### Scheme of Examinations (CBCS PATTERN)

For the students admitted during the academic year 2009-2010 onwards

<table>
<thead>
<tr>
<th>Part</th>
<th>Study Components</th>
<th>Course Title</th>
<th>Ins. hrs / week</th>
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* For subjects without practical  ** For subjects with Practical
@ No University Examinations. Only Continuous Internal Assessment (CIA)
# No Continuous Internal Assessment (CIA). Only University Examinations.

### List of Elective papers (Colleges can choose any one of the paper as electives)

<table>
<thead>
<tr>
<th>Elective – I</th>
<th>A</th>
<th>Analytical Chemistry I : Basic Principles</th>
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<td>Forensic Science and Crime Investigation</td>
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<th>Analytical Chemistry II Lab. Techniques</th>
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<td>B</td>
<td>Chemistry of Plant Based Products</td>
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### Allied Subjects

1. Mathematics
2. Physics
3. Botany
4. Zoology
5. Biochemistry
CORE I - CHEMISTRY PAPER I

Teaching hours: 60 hours per semester

Subject Description: This paper presents the basic principles of Chemistry.

Goals: To enable the students to learn about the basic principles of Chemistry.

Objective: To understand the important concepts of Chemistry.

CONTENTS

UNIT I
Ionic bonding - ionic crystals, NaCl and CsCl crystal structure, Lattice energy and its determination using Born-Haber cycle, factors affecting crystal lattice energy, properties of ionic crystals (high melting point, hardness, electrical conductivity in molten condition and in solution) – ion polarization - Fajan’s rule-solubility of ionic compounds in polar solvent.

UNIT II
Structure and shape of molecules: VSPER Theory and geometry of molecules. Hybridization and geometry of sp, sp², sp³, dsp², d²sp³, sp³d² and sp³d³. Bonding, shapes and structures of the following molecules: Molecules with Sigma bonds only – BeCl₂, SnCl₂, BF₃, CH₄, SiF₄, XeF₄, PCl₅, IF₅, SF₆, and IF₇.

UNIT III
Polar effects – inductive effect, mesomeric effect, electromeric effect, hyper conjugation and steric effects.
Classification of reagents: Electrophiles, Nucleophiles and Free radicals.
Types of reaction: Polar reactions involving carbonium ions and carbanions with simple examples.

UNIT IV
Aliphatic Hydrocarbons: Restricted rotation about single bond preferred rotational conformations.

Alkenes: Preparation by Witting reaction – Mechanisms of beta elimination – E1, E2 and cis elimination – Hoffmanns rule and Saytzeff’s rule. Addition reactions with hydrogen, halogen, hydrogen halide (Markownikoff’s rule) and hydrogen bromide (Peroxide effect).

UNIT V
2. Cycloalkanes: Preparation by Dickmann ring closure and by reduction of aromatic hydrocarbons – ring opening reactions of cyclopropane with H₂, Br₂ and HI.
CORE II - CHEMISTRY PAPER II

Teaching hours: 60 hours per semester (4 hours per week)

Subject description:
This paper presents the concept of resonance and wave mechanical treatment of electrons.

Goals:
To enable the students to learn about the basic concept of resonance and wave theory.

Objectives:
To study the resonance in benzene and quantum theory.

Contents

Unit I:
Ozone and hydrogen peroxide – preparation, properties, structure, uses comparison between the two.
Selenium and Tellurium – Extraction, properties and Uses. Oxides and oxyacids of Se and Te. A comparative study of Sulphur, Selenium, Tellurium and their compounds (hydrides, oxides, halides)

Unit II:
Alkynes: Acidity of Alkynes – formation of acetylides-addition of water with HgSO₄ catalyst-hydroboration.

Unit III:
Liquid crystals–the concept of mesomorphic state-typical liquid crystalline substances and their properties.
Properties of liquids like surface tension and viscosity – Review of structural differences between solids, liquids and gases.
Condensed phases-Coefficients of thermal expansion and compressibility of liquids and solids.

Unit IV:
Failure of classical theory in explaining black body radiation- plancks theory of quantization of energy – Einstein theory of photoelectric effect-compton effect.
de Broglie theory of wave-particle dualism-Heisenberg’s uncertainty principle.

Unit V:
An elementary treatment of Schrodinger wave equation – quantum numbers concept of orbitals-significance of $\psi$ & $\psi^2$ free particles and particle in a box (one and three dimensional)
The covalent bonds-the hydrogen molecule – the vlance bond method hydrogen molecule ion-molecular orbital method-molecular orbitals for homonuclear and heteronuclear diatomic molecules.
CORE III - CHEMISTRY PAPER III

Teaching hours: 60 hours per semester

Subject description:
This paper presents the concept of coordination chemistry, aromaticity and thermodynamics.

Goals:
To enable the students to learn about aromaticity, thermodynamics and coordination chemistry.

Objectives:
To study the principles of thermodynamics and coordination chemistry.

Contents
Unit I:

Unit II:
Chemistry of Boron family – Group discussion – Electron acceptor behaviour and electron deficiency of boron hydrides; bonding in diboranes; NaBH₄, LiBH₄ preparation, properties, structure and uses- borozoels, borides.
Classification of silicate- simple silicates chain silicates and sheet silicates only.

Unit III:
Aromaticity-Huckel’s rule Non-benzenoid aromatic compounds like cyclopentadienyl anion. Toluene and Isoprophyl benzene and side chain substitution – polymerization of styrene. Vinyl chloride Relative reactivity of methyl, ethyl and vinyl chlorides. Gringanard reagents and synthetic applications-Nucleophilic substitution reaction – S_N1, S_N2 and S_N1 reactions – Effect of solvent-nucleophile, structure of substrate and neighbouring group participation, elimination versus substitution-Benzene mechanism and intermediate complex mechanism.

Unit IV:
Unit V:


TEXTBOOKS FOR REFERENCE:

CORE IV - CHEMISTRY PRACTICAL I
Inorganic Qualitative Analysis
I & II Semesters (3 hours per week)

Analysis of a mixture containing two cations and two anions of which one will be an interfering ion. Semimicro methods using the conventional scheme with hydrogen sulphide may be adapted.

CATIONS TO BE STUDIED : Lead, Copper, Bismuth, Cadmium, Iron, Aluminum, Zinc, Manganese, Cobalt, Nickel, Barium, Calcium, Strontium, Magnesium and Ammonium.
ANION TO BE STUDIED : Carbonate, Sulphate, Nitrate, Chloride, Bromide, Fluoride, Borate, Oxalate, and Phosphate.

CORE V - CHEMISTRY PAPER IV
(INORGANIC AND ORGANIC CHEMISTRY)

Teaching hours: 45 hours per semester (3 hours per week)

Subject description:
This paper presents the principle in the extraction of metals and mechanism of some important organic reactions.

Goals:
To enable the students to learn about the extraction principles and mechanism of some addition reaction.
Objectives:
To understand the mechanism and synthetic uses of important organic reactions.

Contents:

Unit I:
Occurrence, extraction, properties and uses of Gallium, Thallium, Germanium, Titanium and Tin - their important compounds such as GeCl₄, GeO₂, TiO₂, TiCl₄, and SnCl₂.

Unit II:
Occurrence, extraction, properties and uses of Zirconium, Vanadium, Molybdenum and Tungsten - their important compounds such as V₂O₅, ZrOCl₂, ammonium molybdate, molybdenum blue, WO₂, and tungsten bronzes.

Unit III:
Chemistry of Carbonyl Compounds – I:
Reaction mechanisms: Nucleophilic addition of Grignard reagent, NH₃, primary amine-Aldol condensation, Cannizzaro reaction, Perkin reaction, Knoevenagel reaction and Claisen-Schmidt reaction.

Unit IV:
Chemistry of Carbonyl Compounds – II
Reaction mechanisms – Reformatsky reaction, benzoin condensation, Wittig reaction, haloform reaction – Reaction with LiAlH₄ and NaBH₄ – Clemmensen reduction, Wolff Kishner reduction, MPV reduction – reducing properties of Carbonyl compounds.

Unit V:
Malonic ester, acetoacetic ester and cyanoacetic ester-their preparation and synthetic applications Tautomerism of acetoacetic ester.

Geometrical isomerism – Cis & Trans, E & Z notations – Geometrical isomerism in maleic acid and fumaric acid - physical and chemical properties of geometrical isomers.

CORE VI - CHEMISTRY PAPER V

NANOTECHNOLOGY PAPER – I

INTRODUCTION TO NANO SCIENCE AND NANO TECHNOLOGY.

UNIT I: INTRODUCTION
Definition-origin of nanotechnology-difference between bulk and nanomaterials-size dependent properties (magnetic, electronic, transport and optical)
UNIT II: CLASSIFICATION OF NANOMATERIALS
Classification based on dimensional property - zero D, 1D, 2D and 3D nanostructures.

UNIT III: TYPES OF NANOMATERIALS
Metal oxides and metal nano particles-ceramic nano particles- semi conducting quantum dots-
coveshell quantum dots-nanocomposites - micellar nanoparticles

UNIT IV: CARBON BASED NANOMATERIALS
Fullerenes- Carbon nanotubes-single walled and multiwalled nano tubes- structures-carbon nanofibre

UNIT V: METALLIC AND OXIDE BASED NANOMATERIALS

CORE VII - CHEMISTRY PAPER VI
Teaching hours : 60 Hours per semester (4 hours per week)

Subject description
This paper presents the chemistry of phenols, amines and phase rule.

Goals
To enable the students to learn about the reactions of phenol and amines.

Objectives
To study the reaction of phenol and amines and applications of phase rule.

Contents
UNIT I:
General methods of Extraction: Concentration – Gravity separation, Froth Floatations magnetic separation, Extraction – Chemical and Electrolytic methods of refining, Zone refining, Van Arkel refining and Electrolytic refining.

UNIT II:
UNIT III:
Amine: Amines preparation & reaction– primary secondary and tertiary amines – their separation, comparison of their basicity – ring substitution, diazotization and coupling reaction of aromatic amines.
Diazomethane and diazoacetic ester – preparation, structure and their synthetic applications.

UNIT IV:

UNIT V:
Solutions: ideal and non ideal – Raoult’s law, Henry’s law – Nernst distribution law and its applications.
Colligative properties- relative lowering of vapour pressure, elevation of boiling point depression of freezing point and osmotic pressure- their applications.

CORE VIII - CHEMISTRY PRACTICAL II
Volumetric and Organic Analysis
III & IV SEMESTERS

I. EXPERIMENTS IN VOLUMETRIC ANALYSIS:
A. Acidimetry & Alkalimetry: Estimation of Na$_2$CO$_3$
B. Permanganometry:
  1. Estimation of Ferrous sulphate & Oxalic acid
  2. Determination of Iron in Ferric Alum.
  3. Estimation of Calcium-Direct method.
C. Dichrometry: Estimation of Ferrous iron using internal indicator.
D. Iodimetry:
  1. Estimation of k$_2$ Cr$_2$O$_7$
  2. Estimation of Copper.
  3. Estimation of As$_2$O$_3$
E. Argentometry: (Demonstration experiments)
  Estimation of chloride- Fajan’s and Volhards method.

II. ORGANIC ANALYSIS
Systematic analysis of an organic compound Preliminary tests, detection of elements present, Aromatic or Aliphatic, Saturated or unsaturated, nature of the functional group,
confirmatory tests and preparation of derivatives - Aldehydes, Ketones, Amines, Amides, Diamide, Carbohydrates, Phenols, Acids, Esters & Nitro compounds.

CORE IX - CHEMISTRY PAPER VII
(INORGANIC CHEMISTRY)

Teaching hours : 60 hours per semester (4 hours per week)

Subject description
This paper presents the principle of radio activity, acids and bases and solvents.

Goals
To enable the students to know about the radio activity, acid and bases, the role of solvent in chemical reactions.

Objectives
To understand the principles of radio activity.

Contents
UNIT I:
Principle of Gravimetric analysis – Precipitation methods – conditions of precipitation – factors influencing the precipitation and solubility – Co precipitation and Post precipitation, digestion, washing and drying and ignition of the precipitate.

UNIT II:

UNIT III:

UNIT IV:

UNIT V:
CORE X - CHEMISTRY PAPER VIII  
(ORGANIC CHEMISTRY)

Teaching hours : 60 hours per square (4 hours per week)

Subject description
This paper presents the chemistry of carbohydrate, molecular rearrangements, amino acids and hetero cyclic compound.

Goals
To enable the students to learn about carbohydrates, amino acids and hetero cyclic compounds.

Objectives
To understand the importance of carbohydrate, amino acids in chemistry.

Contents
UNIT I :

UNIT II :

UNIT III :
Carbohydrates: Chemistry and structure of Glucose, Fructose, Sucrose and Maltose (cyclic structure as well;). Starch andCellulose. An elementary account. (Elucidation of structure not necessary)
Inter conversion of sugars-mutarotaion – Epemerisation.

UNIT IV :
Aminoacids and proteins
Amino acids-Classification –Preparation and properties peptides and poly peptides-proteins classification based on physical properties and biological functions-primary secondary and tertiary structure – properties and uses.

UNIT V :
Heterocyclic compounds
Chemistry of Furan, Pyrrole, Thiophene, Quinoline, IsoQuinoline, Benzofuran, Indole, Isatin and Indigo.
CORE XI - CHEMISTRY PAPER IX
(ELECTRO CHEMISTRY)

Teaching hours : 60 hours per semester (4 hours per week)

Subject description

This paper presents the principles of conduction Electro Motive Force, fuel cells.

Goals

To enable the students to know about electro chemistry.

Objectives

To study EMF, pH and their applications.

Contents

UNIT I :

UNIT II :

UNIT III :
Electrochemical cells. Electrode potentials-The standard hydrogen electrode kinds of electrodes and their potentials-Nernst equation. EMF-computation and measurement of cell EMF single electrode potential-Determination and significance of electrode potentials-electro chemical series-temperature dependence of the cell EMF-Thermodynamic quantities of cell reactions.

UNIT IV :

UNIT V :
CORE XII - NANOTECHNOLOGY PAPER - II
PREPARATION, CHARACTERISATION AND APPLICATIONS OF NANOMATERIALS

UNIT I: PREPARATION OF NANOMATERIALS - I
Definition-bottom-up and top-down approaches- Thin film deposition - catalytic assisted growth - chemical vapor deposition - physical vapor deposition- sol gel method.

UNIT II: PREPARATION OF NANOMATERIALS - II
Chemical reduction - photochemical reduction - biochemical reductions - nano-lithography - ball-milling - template assisted synthesis-stabilization of nanomaterials.

UNIT III: CHARACTERISATION TECHNIQUES – I
Basic principles of scanning Electron Microscopy (SEM) , AFM, STM, SPM and TEM.(Instrumentation not needed).

UNIT IV: CHARACTERISATION TECHNIQUES -II
Paricle size analyzer - XPS - XRD - photoluminescence.(Instrumentation not needed)

UNIT V: APPLICATIONS
Applications of nanoscience and nanotechnology in molecular and nanoelectronics (MEMS and NEMS) - catalysis- drug delivery.

REFERENCES:
3. The chemistry of nanomaterials. Synthesis, properties and applications. CNR Rao, A Muller and AK Cheetham Wiley-VCH Verlag GmbH & co KgaA
10. www.eng.vcedu/Ngbeaucag/callses/XRD/Neutron_diffraction_at_LNL.pdf

CORE XIII - CHEMISTRY PAPER X
(SPECTROSCOPY AND NATURAL PRODUCTS)

Teaching hours : 75 Hours per semester (5 hours per week)

Subject description
This paper represents the principles of spectroscopy and The chemistry of natural products.

Goals
To enable the students to know about terpenoids, vitamins, alkaloids and harmones.

Objectives
To study the spectroscopy and natural products

Contents

UNIT I :
Spectroscopy absorption spectra – fundamental concepts electromagnetic Spectrum-the various regions of the spectrum and the relative energies of the radiation in each region-type of changes induced by the interaction of radiation with matter. Theory of rotations spectra-Molecular rotation-diatomic molecule as rigid rotor-diatomic molecule as non-rigid rotor-intensities of spectral lines. Applications of rotation spectra bond length-isotopic substitution.

Theories of IR spectra-simple harmonic oscillator model-An harmonic oscillator model of diatomic molecules information on molecular constitution from IR spectra; Application of IR spectra.

NMR SPECTRA- Basic principles – chemical shift-NMR spectra of simple molecules (high resolution details not expected)
UNIT II:
Theory of Raman spectra-comparison of IR and Raman spectra Theory of UV and visible spectra-Frank Condon principle-Pre dissociation-determination of dissociation energies – Applications of UV spectra to simple molecules.

UNIT III:
Terpenoids; Introduction-Classification-General methods of isolation-isoprene rule-structural elucidation and synthesis of gernaiol, terpineol, dipentene and alpha pinene.
Vitamins-introduction-importance of vitamins-structural elucidation and synthesis of Retionl, Thiamine, Riboflavin, Ascorbic acid.

UNIT IV:
Harmones; Introduction-Structural elucidation and synthesis of adrenaline and thyroxine.

UNIT V:
Chemotheraphy; Introduction-Classification of drugs-applications of sulpha drugs, anti malerials Ambecidal, Antiseptics, Antiseptics, Analgesics and Antibiotics (Pencilin, Streptomycin, Chloromycetin, tetracycline-structure and uses only).

CORE XIV - CHEMISTRY PAPER XI
(PHYSICAL PROPERTIES AND CHEMICAL KINETICS)

Teaching hours : 75 Hours per semesters (5 hours per week)
Subject description
This paper presents magnetic properties of molecules and kinetics of chemical reaction.

Goals
To enable the students to learn about the kinetic of reaction.

Objectives
To study the magnetic properties of molecules, chemical kinetics and photo chemistry.

Contents
UNIT I:
Electrical properties of molecules: Molar polarization, Orientation polatization and Distortion polarization polar and non polar molecules. Determinationof dipolemoments of polar gases, liquids and solids-Applications of dipole moment in the study of simple molecules.
UNIT II:
Magnetic properties of molecules; Meaning of the terms magnetic susceptibility, magnetic moment, diamagnetism, paramagnetism and ferromagnetism. Determination of magnetic susceptibility by Gouy’s method. Application of magnetic properties in solving structural problems involving simple and complex ions.

UNIT III:

UNIT IV:
Experimental techniques involved in the following kinetics of reaction. Volumetry, manometry, polarimetry and colorimetry, typical examples for each of the techniques.

UNIT V:
Thermal chain reaction H2/Br2 reaction.

TEXT BOOKS AND REFERENCES
Inorganic Chemistry
2. Inorganic chemistry, P.L.Soni, Sultan Chand & Sons
5. A text book of inorganic chemistry, A.K.De, Wiley
6. Concise inorganic chemistry, J.D.Lee.
7. Inorganic chemistry, Shriver and Atkins

Organic chemistry
4. Steroisomerism of carbon compounds, RaviBhusanm, CBS Publishers
5. Stereochernistry. Conformation and mechanisms, Kalsi, Wiley- Eastern Ltd.,
7. Organic chemistry, Vol 1 and 2,I.L. Finar, Addison-Wesly Longman

**Physical Chemistry**
1. Essentials of Physical Chemistry, B.S.bahl and G.D. Tuli,S. Chand & Co.,
2. Text book of physical Chemistry, P.L.Soni, Dharmarke; Sultan Chand & Sons
5. Physical Chemistry, R.a.alberty, John-Wiley & Sons
6. Elements of physical Chemistry, s.Glasstone and D.Lewis, McMillan
7. Physical chemistry, G.W.Castelan, Narosa publishers
9. physical Chemistry – Barrow Tata McGraw H.U. editor

**Computer Application**
5. Unique features of Basic, Pascal and Raman K.V. Chemistry Education june 1996
7. V. Balsgurusamy basic programming TMH Company New Delhi (1980)
8. Ramkumar Programming in Fortran tmh company (1985)
9. Computer and their applications to chemistry- Ramesh kumari –Narosa Publishing house

CORE XV - CHEMISTRY PRACTICAL III
GRAVIMETRIC ANALYSIS AND CHEMISTRY PHYSICAL
V & VI TH SEMESTERS

I. GRAVIMETRIC ANALYSIS :

1. Estimation of Sulphate as Barium Sulphate.
2. Estimation of Barium as Barium Chromate.
3. Estimation of Lead as Lead Chromate.
4. Estimation of Calcium as Calcium Oxalate.
5. Estimation of Nickel as Nickel Dimethylglyoxime.

II. PHYSICAL CHEMISTRY EXPERIMENTS :

1. Determination of partition coefficient of Iodine between Benzene and Water.
2. Determination of rate constant of acid-catalysed hydrolysis of an ester (Methyl acetate or Ethyl acetate).
5. Determination of concentration of an electrolyte (Nacl/Kcl/succinic acid).
6. Phase Diagram – Simple Eutectic system.
7. Determination of cell constant, specific conductivity and equivalent conductivity of strong electrolyte.
8. Determination of dissociation constant of a weak acid (acetic acid).
10. Potentiometric titrations, Acid-base HCl Vs NaOH.
CORE XVI - PRACTICAL FOR ELECTIVE SUBJECTS
V AND VI SEMESTERS (3 hours per week)

1. Determination of Melting point/Boiling point of an organic substance.
2. Preparation of inorganic complexes.
   (a) Tetramine copper (II) sulphate   (b) Potassium Trioxalato chromate (III)
   (c) Prussian Blue               (d) Hexamine Cobalt (II) chloride
   (e) Potassium Trioxalato Ferrate(III) (f) Sodium Cuprous Thiosulphate.
3. Preparation involving Acetylation, Hydrolysis, Oxidation, Halogenation, Nitration and Benzoylation.
4. Estimation of Hardness of Water using EDTA.
5. Calorimetric experiments involving Nessler’s tubes.
   (a) Estimation of Fe+++ with Ammonium thiocyanate.
   (b) Estimation of Ni as Nickel Dimethyl glyoxime.
   (c) Estimation of Mn++ in Potassium permanganate
6. Paper Chromatography-Chromatographic separation of components present in commercial inks (i.e. Green ink, Red ink, Black ink etc) and in flowers like Rose, Hybiscus etc.

DIPLOMA IN TEXTILE CHEMISTRY PAPER – I
(CHEMISTRY OF NATURAL AND SYNTHETIC FIBERS)
Teaching Hours : 30 Hrs. Per Semester (2 Hrs per week)

UNIT: I

UNIT: II
Viscose Fibre: Chemical structure , chemistry of regenarated cellulose. Production of Viscose Fibre : a simple flow chart, wet spinning of viscose filaments. Properties and uses of Viscose Fibre.

UNIT: III

UNIT: IV
Nylon Fibres: Synthesis of caprolactum from aniline, adipic acid from cyclohexane and hexamethylenediamine from adiponitrile. Polycondensation reactions leading to the formation of Nylon 6 and Nylon 6,6. Properties and uses of Nylon fibers. Structure and uses of Kevlar fibers.
UNIT V
Polyester Fibers: Synthesis of Dimethyl Terephthalate (DMT) from p - xylene, terephthalic acid from benzoic acid (Henkel-II process) and synthesis of ethylene glycol. Chemical reactions of Polyethylene Terephthalate (PET) preparation. Properties and uses of Polyester fibers.

Reference:

DIPLOMA IN TEXTILE CHEMISTRY
PAPER - II
(Technology, Processing and Dyeing)

Teaching Hours: 30 Hours per semester (2 Hrs. per week)

UNIT: I
Classification of Yarns: Definition of yarn, classification of yarns - staple yarns, continuous filament yarns and stretch yarns. Definition of twisting of yarns, direction of twist. Mechanical properties of yarns - yarn strength - single thread test.

UNIT: II
Production of fibers: Melt spinning - definition, simple flow chart, explanation and type of polymers processed. Wet spinning - definition, simple flow chart, explanation and type of polymers processed. Dry spinning - definition, simple flow chart, explanation and type of polymers processed.

UNIT: III
Functions of spin finish, desirable properties of spin finish. Major components of spin finish - lubricant antistatic agent and emulsifier - one example each with structure. Application of spin finish - dipping roller method.

UNIT: IV
Dyeing of textile fibers: Definition of dyeing, Attachment of dye molecules to the fiber - Ionic forces hydrogen bonds, van der waals' forces and covalent linkages. Important aspects of dyeing of polyester, nylon and acrylic fibers.
UNIT: V
Carrier Dyeing of polyester fibers - characteristics of a carrier, commonly used carriers, advantages of carrier dyeing. Acid dyeing of nylon fibers - definition, two examples and use of leveling agents, examples of anionic, cationic and non-ionic leveling agents. Cationic Dyeing of acrylic fibers - definition, two examples, use of retarders in cationic dyeing.

References:

DIPLOMA IN TEXTILE CHEMISTRY PAPER – III
(WATER & EFFLUENT TREATMENT AND POLLUTION CONTROL)

Teaching hours : 30 Hours per semester (2 hours per week)

UNIT I:

UNIT II:
WHO, ISO standards for raw water criteria – A general study on raw water pollution and consequence of River water pollution – Effluent discharge standards for inland surface water public sewers, on land for irrigation, marine coastal areas and drinking water parameters – A general study on Boiler water requirements which includes problem caused by water and effect and feed water requirements for low and medium pressure boilers and at a pressure of 450 – 500 psi. Water softening – study includes Cation Exchange softening, lime soda softening, softening by Sequestering agents and De-mineralization with schematic diagram of removal of carbon dioxide and silica.

UNIT III:
Removal of colour and turbidity (simple Coagulation, Flocculation and Filtration methods). General study on removal of Iron and Manganese by Aeration, setting and filtration method- Water analysis – colour, pH value, dissolved solids, suspended solids, total hardness (Calcium + Magnesium). EDTA Titrimetric method, total iron- thiocyanate method, Determination of Alkalinity by Titrimetric method – thiocyanate method, Determination of
Alkalinity by Titrimetric method- Determination of chlorides by silver nitrate method- Determination of dissolved oxygen by iodimetry – Determination of BOD,COD TDS and Toxicity.

UNIT IV:

UNIT V:

Reference
2. Industrial safety & Pollution control Hand Book by National safety council and Associate Data Publisher Pvt Ltd.
5. I.S.O Hand Book.
6. Tamilnadu state publications and Hand book of pollution control – Central Board of pollution control.

DIPLOMA IN TEXTILE CHEMISTRY PAPER – IV
TEXTILE CHEMISTRY – PRACTICAL

Lab- hours : 30 Hours per semester (2 hours per week)

LIST OF EXPERIMENTS
1. Identification of textile fibres by burning test
2. Identification of textile fibres by solubility test
3. Estimation of pH- paper, digital pH meter, pH solution
4. Volumetric analysis of Sodium bi Sulphite
5. Volumetric analysis of Sodium Nitrite
6. Volumetric analysis of Sodium Hydro Sulphite
7. Volumetric analysis of Hydrogen Peroxide (permanganametry)
8. Volumetric analysis of Sodium Hypochlorite.

PREPARATION OF DYES
1. Methyl Red
2. Malachite Green
3. Methyl Orange
4. Pare nitro benzene azo beta napthol
5. Azo Amino Benzene.

ELECTIVE II - A
ANALYTICAL CHEMISTRY I : BASIC PRINCIPLES

UNIT I :
Basic principles and applications of Analytical techniques : Such as Precipitation, filtration, sample drying, transfer of precipitates. Distillation, vacuum distillation fractional distillation and steam distillation. Sublimation, crystallization, fractional crystallization M.P., B.P., and Refractive Indices.

UNIT II :
Evaluation of Analytical date : Accuracy and precision, methods for their expression, classification of errors, detection and correction of determination and intermediate errors. The normal law of Distribution of Intermediate errors.

UNIT III :
Statistical texts and date : The F test and the T test, rejection of data the method of least squares, propagation of errors in computation, significant figures.

UNIT IV :
Theory of Quantitative Analysis ; Applications of Chemical equilibrium to analytical separations and estimations : The equilibrium constants, activity co-efficients. Acid-Base equilibria, solubility equilibria, distribution equilibria, Complex ion equilibria and stability constant Separations and estimations : illustrated with examples.

UNIT V :
Gravimetric methods : Theory of indicators, Theory of precipitation, Co-precipitation, Post-precipitation, theory of purifying the precipitates, Acid-Base, redox, Complexometric and precipitation Titrations, Volumetric analysis.
BOOKS FOR REFERENCE:

1. Quantitative Chemical Analysis, A.I. Vogel.
2. Instrumental Methods of Analysis, Skoog.
3. Instrumental Methods of Analysis, Willard, Dean, Merrit and Settle, CBS.

ELECTIVE I - B
POLYMER CHEMISTRY

UNIT I:
Classification of polymers-natural polymers and synthetic polymers. Synthetic polymers-Addition polymers, condensation polymers-Mechanism of polymerization, step reaction polymerization, chain reaction polymerization, -ionic, radical and coordination polymerization-one example each.

UNIT II:
Molecular weight of polymers-Number average and weight average molecule weight methods.
1. Osmometry (membrane)
2. Cryoscopy & ebullioscopy
3. Osmometry (Vapour pressure)
4. Viscometry
5. End Group Analysis-number average
Weight average Mw (i) Light scattering (ii) Ultra centrifugation Molecular weight distribution.

UNIT III:
Primary and secondary bond forces in polymers-coherence energy-structure property relationship
(i) Mechanical properties (ii) Thermal stability-glass transition temperature
(iii) Flame resistance (iv) Chemical resistance
(v) Degradability (vi) Electrical Conductivity

UNIT IV:
Important industrial polymers, preparation and applications
(i) Polyethylene, polypropylene (ii) Polyamides
(iii) Polyvinyl chloride, polymethylmethacrylate
(iv) Polysters, polycarbonates (v) Polyurethaines
(vi) Phenol-formaldehyde, melamine-formaldehyde
(vii) Polysilanes, polysiloxanes (viii) Polyaniline

UNIT V:
Rubber, Cellulose, starch, wool, silk, collagen, coal, nucleic acids, general structure-importance-applications.
Reference

1. Polymer chemistry an introduction-M.P.Stevens, Oxford-1990

ELECTIVE I - C
AGRO INDUSTRIAL CHEMISTRY

UNIT I:
Water source for agriculture- Water Treatment & Water Analysis

UNIT II:
Chemistry of soil-soil classification and soil analysis

UNIT III:
Fertilizers
1. Effect of N,P,K, secondary nutrients and micro nutrients on plant growth and development.
2. Importance of nitrogenous fertilizers. Nitrogen cycle and fixation of atmospheric nitrogen. Principle and manufacture of ammonium nitrate, ammonium sulphate, and urea
Pesticides
Classification-Insecticides, fungicides and herbicides, general methods of preparation, application and toxicity. Insect attractants and repellants-fluorine compounds, boron compounds, arsenic compounds, organomercuric compounds, DDT, BHC, 2,4 –D compounds, pyridine compounds.

UNIT IV :
Chemistry of sugar and fermentation
1. Details of manufacture of sucrose from cane sugar-extraction of juice, purification, concentration, crystallization, separation and refining of crystals, recovery of sucrose from molasses. Manufacture of sucrose from beetroot. Estimation of sucrose and inversion sugar by polarimetry.
2. Manufacture of alcohol from molasses and starch by fermentation process.

UNIT V :
OILS, fats and Waxes

References
1. Nature and properties of soils-Harry, O Buckman N Yle C. Brandy
2. Soils Scence-A.Sankara
3. Insecticides, Pesticides and Agro based Industries – R.C.Palful, K.Goel, R.K.Gupta
5. Industrial Chemistry-B.N Chakrabarty

ELECTIVE I - D
PHARMACEUTICAL CHEMISTRY

UNIT I :
1. Important terminologies used in pharmaceutical chemistry-Definition of the following terms-drug, pharmacology, pharmacognosy, pharmacy, therapeutics, toxicology, chemotherapy, pharmacopoeia (BP, IP, USP), National formulary, pharmaceutophore, bacteria, virus, vaccines, toxoids, primary immunization, additive effect, synergism, antagonism, plaubo, LD$_{50}$, ed$_{50}$ and therapeutic index
2. Routes of drug administration-local, enema, oral or external, parental-advantages and disadvantages oral and parental routes-inhalation, intradermal, subcutaneous, intramuscular, intravenous-intrathecal-intraarticular-transcutaneous-transmuscusal.
3. Clinical chemistry-A Diagnostic test and one method of estimation bilirubin and cholesterol in serum or plasma or urine. Biuret test for urea.
4. First aid to prevent bleeding and maintain breathing
6. Causes, symptoms and treatment of anemia, diabetes, tuberculosis, asthma, jaundice, piles, leprosy, typhoid, malaria, cholera and filarial.
7. Indian medicinal plants and their importance. Spices and their medicinal uses.

UNIT II:

1. Alkaloids- definition-general methods of isolation-colour tests for identification-source, isolation, structure and use of atropine-source, extraction, structure, SAR and uses of morphine and quinine.

UNIT III:

1. Antiseptics and disinfectants: Definition and distinction- phenol coefficient-examples-phenolic compounds, dyes, cationic surfaces and chloro compounds. Tranquilizers-definition and examples. Psychodelic drugs LSD and marijuana.
4. Definition of cancer and antineoplastic drugs-examples antimetabolite, natural substances hormones, alkylating agents, inorganic complexes and other compounds-definition of hypoglycemic drugs-types and cause for diabetics-examples (Sulphonyl ureas and biguanides)

UNIT IV:

1. Medicinally important compounds of Al₆P₂As, Hg and Fe. Uses of the following MgSO₄ 7H₂O, milk of magnesia, magnesium trisilicate-Aluminium hydroxide gel, dihydroxy aluminium amino acetate, Aluminium acetate and aluminium
monostearate-paroxon-phosphorine, cyclophosphosphomide-tricyclophospho-
preparation and uses of thiotepa-sodium and copper cacodylates-preparation and
uses of aromatic aresericals (carbosone, tripilasmode, acetarsionide, neosarsphenamine, oxophenarsince)- HGCl₂, Hgl₂ and Hg(CN)₂ as disinfestations-importance of organic mercury compounds-structure and uses of thiomersal, netromersal merbromine and mersalyl acid-Ferous gluconate, FeSO₄,
scale preparation (ferric ammonium acetate), ferrous fumarate, ferrous succinate
and ferrous chlorinate.
2. Organic pharmaceutical aids-Definition-agents for kidny function
(aminohippuric acid)-liver function (sulphobrophthalein sodium, rose Bengal)-
corneal ulcer detection (Fluorescein sodium)-Blood volume determination (Evans
Blue) pituitary function (metryrapone)-ointment bases-preservatives-antioxidants-
sequeshants, colouring, sweetening, flavouring, emulsifying and stabilizing
agents.

UNIT V :
1. Blood-composition-grouping-Rh factor-buffers in blood-Functions of plasma
proteins-clotting mechanism-blood pressure.
2. Coagulants and anticoagulants-definitions and examples.
3. Antianemic drugs (iron, vitamin B₁₂, folic acid).
4. Cardiovascular drugs : definition and names of to drugs for each of the following-
carduitibue agents-antiarrythmic drugs-antihypertensive drugs-antianginal agents-
vasodilators-lipid lowering agents-sclerosing agents.

Text and References
2. Pharmacolgy and pharmatherapeutics, Vol.1 & 2, R.S. Satoskar and S.D.
traveler book sellers, Delhi.

ELECTIVE I - E
FORENSIC SCIENCE AND CRIME INVESTIGATION

UNIT I :
Criminology-Definition-nature and scope-types of crimes-penology-Indian penal code-
Indian Evidence Act-Indian Criminal Procedure Code.

UNIT II :
1. Forensic Science-Definition, principles and uses in crime investigation.
2. Fingerprints-Patters-classification-Uses of finger prints in crime investigation
direct and latent prints-development by powders-chemistry of powders-other
methods of development transfer methods for finger prints.

UNIT III:
1. Arson-Natural fires and arson-Nature of action of fire-drifts and air supply-burning characteristics and chemistry of combustible material-Nature of combustion.
2. Explosives-Definition-Classification-Composition and mechanism of explosion-bombs.
3. Balistics-Classification-Internal external and terminal balistics and overall view. Small arms-Classification and characteristics. Laboratory examination of the barrel washing and detection of powder residues by chemical tests.

UNIT IV:

UNIT V:
Poisons-Types and classification-Diagnosis of poisoning in the living and in the dead-clinical symptoms-post-mortem appearances-treatment in cases of poisoning-use of antidotes.

Reference
Forensic Science –T.H.James-Stanley Thornes ltd.1987

ELECTIVE I - F
DAIRY CHEMISTRY

UNIT I:
Milk: Definition-General composition of milk-physical properties of milk-colour, odour, acidity-natural and developed, specific gravity-Recknagel effect viscosity and conductivity, factors affecting the gross competition of milk, physico-Chemical change taking place in milk due to processing parameters-boiling pasteurization-sterilization and homogenization. Adulterants, preservatives and neutralizers-example and their detection. Estimation of fat, specific gravity, acidity and total solids in milk.

UNIT II:
1. Milk lipids-terminology and definitions classification – saponifiable (triglycerides) and unsaponifiable matters (sterols and cholesterol) phospholipids-
structure and properties (Lecithin and Cephalin) Milk fat constants-refractive index-saponification number, Iodine number, R.M.number, R.M number and polenske number.


5. Ash and mineral matters in milk.

UNIT III:


2. Butter : Definition-% composition-manufacture-Estimation of fat, acidity, salt and moisture content-Desi butter.


UNIT IV:


3. Ice cream : Definition-percentage composition-types-ingredients needed-manufacture of ice-cream stabilizers-emulsifiers and their role.

UNIT V:


Reference Books

1. Outlines of Diary Technology-Sukumar De

ELECTIVE II - A
ANALYTICAL CHEMISTRY II-LAB TECHNIQUES

UNIT I:
Chromatography: Classification of the chromatographic methods, principles of differential migration, Adsorption phenomenon, nature of the adsorbent, solvent systems. Rf. values column Chromatography. Partition chromatography, paper chromatography, TLC, Electrophores-theory and techniques.

UNIT II:
Spectroscopy: theory, Instrumentation and application of
(i) UV and visible spectrophotometry (ii) IR spectrophotometry
(iii) Flame Photometry (iv) NMR spectroscopy

UNIT III:
Polarimetry: Theory Instrumentation, experimental procedure and application.

UNIT IV:
Electro chemical methods of Analysis, polarography, cyclic voltametry, differential pulse polarography, calorimetry: Theory, techniques and applications.

UNIT V:
Preparation and purification of organic and inorganic compounds like;
(i) Aspirin from salicylic acid (ii) Acetanilide from aniline
(iii) Benzanilide from aniline (iv) iodoform from ethanol and acetone
(v) Meta di nitro benzene (vi) Methyl orange/methyl red (vii) preparation of Nylon 666
(viii) Caffeine from tea leaves (ix) Caesin and lactose from milk
(x) Nicotine and Nicotine sulphate from tobacco waste (xi) Bakelite from phenol and formaldehyde
(xii) As₂ O₃ Sol, Fe (OH)₃ Sol (xiii) Tetramine-copper sulphate
(xiv) Tetramine Cobalt carbonate (xv) Sodium thiosulphate and dithionate
(xvi) Cuprous chloride

Books for Reference
1. Physical methods of chemistry-R.S.Drago
2. Spectroscopy in Inorganic chemistry-C.N.R Rao and JR Ferraro
3. Analytical Chemistry-R.V.Dills
4. Fundamentals of Analytical Chemistry-D.A.Skoag and D.M.West
5. Instrumental methods of Chemical Analysis-Ewing
ELECTIVE II - B
CHEMISTRY OF PLANT BASED PRODUCTS
(STARCH, CELLULOSE, PROTEINS)

UNIT I:
Chemistry of starch: Structure, physical and chemical properties. Manufacture and uses of unmodified and modified starch, dextrin, sugar syrup, hydrolysis of starch to edible and industrial glucose applications of starch in textile sizing and in fermentation industries.

UNIT II:
Chemistry of cellulose: Structure, physical and chemical properties general reactions, major sources and uses of cellulose, chemical and enzymatic hydrolysis of cellulose. Statistics and economics and cellulose. Chemistry of minor products of wood like lignin, pentosans, resins etc, laboratory preparation, manufacture and uses of chemical cellulose.

UNIT III:

UNIT IV:
Cellulose derivatives like cellulose nitrate, cellulose acetate, ethyl and methyl cellulose, sodium cellulose sulphate, sodium, carboxy, hydroxyl, methyl, cellulose, regenerated cellulose, major cellulose-platics-sodium carboxy methyl cellulose.

UNIT V:
Different methods of pulping, manufacture and uses of different quality of paper products like card-board, newsprint, writing paper, tissue paper and filter paper. A short discussion of the pollution problems and by-products utilization of industries based on starch cellulose and proteins.

Reference

ELECTIVE II - C
DYE CHEMISTRY

UNIT I:
Colour and constitution-Relationship of colour observed-to wave length of light absorbed-Terms used in colour chemistry-Chromophores, Auxochromes, Bathochromic shift, Hypsochromic shift. Colour of a substance-Quinonoid theory molecular orbital approach.
UNIT II:
Classification of Dyes-chemical classifications-classification according to their applications-Acid dyes-Basic dyes. Azoic dyes, mordant dyes, vat dyes, Sulphur dyes, Disperse dyes, Nitro dyes-and Nitroso dyes process of dyeing (simple treatment).
Azo dyes-Principles governing azo coupling-mechanism of diazotization-Coupling with amines, coupling with phenols Classification according to the number of azo group & application-Tautomerism in azo dyes.

UNIT III:

UNIT IV:
Azine, Oxazine and Triazine Dyes.Synthesis and applications of quinonoid dyes including vat dyes based on anthraquinone.

UNIT V:
Pigments-requirements of a pigment: Typical Organic and Inorganic pigments-application and their uses in paints. Reaction of dyes with fibres and water-Fluorescent Brightening agents. Application of dyes in other areas-medicine, chemical analysis, cosmetics, colouring agents, food and beverages.

Reference

ELECTIVE III - A
LEATHER CHEMISTRY

UNIT I:
1. Hides, Skins,Leather-An elementary knowledge of the structure and composition of hides and skins. proteins and their characteristics, Anatomy and histology of protein constituents of leather (an elementary concept).
2. Basic principle involved in pre-tanning such as soaking, liming, deliming, bating, pickling involved in pre-tanning such as soaking, liming, deliming, bating, pickling and depickling.

UNIT II:
1. Types of tanning-vegetable and mineral tanning. Different types of vegetable tanning-materials classification and chemistry of vegetable tanning. Factors and Physico-chemical principle involved in vegetable tanning, Fixation of vegetable tanning.
2. Synthetic tannings-their classifications, general methods of manufacture and use.

UNIT III:
1. The preparation and chemistry of chrome tanning liquids, Olation, Oxolation and hydrolysis of chrome liquids. Effect of adding tanning agents-Role of pH in the reaction of chromium complexes with hide proteins. Factors governing chrome tanning-chemistry of neutralization process. A brief survey of chemistry of other tanning like Al, Zr and Te salts and their relative merit in contrast with chrome tanning
2. Chemistry of combination of tannages involving vegetable tanning aldehydes, chrome and other mineral tanning agents.

UNIT IV:
1. Chemical methods of curing and preservation of hides and skins in acid and alkaline solution.
3. Process of dyeing leather-Use of mordants, dyeing auxillaries such as leveling, wetting and dispersing agents-Dye fixations.

UNIT V:
1. Animal bye-products-their collection, handing and preservation methods (such as hair, blood, bones, glands, Kerationus materials and their utilization).

Books for Reference
1. Chemical technology of Leather (ISI).
3. Tanning processes-Crthmann.
ELECTIVE III - B
ENVIRONMENTAL CHEMISTRY

UNIT I:
1. Concept and scope of environmental chemistry-Nomenclature: Pollutant, contaminant, receptor, sink, pathways of a pollutant, speciation, dissolved oxygen, chemical oxygen demand (COD), biochemical oxygen demand (BOD)-Environmental segments.
2. Composition of the atmosphere-atmospheric structure-earth’s radiation balance – particles, ions and radicals in the atmosphere-formation of inorganic particulate matter-formation of organic particulate matter-ions and radicals-photochemical reactions in the atmosphere-formation of \( \text{NO}_2, \text{SO}_2 \), organic compounds, greenhouse effect.

UNIT II:
Biological cycles & their significance-Gaseous and sedimentary cycles.
(a) Oxygen cycle and ozone chemistry (b) Carbon cycle
(c) Nitrogen cycle (d) Sulphur cycle
(e) Phosphours cycle

UNIT III:
2. Eutrophication-sewag treatment-primary and secondary treatments. Industrial waste water treatment by 1) activated charcoal/synthetic resins 2) membrane techniques.

UNIT IV:

UNIT V:
3. Radioactive pollution: Sources of radioactive pollution-environmental threat of nuclear reactors-breeder reactors-environmental conflicts between nuclear powers Methods of control and prevention.

Reference

ELECTIVE III - C
TEXTILE CHEMISTRY

UNIT I :
2. General classification of fibres-chemical structure, production, properties and uses of the following natural fibres (a)natural cellulosic 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 cellulosic fibres) (ii) Man made protein fibres (Azions) (iii) Poly amide fibres (different types of nyons) (iv) Poly ester fibres (v) Acrylic fibres and (vi) Olefin fibres.

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

UNIT IV :
Dyeing – Classification of dyes and their properties- applications – direct, basic, sulphur and azoic dyes on cotton. Application of Vat and solubilised vat dyes on cotton and viscose. Mordant mineral colours and black. Application of vegetable and other colour to cotton.

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

2. The Identification of Textile Fibres – Bruno Nuntak.
7. Scouring and Bleaching E.R. Trotman, Charles Griffin & Co Ltd.