiley and sons, New York, 1992.

2. S. H. Pine, Organic chemistry, 5th edition, Mcgraw Hill international edition chemistry series, New York, 1987.

3. Seyhan. N. Ege, Organic chemistry, structure and reactivity, 3rd edition, A.I.T.B.S., New Delhi,1998.

4. P. S. Kalsi, Stereochemistry, Conformation analysis and Mechanism, II Edition, Wiley Eastern Limited, Chennai (1993).

5. Ernest Eliel, Stereochemistry of carbon compounds, McGraw Hill, New York (1962).

6. Francis A. Carey and Richard J. Sundberg, Advanced Organic Chemistry, Part A and B, III Edition, Plenum Press (1990).

7. B. Y. Paula Yurkanis Bruise, Organic Chemistry, 3rd edition, Pearson education, New Delhi 2002.

8. J. Miller, Advanced Organic Chemistry, III Edition.

9. J. Miller, Aromatic Nucleophilic Substitution

10. Nasipuri, Stereochemistry, Alhed Publishers, 2003.

11. Mc Murry, Organic Chemistry, V Edition, Asian Books Pvt Ltd (2000).

12. Michael Smith, Organic Synthesis, McGraw Hill, 1996.

13. Clayden, Greeves, Warren, Wothers, Organic Chemistry, Oxford Univ Press.

14. Neil Isaacs, Physical Organic Chemistry, ELBS Publications (1987).

15. P. Ramesh, Basic principles of Organic Stereochemistry, Madurai Kamaraj University.

16. P. S. Kalsi, Stereochemistry and mechanism through solved problems, WileyEastern Ltd., (1994).

17. R. K. Bansal, Organic Reaction Mechanism.

18. R.O.C. Norman, J.M. Coxon, Principle of Organic Synthesis, ELBS Publications,1994.

19. S. M. Mukherji and S.P. Singh, Organic Reaction Mechanism, MacMillan India Ltd., Chennai (1990).

20. T. L. Gilchrist and C.W. Rees, Carbenes, Nitrenes and Arynes, Thomas Nelson and Sons Ltd., London.

21. Peter Sykes, A Guide book to mechanism in organic chemistry, Pearson Edition (2006).

22. C. N. Pillai, Textbook of Organic Chemistry, University press (India) private Ltd (2009).

PAPER -2
INORGANIC CHEMISTRY I

OBJECTIVES:

To learn about the inorganic polymers. To study the concept of coordination chemistry, stability of the complexes and stereochemistry of complexes. To know about the structure and bonding of inorganic compounds.

Outcomes :

The student will be able to

- *Explain Isopolyacids and hetropolyacids of Vanadium, Chromium, Molybdenum and Tungsten.*
- *Descirbe the structure, properties, correlation and applications of some Inorganic polymers.*
- *Illustrates the chemistry of metal clusters.*
- *Discuss polyhedral boranes, carboranes and metallocarboranes.*
- *Explain the stability constant of co-ordination complexes.*
- *Apply the stereo chemistry for co-ordination complexes.*
- *Gain knowledge about the structure and bonding of Inorganic compounds.*

UNIT-I: STRUCTURE AND BONDING - I

Polyacids: Isopolyacids and heteropolyacids of vanadium, chromium, molybdenum and tungsten.

Inorganic Polymers: Silicates, structure - properties - correlation and applications - molecular sieves, polysulphur - nitrogen compounds and poly – organophosphazenes

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UNIT-II: STRUCTURE AND BONDING - II

Boron hydrides: Polyhedral boranes, hydroboration, carboranes and metallocarboranes.

Metal clusters : Chemistry of low molecularity metal clusters (upto) trinuclear metal clusters, multiple metal-metal bonds. Cubane clusters and Zintl clusters.

UNIT-III: COORDINATION CHEMISTRY - I

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

UNIT-IV: COORDINATION CHEMISTRY - II

Stereochemical aspects; stereoisomerism in inorganic complexes; isomerism arising out of ligand distribution and ligand conformation; chirality and nomenclature of chiral complexes; optical rotatory dispersion and circular dichroism. Macrocyclic ligands; types; porphyrins; corrins, Schiff bases; crown ethers and cryptates.

UNIT-V: COORDINATION CHEMISTRY - III

Evidences for metal-ligand orbital overlap, molecular orbital theory and energy level diagrams, concept of weak and strong field ligands, Jahn-Teller distortion, charge - transfer spectra. Term states for "d"- ions, energy diagrams, d-d transitions, Orgel and Tanabe - Sugano diagrams, spin orbit coupling, nephelauxetic effect, spectral and magnetic characteristics of transition metal complexes.

TEXT BOOKS

1. F. A. Cotton and G.W. Wilkinson, Advanced Inorganic Chemistry– A comprehensive Text, John Wiley and Sons (1988).
2. J. E. Huheey, Inorganic Chemistry, Harper and Collins, NY, IV Edition, (1993).
3. K. F. Purcell and J. C. Kotz, Inorganic Chemistry WB Saunders Co., USA, (1977).
4. M. C. Shrivers, P.W Atkins, CH. Langford, Inorganic Chemistry, OUP, (1990).
5. N. N. Greenwood and Earnshaw, Chemistry of the Elements, Pergamon Press, New York (1984).
6. N. H Ray, Inorganic Polymers, Academic Press, (1978)
7. S. F. A. Kettle, Coordination Chemistry, ELBS, (1973).

Suggested References

8. A. B. P. Lever, Inorganic Electronic Spectroscopy, II Edn., Elsevier, New York, (1984).

9. B.E. Dogulas DH McDaniel's and Alexander, Concepts and Models of Inorganic Chemistry, Oxford IBH, (1983).
10. B.N. Figgis, Introduction to Ligand Fields, Interscience, (1966).
11. E.L. Mutterties, Polyhedral Boranes, Academic Press, New York (1975).
12. M.C. Day and J. Selbin, Theoretical Inorganic Chemistry, Van Nostrand Co., NY (1974).
13. W.U. Mallik, G.D. Tuli, R.D. Madan, Selected topics in Inorganic Chemistry, S. Chand and Co., New Delhi, (1992).
14. D. M.P.Mingos and D. J. Wales, Introduction to Cluster Chemistry, Prentice Hall, 1990.
15. R. Gopalan, Text book of Inorganic Chemistry, University press (India) private Ltd.

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PAPER-3
PHYSICAL CHEMISTRY I

OBJECTIVE:

To study the partial molar property, fugacity and its significance. Theories and basic concepts of chemical kinetics - mechanism of acid, base and enzyme catalysis reaction. To acquire knowledge on phase equilibria of three component system. To study the basics of colloids.

OUTCOMES *:*

The student will be able to

- *Explain partial molar properties and the concept of fugacity.*
- *Describe the phase diagrams of three component systems involving solid-liquid and liquid-liquid equilibria.*
- *Gain the knowledge about micelles, surfactants, structure and stability of colloids.*

Illustrate the effect of pressure, dielectric constant and ionic strength of the solution on the rate of the reaction.

- *Describe acid base and enzyme catalysis.*

UNIT-I: THERMODYNAMICS

Partial molar properties -Partial molar free energy (chemical potential), Partial molar volume and Partial molar heat content - Their significance and determination of these quantities. Variation of chemical potential with temperature and pressure.
Definition of fugacity - determination of fugacity by graphical method - variation of fugacity with temperature and pressure - the concept of activity and activity coefficients – determination of activity and activity coefficient by emf method - determination of activity and activity coefficients for non-electrolytes - determination of standard free energies - choice of standard states.

UNIT-II: PHASE EQUILIBRIA

Physical equilibria involving phase transition: Two component system - Congruent system (phenol-aniline) and Incongruent system (sodium chloride- water) - Peritectic reactions. Three component system: Solid - Liquid equilibria - hydrate formation (sodium chloride - sodium sulphate - water); Liquid - Liquid equilibria - one pair of partially miscible liquids (acetic acid - chloroform - water and alcohol - benzene - water); two pairs of partially miscible liquids (water - ethyl alcohol - succinic nitrile).

UNIT-III: COLLOIDS

Surface phenomena - surfactants, micellization, critical micelle concentration (CMC), factors affecting CMC of surfactants, micro emulsions, reverse micelles and surface films (electro kinetic phenomena).
Structure and stability of colloids - Zeta potential (derivation), electro osmosis, protective colloids, gold number, sedimentation potential, streaming potential and Donnan membrane equilibrium.

UNIT-IV: CHEMICAL KINETICS

Absolute Reaction Rate Theory (ARRT) - Potential energy surfaces - partition function and activated complex- Eyring equation - estimation of free energy, enthalpy and entropy of activation and their significance.
Reactions in solutions - effect of pressure, dielectric constant and ionic strength on reactions in solutions - kinetic isotope effects - linear free energy relationships. Hammett and Taft equation.

UNIT-V: CATALYSIS

Acid - Base catalysis - mechanism of acid - base catalyzed reactions - Bronsted catalysis law. Catalysis by enzymes - Kinetics of enzyme catalyzed reaction - Michaelis - Menten equation and its interpretation. Effect of substrate concentration, pH and temperature on enzyme catalyzed reactions - inhibition of enzyme catalyzed reactions - Competitive, Non-competitive and Uncompetitive inhibition.

TEXT BOOKS

1. S. Glasstone, Thermodynamics for Chemists, Affiliated East West Press, New Delhi (1950).
2. J. Rajaram and J. C. Kuriacose, Thermodynamics for Students of Chemistry, Lal Nagin Chand, New Delhi (1986).
3. Samuel Glasstone, Textbook of Physical Chemistry, Macmillan India Limited, 2nd Edition
4. Terence Cosgrove – Colloid Science - Principles, methods and applications
5. Robert J. Hunter - Foundations of Colloid Science, 2nd Edition
6. J. Rajaram and J.C. Kuriacose, Kinetics and Mechanism of Chemical Transformations. Mac Millan India Ltd (1993).
7. K. J. Laidler, Chemical Kinetics, Harper and Row, New York (1987).

Suggested References

1. W. J. Moore, Physical Chemistry, Orient Longman, London (1972).
2. K. G. Denbiegh, Thermodynamics of Steady State, Methien and Co. Ltd, London (1951).
3. K. Nash, Elements of Chemical Thermodynamics, Addision Wesley (1962).
4. Alexander and Johnson- “Colloid science”- Oxford University Press
5. R. G. Frost and Pearson, Kinetics and Mechanism, Wisely, New York (1961).
6. Amdur and G. G. Hammes, Chemical Kinetics, Principles and Selected Topics, McGraw Hill, New York (1968).
7. M.V. Sangaranarayanan and V. Mahadevan, Text book of Physical Chemistry, University press (2011).

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ELECTIVE
PAPER-I
(To choose 1 out of 3)

A. ADVANCED POLYMER CHEMISTRY

OBJECTIVE:

To gain the knowledge in the preparation, properties, characterization and applications of polymers.

OUTCOMES:

- *Have the knowledge on classification, nomenclature and properties of polymers.*
- *Adequate knowledge on kinetics and mechanism of polymerisation.*
- *Understanding on characterization of polymers.*
- *Understand the morphology and applications of polymers.*

UNIT- I: BASIC CONCEPTS

Classification - Nomenclature and isomerism - functionality - Molecular forces and chemical bonding in polymers - molecular weight – linear, branched and cross linked polymers. Thermoplastic and thermosetting polymers - Elastomers, fibers and resins. Techniques of polymerization - bulk solution, emulsion and suspension.

UNIT- II: KINETICS AND MECHANISM

Kinetics and mechanism of polymerization - free radical, cationic, anionic and co-ordination polymerization (Ziegler-Natta Catalyst). Copolymerization - kinetics (Detailed Study). General characterization-kinetic chain length-degree of polymerization, chain transfer - initiators - inhibitors - retarders.

UNIT-III: A. STRUCTURE AND PROPERTIES

Structure - property relationship - mechanical properties, thermal properties - glass transition temperature - factors affecting glass transition temperature - crystallinity and melting point - related to structure.

B. POLYMER CHARACTERIZATION AND ANALYSIS

Crystalline nature - X-Ray diffraction - Differential Scanning Calorimetry (DSC) - Thermo Gravimetric Analysis - molecular weight determination - Osmometry (membrane), viscosity, ultra centrifuge and gel permeation chromatography.

UNIT-IV: INDUSTRIAL AND NATURAL POLYMERS

Important industrial polymers - preparation and application of polyethylene, poly vinyl chloride, poly urethanes, polytetrafluro ethylene (TEFLON), nafion and ion - exchange resins. Importance of natural polymers - application and structures of starch, cellulose and chitosan derivatives.

UNIT-V: ADVANCES IN POLYMERS

Biopolymers - biodegradable polymers - biomedical polymers - poly electrolytes - conducting polymers - high temperature and fire retardant polymers - polymer blend - polymer composites - polymer nanocomposites - IPN inter penetrating network polymers - electroluminescent polymers.

TEXT BOOKS:

1. F. W. Bill Meyer. Text book of polymer science, III Edition, John Wiley and sons, New York.
2. P. J. Flory. Principles of Polymer Chemistry, Cornell Press (recent edition).
3. V. R. Gowarikar, B. Viswanathan, J. Sridhar, Polymer Science - Wiley Eastern, 1986.
4. F. S. Misra - Introduction to Polymer Chemistry, Wiley Eastern Ltd.,
5. P. Bahadur, N. V. Sastry, Principles of Polymer Science, Narosa Publishing House.
6. G. Odian, Principles of Polymerization, McGraw Hill Book Company, New York, 1973.
7. Charles E. Carraher, Jr, Seymour/Carraher's polymer chemistry. -- 7th Edition

Suggested References

1. Rudin, The Elements of Polymer Science and Engineering. Academic Press, New

York, 1973.
2. E. H. Brawn, The Chemistry of High Polymers, Butter worth & Co., London, 1948.
3. G. S. Krishenbaum, Polymer Science Study Guide, Gordon Breach Science publishing, New York, 1973.
4. E. A. Coolins, J. Bares and E. W. Billmeyer, Experiments in Polymer Science, Wiley Interscience, New York, 1973

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PAPER-1

B. HETEROCYCLIC CHEMISTRY

OBJECTIVES:

To know the student about chemistry of heterocyclic compounds. To understands the strategies for designing the chemical synthesis. To make the students knowledgeable in higher heterocycles.

OUTCOMES:

- *Have the knowledge on nomenclature of heterocyclic compounds.*
- *Understanding the molecular geometry of non-aromatic heterocycles.*
- *Gain knowledge on reaction mechanism of small ring heterocyclic compounds.*
- *Have knowledge on reaction mechanism of mesoionic and higher heterocyclic compounds.*

UNIT I: NOMENCLATURE OF HETEROCYCLES

Introduction, nomenclature systems- systematic nomenclature system (Hantzsch – Widman system) and replacement nomenclature system for monocyclic, fused, spiro and bridged heterocycles. Aromatic heterocycles: Introduction, chemical behavior of aromatic heterocycles, classification (structural types). Criteria of aromaticity in heterocycles (bond lengths, dipole moments, empirical resonance energy, delocalization energy, Dewar resonance energy, chemical shits and ^{1}HNMR spectra).

UNIT- II: NONAROMATIC HETEROCYCLES

Introduction, strain, bond angle strain, torsional strain and their consequences in small ring heterocycles, conformations of six membered heterocycles – molecular geometry, barriers to ring inversion, pyramidal inversion and 1,3 diaxial interactions. Stereoelectronic effect in saturated six membered heterocycles- anomeric effect, other related effects and attractive interactions through space.

UNIT III: SMALL RING HETEROCYCLES

Three membered and four membered heterocycles: Synthesis and reactions of aziridines, oxiranes, thiranes, azetidines, oxetanes and thietanes. Benzo- fused five membered heterocycles: Synthesis and reactions including medicinal applications of benzopyrroles, benzofurans and benzothiophenes.

UNIT- IV: MESO IONIC HETEROCYCLES

General classification, chemistry of some important meso-ionic heterocycles of type A and B and their applications. Six membered heterocycles with on heteroatom: Synthesis and reactions of pyrylium salts and pyrones and their comparisons with pyridinium and thiopyrylium salts and pyridones.

UNIT- V: HIGHER HETEROCYCLES

Six membered heterocycles with two or more heteroatom: Synthesis and reactions of diazines. triazines and tetrazines. Seven and large membered heterocycles: Synthesis and reactions of azepines, oxepines , thiepines and diazepines. Synthesis of five and six membered heterocycles with P, As, Sb and Bi.

Text book:

1. Heterocyclic Chemistry, Vol. 1-3, R. R. Gupta, M. Kumar and V.Gupta , Spinger Verlag.

Suggested references:

2. The Chemistry of Heterocycles, T. Eicher and S. Hauptmann, Thieme.
3. Heterocyclic Chemistry, J. A. Joule, K. Mills and G. F. Smith, Chapman and Hall.

4. Heterocyclic Chemistry, T. L. Gilchrist, Longman Scientific Technical.
5. Contemporary Heterocyclic Chemistry, G. R. Newkome and W.W. Paudler, Wily –inter Science.
6. An Introduction to the Heterocyclic Compounds, R. M. Acheson, John wiely.
7. Comprehensive Heterocyclic Chemistry, A. R. Katrizky and C.W. Rees, eds. Pergamon press.

PAPER-1
C. MATERIALS CHEMISTRY

OBJECTIVES:

To learn about different types of materials. To understand the classifications of materials. To learn the advancements of material chemistry.

OUTCOMES:

- *Understanding on alloys, ceramics, composites and nano materials.*
- *Knowledge on liquid crystals, Ironic conductors, and pervoskites.*
- *Understanding on super conductors, NLO materials, second and third harmonic generation.*
- *Basic understanding on smart materials.*

UNIT-I: MULTIPHASE MATERIALS

Ferrous alloys**:** Fe-C phase transformation in ferrous alloys, stainless steels, non- ferrous alloys, properties of ferrous and non-ferrous alloys and their applications.
Glasses**:** Glassy state, glass formers, glass modifiers and applications.
Ceramics**:** Ceramic structures, mechanical properties, clay products, refractories-characterizations, properties and applications.
Composites**:** Microscopic composites- dispersion-strengthened and particle reinforces-fibre-reinforced composites and macroscopic composite.
Nanomaterials**:** Nanocrystalling phase- preparation- special properties and applications.
Thin films and Langmuir - Blodgett films**:** Preparation techniques; evaporation/sputtering and sol-gel methods. Photolithography, properties and application of thin films.

UNIT-II: LIQUID CRYSTALS

Mesomorphic behaviour, thermotropic liquid crystals, positional order, bond orientational order, nematic and smectic mesophases; smectic-nematic transition and clearing temperature-horneotropic, planar and schlieren textures, twisted nematics, chiral nematics, molecular arrangement in smectic A and smectic C phases, optical properties of liquid crystals. Dielectric susceptibility and dielectric constants.

UNIT-III: IONIC CONDUCTORS

Types of ionic conductors, mechanism of ionic conduction, interstitial jumps (Frenkel). Vacancy mechanism, diffusion super ionic conductors; phase transitions and mechanism of conduction in super ionic conductors, examples and applications of ionic conductors.

High Tc Materials**:** Defect perovskites, high Tc superconductivity in cuprates, preparation and characterization of 1-2-3 and 2-1-4 materials, anisotropy, normal state properties: temperature dependence of electrical resistance, optical phonon modes, super conducting state; heat capacity;

Coherence length, elastic constants, position lifetimes and microwave absorption - Applications of high Tc materials.

UNIT-IV: MATERIALS FOR SOLID STATE DEVICES

Rectifiers, transistors, capacitors- IV-V compounds, low dimensional quantum structures, optical properties.

Organic solids: Conducting organic solids, organic superconductors and magnetism in organic materials.

Fullerenes: doped fullerenes as superconductors.

Molecular devices**:** Molecular rectifiers and transistors, artificial photosynthetic devices, optical storage memory and switches-sensors.

Nonlinear optical materials: nonlinear optical effects. Second and third order - molecular hyper polarisability and second order electric susceptibility - materials for second and third harmonic generation.

UNIT-V: ADVANCED MATERIALS

Brief study of the following: Fiber reinforced plastics (FRP), fiber reinforced metals (FRM), metal matrix composites (MMC), surface acoustic wave (SAW) materials, ceramics and cermets, electrets and SMART materials.

BOOKS SUGGESTED:

1. Solid State Chemistry and its applications, Anthony R.West, (1998), John Wiley & Sons, New York.
2. Material Science and Engineering. An Introduction. W.D. Callister. Wiley.
3. Principles of the Solid State, H.V. Keer. Wiley Eastern.
4. Materials Science for Engineers: J. C. Anderson, K.D. Leaver, P. Leevers and R.D. Rawlings, 5^{TH} Edition, Nelson Thornes Ltd.
5. Thermotropic Liquid Crystals. Ed. G.W. Gray. John Wiley.
6. Handbook of Liquid Crystals. Kelker and Hafz. Chemie Verlag.
7. Materials science, M. Arumugam ,Anuradha publications (2012) , Chennai.
8. Materials Science, S. L. Kakani, Amit Kakani, (2006), New Age International (P) Limited, Publishers, Chennai.
9. Material Science and Engineering: A First Course, V. Raghavan, 5^{TH} Edition (2007), Prentice-Hall of India (P) limited.
10. A.R. West, Solid State Chemistry and its Applications, (1984) John Wiley & Sons, Singapore.
11. C.N R. Rao and J. Gopalkrishnan, New Directions in Solid State Chemistry, (1997) Cambridge Univ. Press.
12. T. V. Ramakrishnan and C. N. R. Rao, Superconductivity Today, (1992) Wiley Eastern Ltd., New Delhi.
13. P. Ball, Designing the Molecular World: Chemistry at the Frontier, (1994) Princeton University Press.

OPEN ELECTIVE (NON MAJOR)
PAPER-I
(To choose 1 out of 3)

A. CHEMISTRY IN AGRICULTURE

OBJECTIVES:

- *To make the students learn the different types of fertilizers.*
- *To understand the classification of manures.*
- *To understand the usage of pesticides.*
- *To learn the importance of fungicide and herbicide.*
- *To make the students aware of different soils.*

OUTCOMES:

The student will be able to

- *Differentiate between different types of fertilizers.*
- *Acquire knowledge on the various types of manures.*
- *Appreciate the usage of different pesticides with caution*
- *Illustrate the importance of types of herbicides and preservation of seeds*
- *Analyze the characteristics of different soils.*

UNIT – I Fertilizers : Effect of Nitrogen, potassium and phosphorous on plant growth – commercial method of preparation of urea, triple superphosphate. Complex fertilizers and mixed fertilizers – their manufacture and composition. Secondary nutrients – micronutrients – their function in plants.

UNIT – II Manures : Bulky organic manures – Farm yard manure – handling and storage. Oil cakes. Blood meal – fish manures.

UNIT – III Pesticides and Insectides : Pesticides – classification of Insecticides, fungicides, herbicides as organic and inorganic – general methods of application and toxicity. Safety measures when using pesticides. Insecticides : Plant products – Nicotine, pyrethrin – Inorganic pesticides – borates. Organic pesticides – D.D.T. and BHC.

UNIT – IV Fungicides and Herbicides : Fungicide : Sulphur compounds, Copper compounds, Bordeaux mixture. Herbicides : Acaricides – Rodenticides. Attractants – Repellants. Preservation of seeds.

UNIT – V

SOILS -Classification and properties of soils –soil water,soil temperature,soil minerals, soil acidity and soil testing.

PAPER-I
(To choose 1 out of 3)

B. FOOD CHEMISTRY

OBJECTIVE:

- *To understand the different sources of food*
- *To learn the concept of food poisoning.*
- *To understand the techniques of food preservation.*
- *To study the importance of vitamins and uses.*
- *To appreciate the different minerals needed for day to day life*

OUTCOMES:

The student will be able to

- *Appreciate the importance of various foods.*
- *Acquire knowledge of remedies for various ailments.*
- *Identify the causes for food spoilage.*
- *Reason out the deficiency of vitamins.*
- *Illustrate the importance of minerals.*

UNIT-I FOOD ADULTERATION Sources of foods, types, advantages and disadvantages, constituents of foods, carbohydrate, protein, fats and, oils, colours, flavours, natural toxicants.

UNIT-II FOOD POISONING Sources, causes and remedy- Causes and remedies for acidity, gastritis,indigestion and constipation

UNIT-III FOOD PRESERVATION AND PROCESSING Food spoilage , courses of food spoilage,types of Food spoilage, food preservation ,preservation and processing by heating-sterilisation, pasteurization.

UNIT-IV VITAMINS Sources , requirement deficiency diseases of A, C, K, E1 and B6

UNIT-V MINERALS Mineral elements in food-Principal mineral elements-source. Function-Deficiency and daily requirements-Na, K, Mg, Fe, S and P

REFERENCE BOOKS: 1.Seema Yadav : ―Food Chemistry‖ ,Anmol publishing (P) Ltd,New Delhi
2.Car H. Synder : ― The Extraordinary Chemistry for ordinary things‖ ,John Wiley & sons inc..,New York,1992.
3. Sivasankar – Food Processing and Preservation PHI.(Eastern Economy Editions)

PAPER-I
(To choose 1 out of 3)
C. INDUSTRIAL CHEMISTRY-I

OBJECTIVES:

To make the students learn about fertilizers
To understand the importance of sugarIndustries
To learn the importance of Chemical explosives
To study about the leather industries
To understand the importance of water industry

OUTCOMES:

The students will be able to
Acquire knowledge of fertilizers
Appreciate the importance of sugar industries in India
Acquire knowledge of Chemical explosives
Illustrate the importance of leather industries
Identify the importance of water industry

UNIT I Fertilizers : Fertilizer industries in India, Manufacture of ammonia, ammonium salts, urea, superphosphate, triple superphosphate and nitrate salts.

UNIT II Sugar : Cane sugar manufacture, recovery of sugar from molasses, sugar estimation-sugar industries in India.

UNIT III Chemical Explosives : Preparation and chemistry of lead azide, nitroglycerine, nitrocellulose, TNT, RDX,Dynamite, cordite, picric acid, gunpowder, introduction to rocket propellants.

UNIT IV Leather Industry : Curing, preservation and tanning of hides and skins, process of dehairing and dyeing. Treatment of tannery effluents.

UNIT V Water Industry: Pollution of water by fertilizers, detergents, pesticides and industrial wastes, BOD,COD, thermal pollution. Water Treatment – Ion exchange, electrodialysis, reverse osmosis, softening of hard water. 121

Reference : 1. B.N.Chakrabarty, Industrial Chemistry, Oxford & IBH Publishing Co, New Delhi, 1981.

2. B.K. Sharma, Industrial Chemistry, Goel Publishing House, Meerut.
3. P.P.Singh, T.M.Joesph, R.G.Dhavale, College Industrial Chemistry, Himalaya Publishing House, Bombay, 4th Ed., 1983 125

SEMESTER II

PAPER - 4

ORGANIC CHEMISTRY II

OBJECTIVES:

To understand the nature of carbon-hetero atom multiple bond additions and the mechanism of a chemical reactions. To appreciate the principles of addition and elimination reactions. To learn various synthetically important reactions with a view to appreciate their scope, limitations and use in synthetic sequences. To learn the chemistry of free radicals and their importance. To understand the concept of Aromaticity.

OUTCOMES:

The student will be able to

- *Elucidate the mechanism of addition and elimination reactions*
- *Appreciate the synthetic usage of various oxidizing and reducing reagents*
- *Illustrate the importance of free radicals*
- *Describe the concept of aromaticity*

UNIT-I: ADDITION TO CARBON - CARBON AND CARBON – HETERO MULTIPLE BONDS

Electrophilic, nucleophilic and neighbouring group participation mechanisms - addition of halogen and nitrosyl chloride to olefins. Hydration of olefins and acetylenes. Hydroboration, hydroxylation, Michael addition, 1, 3 - dipolar additions, Simon - Smith reaction. Mannich, Stobbe, Darzen, Wittig, Wittig - Horner and Benzoin reactions. Carbenes and nitrenes: Methods of generation, structure, addition reactions with alkenes and insertion reactions.

UNIT-II: ELIMINATION REACTIONS

E1, E2 and E1CB mechanism - E1, E2 and E1cB spectrum - Orientation of the double bond - Hofmann and Saytzeff rules - Competition between elimination and substitution. Typical elimination reactions- dehydration, dehydrohalogenation and dehalogenation. Stereochemistry of E2 eliminations in cyclohexane systems. Mechanism of pyrolytic eliminations. Chugaev and Cope eliminations.

UNIT-III: OXIDATION AND REDUCTION

Mechanism - study of the following oxidation reactions - oxidation of alcohols - use of DMSO in combination with DCC and acetic anhydride in oxidising alcohols - oxidation of methylene to carbonyl, oxidation of aryl methane - allylic oxidation of olefins - ozonolysis - oxidation of olefinic double bonds and unsaturated carbonyl compounds - oxidative cleavage of C-C bond. Reduction: Selectivity in reduction of 4-t-butylcyclohexanone using selecterides. Hydride reductions - reduction with LiAlH4, NaBH4, sodium cyanoborohydride, trialkyl tin hydride and hydrazines.

UNIT-IV: FREE RADICALS

Long and short-lived free radicals - methods of generation of free radicals - detection of free radicals by ESR - Addition of free radicals to olefinic double bonds - aromatic radical substitutions reactions - decomposition of diazo compounds – phenol coupling - Sandmeyer reaction - Gomberg reaction - Pschorr reaction - Ulmann reaction and Hunsdiecker reaction.

UNIT-V: AROMATICITY

Aromaticity of benzenoid - non-benzenoid, and heterocyclic compounds - Huckel's rule - Aromatic systems with π electron numbers other than six - non-aromatic (cyclo octatetraene etc,) and anti aromatic system (cyclobutadiene etc.) - system with more than 10π electrons - Annulenes upto C18 (synthesis of all these compounds is not expected).

Recommended Books

1. Francis A. Carey and Richard J, Sundberg, Advanced Organic Chemistry - Part B, 3rd Edition (1990).
2. H. O. House, Modern Synthetic Reactions, Benjamin Cummings Publishing Company, London (1972).
3. W. Carruthers, Iain Coldham, Modern Methods of organic synthesis, IV Edition.
4. W. Carruthers,Some Modern Methods of Organic Synthesis,III Edition,Cambridge ,University Press, (1993).
5. J. March, Advanced organic reaction mechanism and structure, Tata McGraw Hill.
6. Mc Murry, Advanced organic chemistry, Thomas Pvt. Ltd.,
7. Michael B. Smith, Organic Synthesis, McGraw Hill, International Edition (1994).
8. L.F. Fieser and M. Fieser, Organic Chemistry, Asia Publishing House, Bombay, 2000.
9. Reinhard Brukner, Advanced Organic Chemistry, Academic Press, Elseiver, 2002.

10. C.K. Ingold, Structure and Mechanism in Organic Chemistry, Cornell Univ. Press .
11. Parmer and Chawla, Organic reaction mechanisms, S. Chand and Co.,
12. R. E. Ireland, Organic synthesis, Prentice Hall of India
13. R.O.C. Norman, Principles of organic synthesis, Chapman and Hall, London. 1980.
14. Raymond K. Mackie and David M. Smith,Guide book to Organic synthesis, ELBS Publication.
15. S. M. Mukherji and S.P. Singh, Organic Reaction Mechanism, MacMillan India Ltd., Chennai (1990).
16. C. N. Pillai, Textbook of Organic Chemistry, University press (India) private Ltd (2009).
17. R. T. Morrison and R. N. Boyd, Organic chemistry, 6th edition, Prentice Hall of India Limited., New Delhi, 1992

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PAPER – 5

INORGANIC CHEMISTRY II

OBJECTIVES:

To make the students knowledgeable in solid state chemistry. To equip the students for their future career in nuclear industry. To learn the chemistry of lanthanides, to learn about nanotechnology and use of inorganic compounds in biological chemistry

OUTCOMES :

- Explain about the structure and properties of solids.
- Describe the types of Nuclear reactions.
- Explain about the stellar energy.
- Discuss the types of Nuclear reactors.
- Illustrate the radio analytical methods
- Describe the chemistry of lanthanides and actinides.
- Applying Nanotechnology to various metals.
- Illustrate the types of transport proteins.

UNIT-I: THE CHEMISTRY OF SOLID STATE

Structure of solids; Comparison of X-ray and Neutron Diffraction; structure of pyrovoskite, cadmium iodide and nickel arsenide; spinels and antispinels, defects in solids, non-stoichometeric compounds. Electrical, magnetic and optical properties of solids, band theory. Semiconductors, superconductors, solid state electrolytes. Types of magnetic behaviour, dia, para, ferro, antiferro and ferrimagnetism, hysterisis.
Solid state lasers, inorganic phosphors and ferrites.

UNIT- II: NUCLEAR CHEMISTRY-I

Nuclear properties: Nuclear spin and moments, origin of nuclear forces, Nuclear models: liquid drop model and nuclear shell model. Modes of radioactive decay: Orbital electron capture, nuclear isomerism, internal conversion. Detection and determination of activity by cloud chamber, nuclear emulsion, bubble chamber, Geiger-Muller, scintillation and Cherenkov counters.
Nuclear reactions: Types, cross section, compound nucleus theory, high energy nuclear, direct nuclear, photonuclear and thermonuclear reactions.

UNIT- III: NUCLEAR CHEMISTRY-II

Stellar energy: synthesis of elements, hydrogen burning, carbon burning. Nuclear reactors: fast breeder reactors, particle accelerators, linear accelerators, cyclotron and synchrotron. Radio analytical methods: Isotope dilution analysis, radiometric titrations, radio immuno assay. Neutron activation analysis.

UNIT-IV: THE CHEMISTRY OF LANTHANIDES, ACTINIDES AND NANOTECHNOLOGY

The chemistry of solid state, lanthanides and actinides, oxidation state, spectral, magnetic characteristics, coordination numbers, stereochemistry, nuclear and non-nuclear applications.
Nanotechnology: Introduction - preparatory methods, characterization, application as sensors, biomedical applications, application in optics and electronics.

UNIT-V: BIOINORGANIC CHEMISTRY

Transport proteins: Oxygen carriers, metalloenzymes, carboxy peptidase, carbonic anhydrase, redox process, iron-sulphur proteins, chlorophyll, salient features of the photo synthetic process, vitamin-B_{12}, role of sodium, potassium, calcium, zinc and copper; fixation of nitrogen, nitrogen cycle.

Text Books

1. A. R. West, Basic solid state chemistry, John Wiley, (1991).
2. S. Glasstone, Source Book on Atomic Energy, Van Nostrand Co., (1969).
3. G. Frielander, J. W. Kennedy and J. M. Miller, Nuclear and Radiochemistry, John Wiley and Sons (1981).
4. Hari Jeevan Arnikar , Essentials of nuclear chemistry, New Age International (P) Ltd., (2005).
5. Hari Jeevan Arnikar,Nuclear Chemistry Through Problems, New Age International (P) Ltd., (2007).
6. G. T. Seaborg, Transuranium elements, Dowden Hitchinson and Ross, (1978).
7. Nishit Mathur, Nanochemistry, RBSA publishers (2010).
8. Patric Salomon, A hand book on Nano Chemistry, Dominant publishers and distributors (2008).
9. G. B. Sergeev, Nanochemistry, Elsevier Science and Technology (2007).
10. U. Saityanarayana, Essentials of Biochemistry, Books and Allied (P) Ltd.,
11. T. Pradeep, Nano: The essentials., McGrew Hill Education.(2007)

Suggested References

11. W. E. Addison, Structural principle in inorganic chemistry, Longman (1961).
12. D. M. Adams, Inorganic solids, John Wiley Sons (1974).
13. Azaroff, Solid State Chemistry, John Wiley.
14. B. E. Dogulas DH McDaniel's and Alexander, Concepts and Models of Inorganic Chemistry, Oxford IBH, (1983)
15. M. C. Day and J. Selbin, Theoretical Inorganic Chemistry, Van Nostrand Co., New York (1974).
16. J.E. Huheey, Inorganic Chemistry - Principles, Structure and Reactivity, Harper Collins, New York, IV Edition (1993).
17. N. Greenwood and A. Earnshaw, Chemistry of Elements, Pergamon, NY, (1984).
18. F.A. Cotton and G. Wilkinson Advanced Inorganic Chemistry - A Comprehensive Text, John Wiley and Sons, V Edition (1988).
19. K.F. Purcell and J.C. Kotz, Inorganic Chemistry - WB Saunders Co., USA (1977)
20. W. U. Mallik, G.D. Tuli, R.D. Madan, Selected topics in Inorganic Chemistry, S. Chand and Co., New Delhi, (1992).

21. M.N. Hughes, The Inorganic Chemistry of Biological processes, Wiley London, II Edition (1982).
22. Jonathan W. Stead, David R. Turner and Karl. J. Wallace., Core concepts in Supramolecular Chemistry and Nanochemistry, John Wiley sons Ltd (2007).
23. Beoffry A.Ozin, Andre Arsenault, Ludovico &Cademartiri. Nano chemistry - A chemical approach to nano materials, Royal Society of chemistry (2009).
24. Kenneth J. Klabunde, Nano scale materials in Chemistry A. John Wiley & Sons Publishers (2001).
25. L. Stryer, Biochemistry, V Edition, Freeman & Co., New York (2002) .
26. D. L. Nelson and M. M. Cox, Lehninger, Principles of Biochemistry, III edition, McMillan North Publication (2002).
27. W. Kaim and B. Schwederski, Bioinorganic Chemistry: Inorganic Elements in the Chemistry of Life, an Introduction and Guide, Wiley, New York (1995).
28. S. J. Lippard and J. M. Berg, Principles of Bioinorganic Chemistry, University Science Books (1994).
29. I. Bertini, H. B. Grey, S. J. Lippard and J. S. Valentine, Bioinorganic Chemistry, Viva Books Pvt. Ltd., New Delhi (1998).
30. R. Gopalan, Text book of Inorganic Chemistry, University press (India) private Ltd.

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PAPER-6
PHYSICAL CHEMISTRY II

OBJECTIVES:

To understand the behavior of kinetic reactions and fast reaction. To understand the behavior of electrolytes in solution. To know the structure of the electrode surface. To differentiate electrode kinetics from other types of kinetic studies. To know the applications of electrode process. To study the concept and applications of group theory.

OUTCOMES :

- *Describe the rate expression for complex reactions and experimental study of fast reactions.*
- *Describe Debeye-Huckel limiting law and Bronsted equation.*
- *Explain the structures of double layer and deriving Lippmann equation.*
- *Apply group theory and finding the symmetries and point group to construct character tables of C2V and C3V.*

UNIT-I: KINETICS OF COMPLEX REACTIONS & FAST REACTIONS

Kinetics of complex reactions, reversible reactions, consecutive reactions, parallel reactions, chain reactions, general treatment of chain reactions - chain length - Rice Herzfeld mechanism - explosion limits.
Study of fast reactions - relaxation methods - temperature and pressure jump methods- stopped flow and flash photolysis methods.

UNIT-II: ELECTROCHEMISTRY – I

Mean ionic activity and mean ionic activity coefficient - activity coefficient of strong electrolytes - determination of activity coefficient by electrochemical method.
Debye Huckel limiting law - qualitative and quantitative verification - limitation - Debye Huckel limiting law at appreciable concentrations of electrolytes - Debye - Huckel - Bronsted equation.

UNIT-III: ELECTROCHEMISTRY – II

Electrode - electrolyte interface - adsorption at electrified interface - electrical double layer - electro capillary phenomenon - Lippmann equation - Structure of double layers - Helmholtz - Perrin, Guoy - Chapman and Stern model of electrical double layers.
Diffusion - Fick's law of diffusion - Effect of ionic association on conductance-electro kinetic phenomena -membrane potential.

UNIT-IV: GROUP THEORY – I

Definition of basic terms in group theory – Group – Abelian group, cyclic group, subgroup, group multiplication table - similarity transformation and class, symmetry elements and symmetry operations -Point groups (any examples limited to n = 4 of C_{nv}, C_{nh}, D_{nh}, D_{nd}, & T, T_d, O, O_h), Reducible and Irreducible representations - direct product representation. Character Table - explanation of various column and Mullliken Symbol.

UNIT-V: GROUP THEORY – II

Orthogonality theorem and its consequences - construction of character table for C_{2V}, C_{3V}, C_{2h}, and D_{2d} point groups - hybrid orbitals in nonlinear molecules (CH_4, BF_3, and NH_3). Determination of representations of vibrational modes in nonlinear molecules

(H_2O, NH_3, BF_3 and $[PtCl_4]^{2-}$). Symmetry selection rules of Infra-red and Raman spectra.

TEXT BOOKS

1. J. Rajaram and J. C. Kuriacose, Kinetics and Mechanism of Chemical Transformations. Mac Millan 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, Mac Millan India Ltd., (2001).
4. S. Glasstone, Introduction to Electrochemistry, Affiliated East West Press, New Delhi (1960).
5. D. R. Crow, Principles and Applications to Electrochemistry, Chapman and Hall (1991).
6. K.V. Raman, Group Theory and its Applications to Chemistry, Tata Mc Graw Hill Publishing Co., (1990).
7. P. K. Bhattacharya, Group Theory and its Applications, Himalaya Publishers.
8. K.V. Ramakrishnan and M. S. Gopinath, Group Theory in Chemistry, Vishal Publications (1998).

SUGGESTED REFERENCES

1. R. G. Frost and Pearson, Kinetics and Mechanism, Wisely, New York (1961).
2. C. Capellos and B. H.J. Bielski, Kinetic Systems, Wisely Interscience, New York (1972).
3. Amdur and G.G. Hammes, Chemical Kinetics, Principles and Selected Topics, McGraw Hill, New York (1968).
4. G. M. Harris, Chemical Kinetics, D. C. Health and Co., (1966).
5. J. Robbins, Ions in Solution - An Introduction of Electrochemistry, Clarendon Press, Oxford (1972).
6. John O. M. Bockris, Amulya K.N. Reddy, Modern Electrochemistry 2B: Electrodics in Chemistry, Engineering, Biology and Environmental Science
7. F. A. Cotton, Chemical Applications of Group Theory, John Wiley and Sons inc., New York (1971).
8. N. Thinkham, Group Theory and Quantum Mechanics, McGraw Hill Book Company, New York (1964).
9. S. Schonland, Molecular Symmetry, Vannostrand, London (1965).
10. Alan Vincent, Molecular Symmetry and Group Theory-Programme Introduction to Chemical Application, Wiley, New York (1977).

11. S. Swarnalakshmi, T. Saroja and R. M. Ezhilarasi, A simple Approach to Group Theory in Chemistry, University press (India) private Ltd (2008).

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MAIN
PRACTICAL PAPER – 1
ORGANIC CHEMISTRY PRACTICAL- I

A) Identification of components in a two component mixture and preparation of their derivatives. Determination of b.p. / m.p. for components and m.p. for the derivatives.

B) Any Six preparations from the following:
   1. Preparation of o-benzoyl benzoic acid (Fridel Crafts Reaction)
   2. p-Nitrobenzoic acid from p-nitrotoluene (Oxidation)
   3. Anthroquinone from anthracene (Oxidation)
   4. Glucose pentaacetate from Glucose (Acetylation)

5. m-Nitroaniline from m-dinitrobenzene (Reduction)
6. Benzophenone oxime from benzophenone (Addition reaction)
7. p-Chlorotoluene from p-toluidine (Sandmeyers' Reaction)
8. 2,3 - Dimethylindole from phenyl hydrazine and 2 - butanone (Fisher Indole Synthesis)
9. 1,2,3,4 - Tetrahydrocarbazole from cyclohexanone (Fisher Indole Synthesis)
10. Methyl orange from sulphanilic acid (Diazo Reaction)

University Examination	**Marks**
Qualitative organic Analysis	40
Preparation	20
Viva voce	10
Record	05
Total	**75**

CONTINUOUS INTERNAL ASSESSMENT MARKS (CIA MARK)
MAX. MARKS = 25

Evaluation method for practical paper:

Distribution of Marks

Internal assessment	Marks
Two Tests	10
Results accuracy	10
Attendance/ Regularity	5
Total	**25**

References:

1. Arthur I. Vogel, "A Textbook of Practical Organic Chemistry", ELBS.
2. N.S. Gnanapragasam and B. Ramamoorthy, "Organic Chemistry Lab Manual" (2006), S. Visvanathan Printers & Publishers.

PRACTICAL PAPER – 2
INORGANIC CHEMISTRY PRACTICAL – I

A) **Semimicro qualitative analysis of mixture containing two common and two rare cations.** The following are the rare cations to be included. W, Ti, Te, Se, Ce, Th, Zr, V, U, Li, Mo and Be.

B) **Complexometric Titrations (EDTA):** Estimation of Ca, Mg and Zn.

C) **Preparation of the followings:**

1. Potassium tris (oxalate) aluminate (III) trihydrate
2. Tris (thiourea) copper (I) chloride
3. Potassium tris (oxalato) chromate (III) trihydrate
4. Sodium bis(thiosulphato) cuprate (I)
5. Tris (thiourea) copper (I) sulphate
6. Sodium hexanitrocobaltate (III)
7. Chloropentammine cobalt (III) chloride
8. Bis (acetylacetonato) copper (II)
9. Hexamminenickel (II) chloride
10. Bis (thiocyanato) pyridine manganese (II)

D). Separation of zinc and magnesium on an anion exchange.

Marks distribution:

University Examination	Marks
Qualitative Inorganic Analysis	25
EDTA Complexometric Titration	20
Preparation	15
Viva Voce	10
Record	05
Total	**75**

CONTINUOUS INTERNAL ASSESSMENT MARKS (CIA MARK)
MAX. MARKS = 25

Evaluation method for practical paper:

Distribution of Marks

Internal assessment	Marks
Two Tests	10
Results accuracy	10
Attendance/ Regularity	5
Total	**25**

PRACTICAL PAPER-3
PHYSICAL CHEMISTRY PRACTICAL- I

Experiments in Thermodynamics, colligative properties, phase rule, chemical equilibrium and chemical kinetics.

Typical examples are given and a list of experiments is also provided from which suitable experiments can be selected as convenient.

1. Heat of solution from Solubility measurements
2. Determination of Molecular weight
3. Determination of activity and activity coefficient
4. Construction of Phase diagram involving two / three component systems
5. Determination of partial molar quantities
6. Verification of Freundlich Adsorption isotherm
7. Reaction rate and evaluation of other kinetic parameters using polarimetry
8. Determination of Reaction rate and Rate constant using Analytical techniques: Conductometry and Dilatometry
9. Verification of Beer Lambert law.

Detailed list of Experiments for Physical Chemistry Practical I

Typical list of possible experiments is given.
Experiments of similar nature and other experiments may also be given.
Any 15 experiments have to be performed in a year.

1. Determine the temperature coefficient and energy activation of hydrolysis of ethyl acetate.
2. Study the kinetics of the reaction between acetone and iodine in acidic medium by half-life method and determine the order with respect to iodine and acetone.
3. Study the effect of solvent (DSMO-water, acetone-water system) on the rate of acid catalysed hydrolysis of acetal by dilatometry.
4. Study the Saponification of ethyl acetate by sodium hydroxide conductometrically and determine the order of the reaction.
5. Determine the order with respect to Silver (I) in the oxidation and rate constant and for uncatalysed reaction.
6. Study the inversion of cane sugar in the presence of acid using Polarimeter.
7. Determine the rate constant and order of the reaction between potassium persulphate and potassium iodide and determine the temperature coefficient and energy of activation of the reaction.
8. Study the effect of ionic strength on the rate constant for the saponification of an

ester.

9. Study the salt effect on the reaction between acetone and iodine.
10. Study the kinetics of the decomposition of sodium thiosulphate by mineral acid (0.5M HCI).
11. Study the primary salt effect on the kinetics of ionic reactions and test the Bronsted relationship (iodide ion is oxidized by persulphate ion).
12. Study the kinetics of enzyme catalysed reactions (Activity of tyrosinase upon tyrosine spectrophotometrically).
13. Study the salt effect, the solvent effect on the rate law of alkaline hydrolysis of crystal violet.
14. Study the reduction of aqueous solution of ferric chloride by stannous chloride.
15. Determine the molecular weight of benzoic acid in benzene and find the degree of association.
16. Determine the activity coefficient of an electrolyte by freeing point depression method.
17. Study the phase diagram form-toluidine and glycerine system.
18. Construct the phase diagram for a simple binary system naphthalene - phenantherene and benzophenone-diphenyl amine.
19. Construct the boiling point composition diagram for a mixture having maximum boiling point and minimum boiling point.
20. Study the complex formation between copper sulphate and ammonia solution by partition method.
21. Study the simultaneous equilibria in benzoic acid - benzene - water system.
22. Determine the degree of hydrolysis and hydrolysis constant of aniline hydrochloride by partition method.
23. Determine the molecular weight of a polymer by viscosity method.
24. Determine the viscosities of mixtures of different compositions of liquids and find the composition of a given mixture.
25. Determine the partial molal volume of glycine / methanol and formic acid / sulphuric acid by graphical method and by determining the densities of the solutions of different compositions.
26. Study the temperature dependence of the solubility of a compound in two solvents having similar inter molecular interactions (benzoic acid in water and in DMSO water mixture) and calculate the partial molar heat of solution
27. Construct the phase diagram of the three component of partially immiscible liquid system (DMSO-water benzene; acetone-chloroform -water; chloroform-acetic acid-water)
28. Construct the phase diagram of a ternary aqueous system of glucose -potassium chloride and water
29. Study the surface tension - concentration relationship for solutions (Gibb's equation)
30. Study the absorption of acetic acid by charcoal (Freundlich isotherm).
31. Study the complex formation and find the formula of silver-ammonia complex by

distribution method.

32. Determine the dissociation constant of picric acid using distribution law

Marks distribution:

University examination	Marks
Procedure	10
Manipulation	25
Result	25
Viva voce	10
Record	05
Total	**75**

CONTINUOUS INTERNAL ASSESSMENT MARKS (CIA MARK): MAX. MARKS = 25

Evaluation method for practical paper:

Distribution of Marks

Internal assessment	Marks
Two Tests	10
Results accuracy	10
Attendance/ Regularity	5
Total	**25**

ELECTIVE
PAPER-2
(to choose 1 out of 3)

A. GREEN CHEMISTRY

OBJECTIVES:

To know the principle and importance of green chemistry. To understand the student green chemistry strategies for designing the chemical synthesis. To know the solvent free synthesis. To make the students knowledgeable ultrasound and microwave assisted green synthesis.

OUTCOMES:

Have the knowledge on 12 rules on green chemistry.
Apply the attractive techniques in green synthesis.
Use of ionic liquids, and polymer supported reagents in green synthesis.
Apply the phase transfer catalysis in green synthesis.

UNIT- I: BASIC PRINCIPLES OF GREEN CHEMISTRY

Basic principles, prevention of waste/by-products, maximum incorporation of the reactants (starting materials and reagents) into the final product, prevention or minimization of hazardous products, designing safer chemicals, energy requirements for synthesis, selection of appropriate solvent, selection of starting materials, use of protecting groups, use of catalyst and products designed should be biodegradable.

UNIT- II: ULTRASOUND AND MICROWAVE ASSISTED GREEN SYNTHESIS

Ultrasound: Introduction, instrumentation, the phenomenon of cavitation. Sonochemical esterification, substitution, addition, alkylation, oxidation, reduction and coupling reactions.

Microwaves: Introduction, concept, reaction vessel/ medium, specific effects, atom efficiency (% atom utilization), advantages and limitations. N-alkylation and alkylation of active methylene compounds and Diels –Alder reactions. Reactions in water and reaction in organic solvents. Solvent free reactions and deprotection of esters.

UNIT- III: IONIC-LIQUIDS AS GREEN SOLVENTS

Introduction, structure, synthesis and applications of some important ionic liquids in organic synthesis.

Polymer supported reagents in green synthesis**:** Introduction - properties and advantages of polymer supported reagents and choice of polymers.

Substrate covalently bound to the support: Synthesis of oligosaccharides, intramolecular cyclisation. Selective chemical reactions on one aldehyde group of symmetrical aldehydes - Asymmetric synthesis.

Reagent linked to a polymeric material: Preparation of sulfonazide polymer and application in diazotransfer reaction. Synthesis of polymer bound per acid and its applications, synthesis of polystyrene tin dichloride resin and its applications.

Polymer supported catalytic reactions: Preparation of polymer supported $AlCl_3$ and applications - polymer supported photo sensitizers.

UNIT- IV: PHASE TRANSFER CATALYSIS IN GREEN SYNTHESIS

Introduction, mechanism of phase transfer catalyst reaction, types and advantages of phase transfer catalyst, types and applications of phase transfer reaction: Nitriles from alkyl or acyl halides, alkyl fluorides, alcohols, azides from alkyl halides, generation of dichlorocarbenes, addition to olefins, elimination reaction, alkylation reactions, Willamson synthesis, Benzoin condensation, Darzen reaction, Michael reaction, Wittig reaction, oxidation under PTC condition and reduction.

UNIT-V: INDUSTRIAL CASE STUDIES

Methyl Methacrylate (MMA)-Greening of Acetic acid manufacture, Vitamin-C- Leather manufacture-Types of Leather- Difference between Hide and Skin- Tanning –Reverse tanning-Vegetable tanning-Chrome tanning- Fat liquoring- Dyeing- Application-Polyethylene-Ziegler Natta Catalysis, Metallocene Catalysis- Eco friendly Pesticides-Insecticides.

Text Books:

1. New Trends in Green Chemistry, V. K. Ahluwalia, M. Kidwai, II Edn., Anamaya publishers New Delhi(2007).
2. Green Chemistry and Introductory text, Mike Lancaster, II Edition

3. Organic synthesis: Special techniques, V. K. Ahluwalia and R. Aggarwal, Narosa, New Delhi, 2003.

References:

4. Green Chemistry environment friendly alternatives, R. Sanghi and M M Srivastava, Narosa, New Delhi, 2003.
5. Green Chemistry – an introduction text, Royal Society of Chemistry, UK, 2002
6. P. T. Anastas and J. C. Warner, Green Chemistry theory and Practice, Oxford University press. Oxford (1988).
7. Phase Transfer Catalysis in Organic Synthesis, W. B. Weber, G. W. Gokel, Springer, Berlin, 1977.
8. Phase Transfer Catalysis, E. V. Dehmlov, S. S. Dehmlov, 2nd Edn., Verlagchemie, Wienhein, 1983.
9. Polymers as aids in Organic Synthesis, N. K. Mathur, C. K. Narang and R. E. Williams, Academic Press, NY, 1980.

PAPER-2

B. SUPRAMOLECULAR AND NANOCHEMISTRY

OBJECTIVES:

To know the student the basis of suprmolecular chemistry, metal-organic framework solids, nano materials and their applications.To understand the various techniques available to characterize the advanced nano materials. To identify the applications of nanotechnology.

OUTCOMES:

Understand the basic concepts of interaction in supramolecular structures.
Adequate knowledge on supramolecular frame works and synthesis.
Gain knowledge on synthesis and preparation of nanomaterials.
Understand the nanomaterials characterization and applications.

UNIT-I: SUPRAMOLECULAR CHEMISTRY

Definition of supramolecular chemistry. Nature of binding interactions in supramolecular structures: ion-ion, ion-dipole, dipole-dipole, H-bonding, cation-p, anion-p, p-p, and vander Waals interactions. Supramolecular synthons.

Self-assembly molecules: Design, synthesis and properties of the molecules, self-assembling by H-bonding, metal-ligand interactions and other weak interactions, metallomacrocycles, catenanes, rotaxanes, helicates and knots.

UNIT-II: FRAMEWORK SOLIDS

Introduction-definition of porosity, pore size, pore volume, pore density-zeolites-synthesis and applications-metal organic frame work solids-definition-classifications-uses of different types of organic ligands- tuning of structure and properties - synthetic methods- advantage of MOF solids over zeolites- cracking of petroleum products

UNIT-III: SYNTHESIS OF SUPRAMOLECULES

Synthesis and structure of crown ethers, lariat ethers, podands, spherands, cyclophanes, cryptophanes, carcerands and hemicarcerands., Host-Guest interactions, lock and key analogy. Binding of cationic, anionic, ion pair and neutral guest molecules.
Molecular devices: molecular electronic devices, molecular wires, molecular rectifiers, molecular switches and molecular logic.

UNIT-IV: NANOCHEMISTRY

Introduction and definition of nanoparticles and nanomaterials, emergence of nanotechnology, challenges of nanotechnology. Synthesis of nanoparticles of ZnO_2, TiO_2, silver, gold, rhodium, palladium and platinum; carbon materials- fullerene- porous nano carbon (PNC).
Techniques of synthesis: Electroplating and electrophoretic deposition, conversion through chemicalreactions and lithography; Thin films: Chemical vapor deposition and atomic layer deposition techniques; Carbon fullerenes and nanotubes.

UNIT-V: ANALYTICAL CHARACTERIZATION AND APPLICATIONS

X-rays, Infrared, UV-Vis, Laser Raman, Electron microscopic techniques (SEM and TEM) - Thermal analysis (TG/DTA/DSC) methods.
Application of nanotechnology: modern technology in electronic, biological, consumer and domestic applications. Energy related application: photo-voltaic cells, energy storage nanomaterial. Drug delivery, drug targeting. Sensors and biosensors.

Reference Books

1. C.N.R. Rao, A. Muller, A.K. Cheetam (Eds), The Chemistry of Nanomaterials, Vol.1, 2, Wiley – VCH, Weinheim, 2004
2. Nanochemistry, Kenneth J. Klabunde and G.B.Sergeev
3. G.Zhong Cao. Nanostructures and Nanomaterials: Synthesis, Properties and Applications, Imperial College Press (2004)
4. Metal-Organic Frameworks Applications from Catalysis to Gas Storage. Cejka, J, ed. (2011). Wiley-VCH. ISBN 978-3-527-32870-3
5. Zeolites and Catalysis: Synthesis, Reactions and Applications. Jiri Cejka; Avelino Corma; Stacey Zones (2010). John Wiley & Sons. ISBN 978-3-527-63030-1.
6. J.-M. Lehn; Supramolecular Chemistry-Concepts and Perspectives (Wiley-VCH, 1995)

7. P. D. Beer, P. A. Gale, D. K. Smith; Supramolecular Chemistry (Oxford University Press, 1999)
8. J. W. Steed and J. L. Atwood; Supramolecular Chemistry (Wiley, 2000).
9. C. P. Poole Jr, F. J. Owens, Introduction to nanotechnology, 2nd edition, Wiley-India, Delhi, 2008.
10. C. C. Kouch, Nanostructures materials: Processing, properties and applications, William Andrew publications, Newyork, 2002.
11. T. Pradeep, Nano: The essentials., McGrew Hill Education.(2007)

PAPER-2

C. MODERN SEPARATION TECHNIQUES

OBJECTIVES:

To learn the basic concept of chromatography. To understand the different chromatographic techniques. To study the applications of chromatography. To know the separation and purification methods.

OUTCOMES:

Have knowledge on principles on chromatography.
Working knowledge on gas and HPCL chromatographic techniques.
Adequate knowledge on application of ion-exchange chromatography.
Understanding on solvent extraction and distillation techniques

UNIT-I: BASIC CONCEPTS OF CHROMATOGRAPHY

General description: Definitions, terms and parameters used in chromatography. Classification of chromatographic methods. Elution chromatography on columns. Migration rates of solutes, zone broadening, column efficiency and optimization of column performance.

UNIT-II GAS CHROMATOGRAPHY(GC)

Principles of gas-liquid chromatography, instrumentation, carrier gas, sample injection, column configuration and detection system (FID, TCD, ECD). Gas chromatographic columns (open tubular columns and packed columns) and stationary phases. Interfacing GC/MS.

UNIT-III: HIGH PERFORMANCE LIQUID CHROMATOGRAPHY (HPLC)

Column efficiency. Instrumentation: pumping system, sample injection system. Liquid chromatographic columns - types of column packing. Detectors: Absorbance detector and electrochemical detectors. Partition chromatography.

UNIT-IV: ION-EXCHANGE CHROMATOGRAPHY (IEC)

Definition, requirements for ion exchange resin. Synthesis and types of ion-exchange resins. Principle and basic features of ion - exchange reactions. Exclusion chromatography: Theory and principle of size exclusion chromatography. Experimental techniques of gel-filtration chromatography (GFC) and gel-permeation chromatography (GPC). Materials for packing-factors governing column efficiency. Methodology and applications.

UNIT-V: PURIFICATION AND EXTRACTION TECHNIQUES

Principle and techniques: Desiccants, precipitation: types of precipitation, factors affecting the precipitation. Distillation: fractional, steam, azeotropic, vacuum distillations. Recrystalization and sublimation.
Solvent extraction: Principle and techniques. Factors affecting the extraction efficiency: Ion association complexes, chelation, synergistic extraction and pH. Role of chelating ligands in solvent extraction. Introduction to solid phase extraction (SPE) and microwave assisted extraction (MAE) and applications.

REFERENCES

1. Fundamental of Analytical Chemistry, D.A. Skoog, D.M. West, Holler and Crouch, 8th Edition, 2005, Saunders College Publishing, New York.
2. Analytical Chemistry, G.D. Christian, 5th ed., 2001 John Wiley & Sons, Inc, India.
3. Quantitative Analysis, R.A. Day and A.L. Underwood, 6th edition, 1993, prentice Hall, Inc. New Delhi.

4. Vogel's Textbook of Quantitative Chemical Analysis, J. Mendham, R.C. Denney, J.D. Barnes and M.J.K. Thomas, 6th edition, Third Inidan Reprint.2003 Pearson Education Pvt. Ltd., New Delhi.
5. Analytical Chemistry Principles, John H. Kennedy, 2nd edition, Saunders College Publishing, California, 1990.
6. Introduction to Chromatography Theory and practice, V.K.Srivastava, K.K.Srivastava, Chand &.Company Ltd , New Delhi
7. Principles of Instrumental Analysis, , D.A. Skoog,,F.James Holler, Timothy.A.Nieman ,Harcourt Asia (P) Ltd
8. Principles of Instrumental Analysis, D.A. Skoog, , Saunders College Pub. Co, III Edn., 1985
9. Text Book of Quantitative Organic Analysis A.I Vogel, , ELBS III Edn, 1987.
10. Fundamentals of Analytical Chemistry, D.A. Skoog and D. M. West, Holt Rinehart and Winston Publications, IV Edn, 2004.
11. Instrumental Methods of Analysis, Willard, Merit, Dean and Settle, , CBS Publishers and Distributors, IV Edn.,1989
12. G. D. Christian and J. E. O. Reilly, Instrumental Analysis, Allyn and Bacon Inc, II Edn., 1988.
13. R. M. Upadhyay , Instrumental & Analytical Chemistry Principles & Procedure Kalyani Publishers(2002).

OPEN ELECTIVE (NON MAJOR)
PAPER-II

(To choose 1 out of 3)

A. MEDICINAL CHEMISTRY

OBJECTIVES:

To make the students learn the concept of medicinal chemistry
To understand the various sourcesand classification of drugs
To learn the importance of Chemotherapy
To study about the common body ailments
To understand about health promoting drugs

OUTCOMES:

The students will be able to
Appreciate the importance of medicinal chemistry
Acquire knowledge of classification of drugs
Identify the importance of Chemotherapy
Acquire knowledge of common body ailments
Illustrte the importance of health promoting drugs

UNIT I-INTRODUCTION Common diseases – infective diseases – insect – borne, air – borne and water-borne – hereditary diseases – Terminology – drug, pharmacology, antimetabolites, absorption of drugs – factors affecting absorption –therapeutic index (Basic concepts only)

UNIT II-DRUGS Various sources of drugs, pharmacologically active constituents in plants, Indian medicinal plants – tulsi, neem, keezhanelli – their importance – Classification of drugs – biological chemical (Structure not required) Drug receptors and biological responses – factors affecting metabolism of drugs. (Basic concepts only)

UNIT III-CHEMOTHERAPY Drugs based on physiological action, definition and two examples each of anesthetics- General and local – analgesics – narcotic and synthetic – Antipyretics and anti inflammatory agents – antibiotics – Penicillin, Streptomycin, Antivirals, AIDS – symptoms, prevention, treatment – Cancer (Structure not required)

UNIT IV-COMMON BODY AILMENTS

Diabetes – Causes, hyper and hypoglycemic drugs – Blood pressure – Sistolic & Diastolic Hypertensive drugs – Cardiovascular drugs – depressants and stimulants – Lipid 128 profile – HDL, LDL cholesterol lipid lowering drugs. (Structure not required)

UNIT V-HEALTH PROMOTING DRUGS Vitamins A,B, C, D, E and K micronutrients – Na, K, Ca, Cu, Zn and I, Medicinally important inorganic compounds of A1, P, As, Hg and Fe, Examples and applications, Agents for kidney function (Aminohippuric acid). Agents for liver function (Sulfo bromophthalein), antioxidants, treatment of ulcer and skin diseases. (Structure not required)

RECOMMENDED TEXT BOOKS:

1. S.Lakshmi Pharmaceutical Chemistry, S.Chand & Sons, New Delhi, 2004

2. V.K. Ahluwalia and Madhu Chopra, ―Medicinal Chemistry‖, Ane Books, New Delhi, 2008
3. P.Parimoo, ― A Text Book of Medicinal Chemistry‖, CBS publishers, New Delhi, 2006

RECOMMENDED REFERENCE BOOKS

1. Ashutosh Kar, ―Medicinal Chemistry‖, Wiley Eastern Ltd., New Delhi, 1993,
2. David William and Thomas Lemke, Foyes Principles of Medicinal Chemistry, BI Publishers.
3. Romas Nogrady, Medicinal Chemistry, Oxford Univ. Press 129

PAPER-II
(To choose 1 out of 3)

B.TEXTILE CHEMISTRY

OBJECTIVES:

To make the students learn the concept of textile chemistry
To understand about synthetic fibres
To learn the importance of raw cotton
To study about the dyeing process
To understand about finishes given to fabrics

OUTCOMES:

Appreciate the importance of textile chemistry
Acquire knowledge of synthetic fibres
Identify the importance of raw cotton
Acquire knowledge of dyeing
Illustrate the importance of finishes given to fabrics

UNIT I : 1. General classification of fibres-chemical structure, production, properties and uses of the following natural fibres (a)natural cellulose fibres (cotton and jute) (b) natural protein fibre (wool and silk).

UNIT II : Chemical structure, production, properties and uses of the following synthetic fibres. (i) Man made cellulosic fibres (Rayon, modified cellulose fibres) (ii) Polyamide fibres (different types of nylons) (iii) Poly ester fibres.

UNIT III : Impurities in raw cotton and grey cloth, wool and silk- general principles of the removal – Scouring – bleaching – Desizing – Kierboiling- Chemicking.

UNIT IV : Dyeing - Dyeing of wool and silk –Fastness properties of dyed materials – dyeing of nylon, terylene and other synthetic fibres.

UNIT V : Finishing- Finishes given to fabrics- Mechanical finishes on cotton, wool and silk, method used in process of mercerizing –Anti-crease and Anti-shrink finishes –Water proofing.
117

Reference

1. Chemical Technology of fibrous Materials – F.sadov, M.Horchagin and A.Matetshy, Mir Publishers.
2. The Identification of Textile Fibres – Bruno Nuntak.
3. Introduction to Textile Science -3rd edition, Maryory L.Joseph.
4. Textile Chemistry –Vol.II R.H.Peters, Elserier, Avesterdam.
5. Dyeing and chemical Technology of Textile fibres-5th Edition, E.R.Trotman,Charles Griffin & Co Ltd
6. Chemistry of dyes & Principles of Dyeing -V.A.Shenai, Sevak Publications.
7. Scouring and Bleaching E.R.Trotman, Charles Griffin & Co Ltd.

PAPER-II
(To choose 1 out of 3)

C.DAIRY CHEMISTRY

OBJECTIVES:

To make the students learn about diary chemistry
To understand the importance of mikl-lipids, proteins, carbohydrates and vitamins
To learn the importance of creams
To understand the importance of dairy detergents
To study about the milkpowder and ice-cream

OUTCOMES:

The students will be able to
Identify the importance of diary chemistry
Acquire knowledge of mikl-lipids, proteins, carbohydrates and vitamins
Appreciate the importance of creams
Acquire knowledge of milk powder and ice- creams
Illustrate the importance of diary detergents

UNIT I : Milk: General composition of milk factors affecting the gross composition of milk, physico-Chemical change taking place in milk due to processing parameters-boiling pasteurization- sterlilzation and homogenization.

UNIT II : 1. Milk lipids-terminology and definitions 2. Milk proteins:. Physical properties of milk proteins-Electrical properties and hydration, solubility. Reaction of milk proteins with formaldehyde and ninhydrin. 3. Milk carbohydrate-Lactose- Estimation of lactose in milk. 4. Milk vitamins-water and soluble vitamins, effect of heat and light on vitamins. 5. Ash and mineral matters in milk.

UNIT III : 1. Creams : Definition-composition-chemistry of creaming process- gravitational and centrifugal methods of separation of cream-Factors influencing cream separation (Mention the

factors only)-Cream neutralization. Estimation of fat in cream. 2. Butter : Definition-% composition-manufacture-Estimation of fat, acidity, salt and moisture content-Desi butter. 113

UNIT IV : 1. Milk powder : Definition-need for making powder-drying process- spraying, drum drying, jet drying and foam drying-principles involved in each. Manufacture of whole milk powder by spray drying process-keeping quality of milk powder. 2. Ice cream : Definition-percentage composition-types- ingredients needed -manufacture of ice-cream stabilizers-emulsifiers and their role.

UNIT V : Dairy Detergents : Definition-characteristics-classification-washing procedure (modern method) sterilization-chloramin-T and hypochlorite solution.

Reference Books 1. Outlines of Diary Technology-Sukumar De
2. Principles of Dairy Chemistry-Robert Jenness & S.Patorn.
3. Indian Diary products-K.S. Rangappa and K.T. Achaya.

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