### BHARATHIAR UNIVERSITY, COIMBATORE - 641 046

**B.Sc. CHEMISTRY - SCHEME OF EXAMINATIONS (CBCS PATTERN)**

(For the students admitted during the academic year 2010-2011 and onwards)

<table>
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<tr>
<th>Part</th>
<th>Study Components</th>
<th>Course Title</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 papers as electives)**

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<tr>
<th>Elective I</th>
<th>Elective II</th>
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<tr>
<td>(A) polymer chemistry</td>
<td>(A) Leather chemistry</td>
<td>(A) Analytical chemistry II Lab Techniques</td>
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<tr>
<td>(B) Agro industrial chemistry</td>
<td>(B) Chemistry of plant based products</td>
<td>(B) Environmental chemistry</td>
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<td>(C) Pharmaceutical chemistry</td>
<td>(C) Dye chemistry</td>
<td>(C) Textile chemistry</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

Structure and shape of molecules: VSEPR Theory and geometry of molecules. Hybridization and geometry of sp, sp<sup>2</sup>, sp<sup>3</sup>, dsp<sup>2</sup>, dsp<sup>3</sup>, d<sup>2</sup>sp<sup>3</sup>, sp<sup>3</sup>d<sup>2</sup> and sp<sup>3</sup>d<sup>3</sup>. Bonding, shapes and structures of the following molecules: Molecules with Sigma bonds only – BeCl<sub>2</sub>, SnCl<sub>2</sub>, BF<sub>3</sub>, CH<sub>4</sub>, SiF<sub>4</sub>, XeF<sub>4</sub>, PCl<sub>5</sub>, IF<sub>5</sub>, SF<sub>6</sub>, and IF<sub>7</sub>.

UNIT II

1. 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.

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

3. Cycloalkanes: Preparation by Dieckmann ring closure and by reduction of aromatic hydrocarbons – ring opening reactions of cyclopropane with H<sub>2</sub>, Br<sub>2</sub> and HI.

UNIT III


UNIT IV

Liquid crystals–the concept of mesomorphic state-typical liquid cryalline 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 V:

1. Failure of classical theory in explaining black body radiation- Planck’s theory of quantization of energy – Einstein theory of photoelectric effect–Compton effect. deBroglie theory of wave-particle dualism-Heisenberg’s uncertainty principle

2. Covalent bonds – Molecular orbital theory – application to molecules such as H<sub>2</sub>, H<sub>2</sub><sup>+</sup>, He<sub>2</sub>, O<sub>2</sub>, N<sub>2</sub>, F<sub>2</sub>, CO and NO.
CORE II - CHEMISTRY PAPER II

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 acids and bases, aromaticity, and thermodynamics

Objectives: To study the principles of acids and bases and thermodynamics.

Contents

Unit I:
- Acids and bases; Definitions- different approaches to protonic acid – base systems – strengths of Lewis Acids and Bases - Hard and Soft Acids and Bases. Applications of HSAB concept Basis of hardness and softness, limitations of HSAB concept.

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

Unit III:
- Structure of benzene-Aromaticity-Huckel’s rule. Electrophilic substitution in benzene with mechanism. Grignard reagents and synthetic applications-Nucleophilic substitution reaction – S_N1, S_N2 and S_Ni reactions – Elimination versus substitution-Benzyne mechanism and intermediate complex mechanism.

Unit IV:

Unit V:

TEXTBOOKS FOR REFERENCE:

CORE III - 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 adopted.

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 IV - CHEMISTRY PAPER III

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

UNIT II
Occurrence, extraction, properties and uses of Thallium, Germanium, Titanium and Tin - their important compounds such as GeCl₄, TiO₂, TiCl₄, and SnCl₂.

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 V - CHEMISTRY PAPER IV
Teaching hours: 45 hours per semester (3 hours per week)

Subject description
This paper presents the basic things of computer, C programming and its applications in chemistry. This paper also deals with second and third law of thermodynamics.

Goals
To enable the students to understand computer, its application in chemistry and laws of thermodynamics.

Objectives
To study the applications of computer programming in chemistry and importance of second and third law of thermodynamics.

Contents
UNIT I:
Introduction to second law of thermodynamics - Carnot cycle - entropy - Definition - entropy changes in isothermal transformation - Trouton’s rule. Entropy as function of T and V - Entropy as a function of T and P - Changes of entropy with T, Entropy changes in ideal gas - entropy of mixing of ideal gases.

UNIT II
General conditions of equilibrium and spontaneity - conditions of equilibrium and spontaneity under constants - definition of A and G-physical significance of - dA and dG. Temperature and pressure dependence of G - Gibbs - Helmholtz equation. Chemical equilibrium - The concept of chemical potential - chemical equilibrium in a mixture of ideal gases - van’t Hoff Isotherm and isochore - Third law of thermodynamics- statement and applications. Exception to third law.

UNIT III Introduction to computer:
Hardware components of a computer - Input unit, Output unit, Central processor, Data storage and Processing cycle.

UNIT IV C Language
Steps in program development-Programming Language-classification:Machine language, Assembly language and Third generation language.
Data types, Variables and Constants: The C Character set, Data Types, Constants, Variables and C Constants.
Rules for constructing Integer Constants, Real Constants, Character Constants, Logical Constants and String Constants.
C Variables, C Keywords. The First C Program.
Operators: Arithmetic, Increment, Decrement relational and Logical Operators.

UNIT V Some important C programs for Chemistry
Programs: To calculate the pH of solution and find that it is basic, acidic or neutral. Calculation of pH of a solution using Henderson equation. To compute the order of a reaction. To compute half-life period of a reaction. To compute the rate constant of a 1st order reaction. To compute the energy of activation of a reaction.

Ref:
Principles of physical chemistry,B.R.Puri,L.R.Sharma and M.S.Phathania, Shobanlal Nagin Chand&co
Physical chemistry G.W.Castelan,Narosa publishers
Computer for Chemists - By PUNDIR BANSAL - Pragati Prakasam Pubs
Introduction to the computers , Jeffrey Frates & William Moldrup.

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

Subject description
This paper presents the chemistry of few metals, 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 :
Occurrence, extraction, properties and uses of Zirconium, Vanadium, Molybdenum and Tungsten -their important compounds V₂O₅, ZrOCl₂, ammonium molybdate, molybdenum blue, WO₂, and tungsten bronzes.
UNIT II:

UNIT III:
Amines- Preparation and properties of aliphatic and aromatic 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:
Phase rule and phase equilibria – the equilibrium condition. Stability of phase of a pure substance. Pressure dependence of \( \mu \) and \( T \) curves. The Clapeyron and Clapeyron-Clausius equations. Derivation of Gibbs phase rule. Phase equilibria in one component system. Phase diagram for sulphur, water, carbondioxide system, phase diagram for two component system – construction of the phase diagram/Thermal analysis method Bi-Cd; Zn-Mg and Na-K system.

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

I. EXPERIMENTS IN VOLUMETRIC ANALYSIS:
A. Acidimetry & Alkalimetry: Estimation of \( \text{Na}_2\text{C}_0\text{3} \)  
B. Permanganametry:
   1. Estimation of Ferrous sulphate & Oxalic acid  
   2. Estimation of Calcium-Direct method.  
C. Dichrometry: Estimation of Ferrous iron using internal indicator.  
D. Iodimetry:
   1. Estimation of \( \text{K}_2\text{Cr}_2\text{O}_7 \)  
   2. Estimation of Copper.  
   3. Estimation of \( \text{As}_2\text{O}_3 \).

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.
Subject description

This paper presents the principle of radio activity, acids, 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:


UNIT II:


UNIT III:

Nature of isotopes and isobars—detection and isolation of isotopes—various methods—importance of discovery of isotopes—uses of isotopes in various fields. Nuclear stability n/p ratio, magic numbers, C-12 atomic weight scale, C-14 dating, mass defect and nuclear binding energies. Radio active disintegration series.

UNIT IV:

Co-ordination compounds—Nomenclature—conductivity and precipitation studies—Werner Co-ordination theory—electronic interpretation of coordinate bond by SidgeWick. Isomerism: Examples of Geometrical and optical isomerism in square planar and octahedral coordination compounds—magnetic properties of coordination compounds and their interpretation by Pauling’s valence bond theory and crystal field theory.

UNIT V:

CORE IX - CHEMISTRY PAPER VII
Teaching hour: 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:
Optical activity of compounds with asymmetric carbon-racemisation – resolution – asymmetric synthesis- configuration D,L and R.S. nomenclature. Optical activity due to restricted rotation (biphenyls, allenes and spiranes) and molecular over crowding.

UNIT II:
Mechanism of molecular rearrangement reactions: Pinacol Pinacolone, Beckmann, Hoffmann, Curtius, Benzilic acid, Schmidt, Lossen, Cope and Claisen rearrangements.

UNIT III:
Carbohydrates: Chemistry and structure of Glucose, Fructose, Sucrose and Maltose (cyclic structure as well). Starch and Cellulose - an elementary account. (Elucidation of structure not necessary)
Inter conversion of sugars-mutarotation – Epimerisation.

UNIT IV:
Aminoacids and proteins
Amino acids-Classification –Preparation and properties of 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, Pyridine, Quinoline, Isoquinoline, Indole and Indigo.
CORE X - CHEMISTRY PAPER VIII
Teaching hour : 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 XI - CHEMISTRY PAPER IX

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 and Refractive Indices.

UNIT II:
Evaluation of Analytical data: Accuracy and precision, methods for their expression, classification of errors, detection and correction of determinate and indeterminate errors. The normal law of Distribution of Indeterminate errors.

UNIT III:
Statistical texts and data: 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; Application of Chemical equilibrium to analytical separations and estimations: The equilibrium constants, activity coefficients. 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.
CORE XII - CHEMISTRY PAPER X
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 hormones.

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 rotational spectra-Molecular rotation-diatomic molecule as rigid rotor-diatomic molecule as non-rigid rotor-intensities of spectral lines. Applications of rotational spectra- bond length-isotopic substitution.
Theories of IR spectra-simple harmonic oscillator model-Anharmonic oscillator model of diatomic molecules- information on molecular constitution from IR spectra; Application of IR spectra.

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

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

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

UNIT V :
Chemotheraphy; Introduction-Classification of drugs-applications of sulpha drugs, anti malarials Amebecidal, Antiseptics, Analgesics and Antibiotics (Penicillin, Streptomycin, Chloromycetin, tetracycline-structure and uses only).
CORE XIII - CHEMISTRY PAPER XI

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 kinetics 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 polarization and Distortion polarization polar and non polar molecules. Determination of dipole moment 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 Guoy’s method. Application of magnetic properties in solving structural problems.

UNIT III:

UNIT IV:
Experimental techniques involved in following kinetics of reaction. Volumetry, manometry, polarimetry and colorimetry, typical examples for each of the techniques. Theoretical aspects. Effect of temperature on rate constant. The activation energy. The collision theory of reaction rates and its limitation. Lindemann theory of unimolecular reactions. The theory of Absolute reaction rates. Comparison of the collision theory with the Absolute reaction rate theory.

UNIT V:
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. Stereochemistry, 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 Dimethyl glyoximate.

II. PHYSICAL CHEMISTRY EXPERIMENTS :
1. Determination of partition coefficient of Iodine between carbon tetra chloride and Water.
2. Determination of rate constant of acid-catalysed hydrolysis of an ester (Methyl acetate or Ethyl acetate).
3. Determination of $K_f$/ molecular weight by Rast’s macro method-Naphthalene, Diphenyl and diphenylamine.
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).

CORE XVI - PRACTICAL FOR ELECTIVE SUBJECTS
V AND VI TH SEMESTERS (3hours per week)

1. Determination of Melting point/Boiling point of an organic substance.
2. Preparation of inorganic complexes.
   (a) Tetrammine copper (II) sulphate  (b) Potassium Trioxalato chromate (III)
   (c) Prussian Blue  (d) Hexammine Cobalt (II) chloride
   (e) Potassium Trioxalato Ferrate(III)  (f) Sodium Cuprous Thiosulphate.
3. Preparation involving, 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 glyoximate.
   (c) Estimation of Cu^{++} by $K_4Fe(CN)_6$.
SKILL BASED SUBJECT - TEXTILE CHEMISTRY PAPER – I
(Chemistry of Natural and Synthetic Fibers)
Teaching Hours: 30 Hrs. per Semester (2 Hrs per week)

UNIT: I

UNIT : II

UNIT :III

UNIT :IV
Nylon Fibres: Synthesis of caprolactum from aniline, adipic acid from cyclohexane and hexamethylene diamine 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 Poly Ethylene Terephthalate (PET). Preparation, properties and uses of Polyester fibers.

Reference:
5. A.A.Vidya,. ed.:Production of Synthetic Fibers, Prentice-Hall of India, 1988, New-Delhi..
SKILL BASED SUBJECT - TEXTILE CHEMISTRY PAPER – II
(TECHNOLOGY OF DYEING OF NATURAL FIBRES)
Teaching hours:30 Hours per semester (2 hours per week)

UNIT I:

UNIT II:

UNIT III:

UNIT IV:

UNIT V:

Reference
11. J.K. Aspland, Textile Dyeing and Colouration, AATCC Publications, USA.
15. Wilfred Ingamells, Colour for Textiles, SDC Publications, UK.

SKILL BASED SUBJECT - 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:

UNIT IV:

UNIT V:
Model schematic diagram for waste water treatment plant for textile mills-Primary & secondary units –Effects of air pollution –Effects of Sulphur oxide on human health – Ambient air quality standards- Noise pollution –ill effects of noise-Noise level in decibels. brief study on modern methods for pollution analysis like molecular luminescence, BOD incubator, ion exchange chromatography and HPLC.

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.
SKILL BASED SUBJECT - PAPER – IV
TEXTILE CHEMISTRY – PRACTICAL

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

LIST OF EXPERIMENTS
1. Estimation of pH- paper, digital pH meter, pH solution
2. Volumetric analysis of Sodium bi Sulphite
3. Volumetric analysis of Sodium Nitrite
4. Volumetric analysis of Sodium Hydro Sulphite
5. Volumetric analysis of Sodium Hypochlorite.

PREPARATION OF DYES
1. Methyl Red
2. Methyl Orange
3. Pare nitro benzene azo beta naphthol
4. Azo amino benzene.

ELECTIVE I - A
POLYMER CHEMISTRY

UNIT I:
2. Methods of preparation of polymers-bulk, solution , suspension and emulsion

UNIT II:
Different types of polymerization-step growth polymerization, addition polymerization and co-polymerization -random, alternate ,block and graft polymerization.

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:
Molecular weight of polymers-number average and weight average molecular weight methods.
1. Osmometry (membrane) 2. Cryoscopy & ebullioscopy
3. Osmometry (Vapour pressure) 4. Viscometry
5. End Group Analysis.
UNIT V:
Important industrial polymers, preparation and applications of
(i) Polyethylene, polypropylene    (ii) Polyamides
(iii) Polyvinyl chloride, polymethylmethacrylate
(iv) Polyster, polycarbonates     (v) Polyurethanes
(vi) Phenol-formaldehyde, melamine-formaldehyde
(vii) Polysilanes, polysiloxanes  (viii) Polyaniline

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

ELECTIVE I - B
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
3. Phosphate fertilizers. preparation and uses of mono and diammonium phosphates, super phosphate and triple super phosphate.

**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 Sceince—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 - C
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, LD50, ED50 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-transmucusal.

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, diabetis, tuberculosis, asthma, jaundice, piles, lepoid, 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.


3. Antibiotics: definition-microbial synthesis structure, assay and uses of chloramphenicol and pentilicn-structure and use of streptomycin and tetracyclines.


UNIT III:

1. Antiseptics and disinfectants: Definition and distinction-phenol coefficient-examples-phenolic compounds, dyes, cationic surfacts and chloro compounds.

2. Anaesthetics – Definition-Classification–volatile anaesthetics(N2O, ethers, halohydrocarbons, chloroform, haloethane)-ferguson principle—intravenous
anaesthetics- structure of thiopental sodium-local anaesthetic cocaine-source and structure – preparation and uses of procaine orthocaine and benzocaine.


4. Definition of cancer and antineoplastic drugs-examples antimetabolite, natural substances harmones, 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 Al₂P₂As, 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, cyclophosphomide-tricyclosphor preparation and use of thiotepa-sodium and copper cacydlates-preparation and uses of aromatic aresercials (carbosone, triparasomide, acetarsonide, neaarsphenamine, oxophenarisince)- HgCl₂, Hgl₂ and Hg(CN)₂ as disinfectations-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 kidney function (aminophippuric 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 :

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-scelrosing agents.

Text and References
ELECTIVE II - 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. Factoros and Physio-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, Keratious materials and their utilization).

Books for Reference
1. Chemical technology of Leather (ISI).
3. Tanning processes-Crthmann.
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 piper 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 and molecular orbital approach.

UNIT II:
Classification of Dyes-chemical classification-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
ANALYTICAL CHEMISTRY II-LAB TECHNIQUES

UNIT I:

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 and 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 66
(viii) Caffeine from tea leaves (ix) Caesin and lactose from milk
(x) Nicotine and Nicotine sulphate (xi) Bakelite from phenol and formaldehyde
From tobacco waste (xii) As₂O₃ Sol, Fe(OH)₃ Sol (xiii) Tetrammine-copper sulphate
(xiv) Tetrammine 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 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) Phosphorous cycle

UNIT III :  
2. Eutrophication-sewage 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.