T.Y.B.Sc. (CHEMISTRY)
REVISED SYLLABUS FROM JUNE 2010
(SEMESTER SYSTEM)
STRUCTURE OF THE SYLLABUS

FIRST TERM (SEMESTER III)
COMPULSORY COURSES

COURSE NO.	TITLE
CH-331	PHYSICAL CHEMISTRY
CH-332	INORFANIC CHEMISTRY
CH-333	ORGNIC CHEMISTRY
CH-334	ANALYTICAL CHEMISTRY
CH-335	INDUSTRIAL CHEMISTRY

OPTIONAL COURSE

CH-336-A	NUCLEAR CHEMISTRY
OR	
CH-336-B	POLYMER CHEMISTRY
OR	
CH-336-C	BIO-CHEMISTRY
OR	
CH-336-D	ENVIRONMENTAL CHEMISTRY
OR	
CH-336-E	AGRICULTURE CHEMISTRY

SECOND TERM (SEMESTER-IV)

COMPULSORY COURSES

CH-341	PHYSICAL CHEMISTRY
CH-342	INORGANIC CHEMISTY
CH-343	ORGAMIC CHEMISTRY
CH-344	ANALYTICAL CHEMISTRY
CH-345	INDUSTRIAL CHEMISTRY

OPTIONAL COURSE

CH-346-A	NUCLEAR CHEMISTRY
OR	
CH-346-B	POLYMER CHEMISTRY
OR	
CH-346-C	BIO-CHEMISTRY
OR	
CH-346-D	ENVIRONMENTAL CHEMISTRY
OR	
CH-346-E	DAIRY CHEMISTRY

PRACTICAL COURSES

CH-347	PHYSICAL CHEMISTRY PRACTICALS
CH-348	INORGANIC CHEMISTRY PRACTICALS
CH-349	ORGANIC CHEMISTRY PRACTICALS

NOTE:------

1. Each theory paper will carry 50 Marks out of which 10 Marks will be allotted for internal assessment and University Examination will be conducted for 40 Marks at the end of each semester.
2. The practical examination will be conducted at the end of Semester-IV. Each practical course will carry 100 Marks out of which 20 Marks will be allotted for internal assessment and University Examination will be conducted for 80 Marks.
3. **Marks for internal assessment of Practical courses will be allotted as follows.**
   a. Completed and certified journal 10 Marks
   b. Overall performance and regularity of the student during whole academic year 10 Marks
4. Internal assessment for theory courses will be done on the basis of the performance of the student in tests. Minimum two tests should be arranged for each courses in a Semester.

T.Y.B.Sc. Chemistry

CH-331, SemIII Physical Chemistry

1. Kinetics of Homogeneous Reactions (14)

- molecularity and order,
- First order reactions and its characteristics,
- Second order reactions (with equal and unequal initial concentrations) and its characteristics,
- Third order reactions (with equal initial concentrations) and its characteristics,
- Pseudomolecular reactions,
- Effect of temperature on rate of reaction,
- The energy of activation.

References:

1. Principles of Physical Chemistry, 4^{th} edition by S.H. Marron and C.F.Pruton

2. Adsorption (08)

- Adsorption phenomenon
- Adsorption of gases by solids,
- Types of adsorption,
- Adsorption isotherm - Freundlich and Langmuir ,
- Adsorption of solute by solids,
- Applications of adsorption,
- Catalysis of gaseous reactions by solid surfaces,
- One reactant gas slightly, moderately and strongly adsorbed
- Retarded reactions
- The order of heterogeneous reactions.

References :

1. Principles of Physical Chemistry, 4^{th} edition by S.H.Maron and C.F.Proton

3. Crystal Structure (10)

- Crystallization and fusion process,
- Crystallography, Crystal systems,
- Properties of crystals,
- Crystal lattice and unit cell,
- Crystal structure analysis by X ray - The Laue method and Braggs method,
- X-ray analysis of NaCl crystal system,
- Calculation of d and λ for a crystal system.

Reference

1. Principles of Physical Chemistry, 4^{th} edition , by S.H. Marron and C.F.Pruton

4. Investigations of molecular structure (16L)

- Molar refraction,
- Electrical polarization of molecules,
- Permanent dipole moment,
- Determination of dipole moment,
- Molecular spectra - Rotational, vibrational and Raman spectra

Reference

2. Molecular Spectroscopy
   C.N.Banwell, 3rd edition
   Pages- 1-15, 25.

---------- Reference Books-

1. Principles of Physical Chemistry,
   4th edition by S.H. Marron and C. F. Pruton

2. Molecular Spectroscopy
   C. N. Banwell, 3rd edition

3. University general Chemistry,
   C.N.R.Rao, Mc Millan

4. Elements of Physical Chemistry,
   G.M. Barrow,
   Mc Graw Hill Publication

T.Y.B.Sc. Chemistry
CH-341, Sem IV Physical Chemistry

1. Electrolytic conductance (12L)

- Recapitulation of Electrolytic conductance,
- Specific and equivalent conductance,
- Variation of equivalent conductance with concentration,
- Kohlrausch's law and its applications to determine
  - i) Equivalent conductance at infinite dilution of a weak electrolyte,
  - ii) The ionic product of water,
  - iii) Solubility of sparingly soluble salts,
- Migration of ions and ionic mobilities, absolute velocity of ions
- Transport number determination by Hittorf;s method and moving boundary method,
- Relation between ionic mobility, ionic conductance and transport number,
- Ionic theory of conductance,
- Debye-Huckel –Onsager equation and its validity,
- Activity in solution, fugacity and activity coefficient of strong electrolyte,

References

1. Pages: 398-437

2. Electrochemical cells (14 L)

- Reversible and irreversible cells,
- Emf and its measurements,
- Standard cells, cell reaction and Emf,
- Single electrode potential and its calculation,
- Calculation of cell Emf,
- Thermodynamics of cell Emf,
- Types of electrodes,
- Classification of electrochemical cells with and without transference,
- Applications of Emf measurment-
  - i) Solubility product of sparingly soluble salt,
  - ii) Determination of pH,
  - iii) Potentiometric titration

References

1. Pages: 471-486, 492-519.

3. Nuclear Chemistry (12 L)

- The atom, nucleus and outer sphere, classification of nuclides, nuclear stability and binding energy.
- Discovery of radioactivity, types of radioactivity, general characteristics of radioactive decay and decay kinetics,
- Measurements radioactivity, gaseous ion collection method, proportional and G.M.Counter,
- Applications of radioactivity-
  Radiochemical principles in the use of tracers,
  Typical applications of radioisotopes as a tracer-
  - i) Chemical investigations- reaction mechanism ,

ii) Sructure determination- phosphorus pentachloride and thiosulphate ion
iii) Age determination- dating by ^{3}H and ^{14}C content,
iv) Medical applications

References:

2. pages 1, 4-15, 117-119,121-125,371-378,
3. pages 243-245,247-251,
4. pages 198-209

4. Elements of Quantum Chemistry: (10 L)

concept of quantization, atomic spectra (no derivation), wave particle duality, uncertainty principle, wavefunction and its interpretation, well-behaved function, Hamiltonian (energy) operator, formulation of Schrodinger equation, particle in box (1D, 2D and 3D box) (no derivations), sketching of wavefunction and probability densities for 1D box, correspondence principle, degeneracy, applications to conjugated systems, Jahn teller effect and energies of 3 D box (lifting of degeneracy), harmonic oscillator, wavefunction and probability densities (no derivation), zero point energy and quantum tunneling.

Reference

5. Physical Chemistry
a molecular approach
by Donald A. McQuarrie , John D. Simon

References:

1. Principles of Physical Chemistry,
Fourth Edition by S.H. Marron and C. F. Pruton
2. Essentials of Nuclear Chemistry,
H.J.Arnikar Second edition
3. Nuclear and radiation Chemistry, Third edition
4. Quantum Chemistry second edition
by Manas Chandra
5. Physical Chemistry a molecular approach
by Donald A. McQuarrie , John D. Simon

T.Y.B.Sc. Physical Chemistry Practicals

CH- 347

1. Chemical Kinetics (any five)

1. To study the effect of concentration of the reactants on the rate of hydrolysis of an ester.
2. To compare the relative strength of HCl and H_2SO_4 by studying the kinetics of hydrolysis of an ester.
3. To compare the relative strength of HCl and H_2SO_4 by studying the kinetics of Inversion of cane sugar using Polarometer.
4. To study the kinetics of iodination of acetone
5. To determine the first order velocity constant of the decomposition of hydrogen peroxide by volume determination of oxygen.
6. To determine the energy of activation of the reaction between potassium iodide and potassium persulphate.
7. To determine the order of reaction between $K_2S_2O_8$ and KI by equivalent method.

2. Viscosity

To determine the molecular weight of a high polymer by using solutions of different concentrations.

3 Adsorption

To investigate the adsorption of oxalic acid /acetic acid by by activated charcoal and test the validity of Freundlich / Langmuir isotherm

4. Phenol-water system

To study the effect of addition of salt on critical solution temperature of phenol water System

5. Transport number

To determine the transport number of cation by moving boundry method .

6. Refractometry (any two)

i) To determine the specific refractivities of the given liquids A and B and their mixture and hence determine the percentage composition their mixture C.

ii) To determine the molecular refractivity of the given liquids A,B,C and D.

iii) To determine the molar refraction of homolouges methyl, ethyl and propyl alcohol and show the constancy contribution to the molar refraction by $-CH_2$ group.

Group B

1. Colorimetry (any two)

i) Determination of λ_{max} and concentration of unknown solution of $KMnO_4$ in 2 N H_2SO_4

ii) Determination of λ_{max} and concentration of unknown solution of $CuSO_4$.

iii) To titrate Cu^{2+} ions with EDTA photometrically ,

iv) To determine the indicator constant of methyl red indicator

2. Potentiometry (any three)

i) To prepare standard 0.2 M Na_2HPO_4 and 0.1 M Citric acid solution, hence prepare four different buffer solutions using them. Determine the Pk value of these and unknown solutions.

ii) To determine Pka value of given monobasic acid by potentiometric titration.

iii) To determine the amount of NaCl in the given solution by potentiometric titration against silver nitrate.

iv) To determine the formal redox potential of Fe^{2+}/ Fe^{3+} system potentriometrically

v) To determine the amount of Cl^- and Br^- from the given halide mixture by titrating with silver nitrate solution

3. pH metry. (Any two)

i) To determine the degree of hydrolysis of aniline hydrochloride

ii) To determine Pka value of given weak acid by pH-metric titration with strong base.

iii) To determine the dissociation constant of oxalic acid by pH-metric titration with strong base

iv) To determine pH of various mixtures of sodium acetate and acetic acid in aqueous solution and hence to find the dissociation of acetic acid.

4. Radioactivity. (any one)

i) To determine plateau voltage of the given G M counter.

ii) To determine the resolving time of GM counter

iii) To determine Emax of beta particle

5. Conductrometry (any two)

i) To determine the cell constant of the given cell using 0.01 M KCl solution and hence determine dissociation constant of a given monobasic weak acid.

ii) To estimate the amount of lead present in given solution of lead nitrate by conductometric titration with sodium sulphate.

iii) To investigate the conductometric titration of any one of the following

a) Strong acid against strong base
b) Strong acid against weak base
c) Strong base against weak acid
d) Weak acid against weak base

Structure of practical examination	**Marks**
1. One experiment from group-A	35
2. One experiment from group-B	35
3. Oral	10

Reference books

1. Practical Physical Chemistry 3rd edition
   A.M.James and F.E. Prichard , Longman publication
2. Experiments in Physical Chemistry
   R.C. Das and B. Behra, Tata Mc Graw Hill
3. Advanced Practical Physical Chemistry
   J.B.Yadav, Goel Publishing House
5. Advanced Experimental Chemistry. Vol-I J.N.Gurtu and R Kapoor,
   S.Chand and Co.

Inorganic Chemistry

Paper – CH-332

Topic	No. of Lectures
1. Molecular Orbital Theory	15
2. Coordination Chemistry	33
	48

1. Molecular Orbital Theory

M.O. Method

- LCAO principle & Rules of LCAO.
- Combination of Atomic orbital: S-S, S-P, P-P and d-d
- Non-bonding combination orbitals.
- M.O. Energy leveldaigram for homonuclear diatomic molecules.
- Explaining existence by calculating bond order, energy and magnetic behavior for following molecules or ions H_2, H_2^+, He_2^+, Li_2, Be_2, B_2, C_2, N_2, O_2, O_2^+, O_2^-, O_2^{--}, F_2, Ne_2
- M.O. energy level diagram for heteronuclear diatomic molecule like CO, NO, HCl, HF.

Ref. 2 page 89-112, 106-117
Ref. 4 page 55-72

Aims and objective:

Student should know:

1. Shapes of S,P, d orbital
2. Overlap of S-S, S-P, P-P and d-d orbital to form molecular orbitals.
3. Comparison of
    a) Atomic orbital and molecular orbital
    b) BMO and ABMO
    c) VBT and MOT
4. Comparison between BMO, ABMO and n BMO.
5. Drawing of molecular orbital and calculate bond order and explain stability of the following molecule and ions.
    a) H_2, H_2^+, He_2^+, Li_2, Be_2, B_2, C_2, N_2, O_2, O_2^+, O_2^-, O_2^{--}, F_2, Ne_2
    b) CO, NO, HCl, HF.

2. Coordination Chemistry

I. INTRODUCTION TO COORDINATION CHEMISTRY

- General account and meaning of the terms involved in coordination chemistry (central metal atom or ions, complex compound , complex ion calculation of oxidation number of metal, coordination number etc)
- Ligands: Definition, Classification, Chelates and chelating agents.
- Formation Constant, inert and labile complexes.
- IUPAC nomenclature
- Application of complexes in different fields.

II. WERNER THEORY OF COORDINATION COPMOPOUNDS

- Assumptions
- Stereochemistry of Complexes

III. ISOMERISM IN COORDINATION COMPLEXES

- Structural isomerism (ionization, hydrated, linkage ligand, coordination position, polymerization isomers)
- Geometrical isomerism and optical isomerism.

IV. SIDWICK MODEL, EAN RULE LIMITATIONS

V. PAULINGS VALENCE BOND THEORY

- Introduction
- Assumptions
- Concept of hybridization
- Bonding in tetrahedral, square planer, trigonal bipyramidal and octahedral complexes with examples.
- Inner and outer orbital complexes.
- Electro neutrality principle
- Multiple bonding
- Limitations

VI. CRYSTAL FIELD THEORY

- Introduction
- Assumptions
- Degeneracy of d orbital.

- Application of CFT to octahedral, tetrahedral, square planer complexes
- CFSE, calculation of CFSE in weak field and strong field complexes.
- Evidences of CFSE.
- Factors affecting 10 Dq
- CFT and magnetic properties :- Spin only magnetic moments equation, electron occupancy in CFT. Problems related to calculation of spin only magnetic moment for octahedral, tetrahedral & square plannar complexes. (i.e. for high spin & low spin complexes)
- Spectrochemical series.
- Nephelauxatic effect
- John teller distortion, limitations.

VII. MOLECULAR ORBITAL THEORY OF COORDINATION COMPLEX

- Introduction
- Assumptions
- MO treatment to octahedral complexes with δ and π bonding, effect of π-bonding.
- Charge transfer spectra.
- Comparison of VBT, CFT, & MOT.

Ref. 2 pages 194 -236

Ref. 8 Relevant pages

Ref. 9 Relevant pages

Aims and objective

The student should:

1. Know the various types of Ligands
2. Know the meaning of the terms used in co-ordination chemistry
3. Be able to name the co-ordination compound when the structure is given to them.
4. Know the application of co- ordination compounds in biology and chemistry.
5. Be able to draw the geometrical and optical isomerism of complexes.
6. Be able to explain various types of isomerism.
7. Know the merits and the demerits of Sidwick's theory
8. Know the assumptions of VBT and explain the VBT / and explain the VBT of different complexes.
9. Know the limitations of VBT.
10. Know outer and inner orbital complexes, electro neutrality principle, multiple bonding
11. Be able to draw crystal filled splitting of d orbital of metal ion in octahedral, tetrahedral square planer of tetragonal ligand field.
12. Know the assumptions of CFT.
13. Be able to explain the terms Strong field and weak field splitting.
14. Be able to explain magnetic property CFT spectra.

15. Be able to give evidences of CFSE.
16. Be able to explain Charge transfer Spectra.
17. Be able to explain John- Teller distortion of octahedral complex and its effect on Spectra.
18. Be able to compare the different approaches to bonding in Co-ordination compounds.

Reference Books:

Ref. 1 Introduction to electrochemistry by Glasstone - 2nd edition.

Ref. 2 Concise inorganic chemistry by J.D. Lee - 5th edition.

Ref. 3 Inorganic Chemistry

- D.F. Shiver & P.W. Atkins
- C.H.Largeford ELBS - 2nd edition.

Ref. 4 Basic Inorganic Chemistry

- F.A. Cotton and Wilkinson, Wiely Eastern Ltd 1992.

Ref .5 Concept and model of inorganic chemistry by Douglas – Mc Daniels - 3rd edition.

Ref. 6 Chemistry by Raymond Chang - 5th edition

Ref. 7 New guide to modern valence theory by G.I. Brown - 3rd edition

Ref. 8 Co-ordination Compounds by Baselo and Pearson.

Ref. 9 Theoretical Inorganic Chemistry by day and Selbin.

Ref.10 Inorganic Chemistry by Sharpe - 3rd Edition

INORGANIC CHEMISTRY

Paper CH-342

Topic	No. of Lectures
1. Chemistry of f-block element	08
2. Bioinorganic Chemistry	06
3. Organometalic Chemistry	10
4. Metals Semiconductors and Superconductors	10
5. Ionic Solids	06
6. Thermodynamic properties of Co-ordination Complexes	08
	48

1. Chemistry of f- block elements

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I. <u>Lanthanides</u>

- Position in periodic Table
- Name electronic Configuration
- Oxidation States
- Occurrence and separation (Group/ Individual) by ion exchange and solvent extraction method.
- Lanthanide contraction & its effect on chemistry of Lanthanides and post lanthanide element.
- Applications.

II. <u>Actinides</u>

- Position in periodic Table
- Name electronic Configuration
- Oxidation States
- Occurrence and general methods of preparation of transition element

    1. Neutron Bombardment
    2. Accelerated projectile bombardment.
    3. Heavy ion bombardment.

- Nuclear Fuels:
    1. Nuclear Fusion fuels & nuclear fission fuels
- IUPAC nomenclature system for super heavy elements with atomic no. (z) greater than 100.

- Comparison between Lanthanides and Actinides.

Ref. 2 Page 859-863, 865-866, 874 – 875
Page 879-886, 891-893, 898-900

Aims and objective

Students should know:

1. Meaning of term f-block elements, Inner transition elements, lanthanides
2. Electronic configuration of lanthanides
3. Oxidation state s of lanthanides and common oxidation states.
4. Use of lanthanide elements in different industries.
5. Meaning of Actinide elements their position in periodic table.
6. Transuranic elements.
7. Preparation methods of Transuranic elements
8. Nuclear fuels and their applications.
9. Why transuranic elements are called as the synthetic elements?
10. IUPAC nomenclature for super heavy elements with atomic no. 100 onwards.

2. Bioinorganic Chemistry

- Introduction
- Role of metal in bioinorganic chemistry.
- Compounds of Ca, Mg, Fe and Co
- Bioinorganic Chemistry of Iron: Heam proteins – hemoglobin and myglobein, Functions of Oxygen transfer, Fe (II) complex of porphyrin, oxygen binding O_2 transfer, partial pressure, pH dependence
- Nature of oxyheamoglobein & deoxyheamoglobein, geometry of Complex.
- Vitamin B_{12} Structure and Applications.

Ref. 3 page 782-783, 790-796, 813-815
Ref. 2 page 353, 775, 779, 796-797
Ref .4 page 553-557, 560-562

Aims and objective

1. The biological role of inorganic ions & compounds
2. Abundance of elements in living system and earth crust.
3. Classification of functions of the elements in relation to their biological environment

4. Biological catalysis, metalloids involves in acid catalyzed hydrolysis (Hydrolyses), redox reactions (oxidases and isomerase's) process that rearrange C-C bonds (synthesis & isomerise)
5. Biomolecules containing metal ion that serves as electron carries , metal storage sites and O_2 binding and storage and participate in signal transudation
6. Biological role of Mg^{2+} & Ca^{2+}
7. Bioinorganic chemistry of iron hemoglobin, myoglobein.
8. Photosynthesis structure of Chlorophyll, photo system I & II
9. Structure & applications of Vitamin B_{12}

3. Organometalic Chemistry

- Introduction
- General principle
- Carbonyl complexes
- CO most important π ligand
- Binary carbonyl complexes
- Synthesis
- 18 electron rule
- Solid state structure of some neutral binary metal carbonyl
- Homogeneous catalysis by soluble transition metal complex
- Feed stock for chemical industry
- Hydroxylation (oxoreaction)
- Wacker process
- Monsanto acetic acid synthesis

Ref. 5 page 561-570, 685-690, 695-696
Ref. 6 Related pages

4. Metal semiconductor and Super conductors

- Introduction
- Band theory with respect to Na along with n (E) and N(E) diagrams
- Electrical conductance of metal (Na, Mg, Al)
- Semiconductors – types of Semiconductors: I. Intrinsic II. Extrinsic
- N & P type semiconductors ZnO and NiO
- Super conductivity
- Discovery
- Property
- Models structure and superconductivity
- Applications

Ref. 7 209-221
Ref. 6 Related pages

Aims and objective

A student should know

1. Meaning of metal & semiconductor
2. Difference between metal semiconductor and insulator
3. Metallic bond on the basis of band theory
4. Intrinsic and extrinsic semiconductor
5. The term valancy band and conduction band
6. Drawing of n (E) & N (E) Curves
7. n and p type of semiconductors
8. Non-stoitiometry and semi conductivity
9. Electrical insulators o the basis of band theory
10. Difference between properties of Na, Mg, and Al in terms of conductivity
11. Meaning of super conductors
12. Structure
13. Discovery and applications

5. Ionic Solids

- Crystal structure simple cubic
- Voids in crystal structure
- Ionic radius
- Palings univalent and crystal radii (Problems)
- Radius ratio effect, lattice energy, Born-lande equation Born Haber cycle and its applications
- Scotty and Frankel's defect

Ref. 2 page 32-61
Ref. 7 page 55-62
Ref. 5 page 102-127

Aims and objectives

A student should know

1. Draw the simple cube BCC
2. Be able to solve simple problems based on Pauling's univalent radii and crystal radii.
3. Be able to explain radius ratio effect and its limitations
4. Know how to draw Born-Haber cycle.
5. Be able to solve simple problems as Born- Haber cycle
6. Know the defects in Ionic solids
7. Be able to differentiate between the defects.

6. Thermodynamic properties of Coordination Complexes

- CFSE: High spins octahedral complexes.
- CFSE: Tetrahedral complexes of site preferences
- CFSE: Low spin octahedral complexes
- Oxidation states of transition metal complexes in aqueous media.
- Ionization potential of transition complexes
- Qualitative survey of the substitution of co-ordination complexes

References

Ref. 1 Modern aspects of Inorganic Chemistry

- H.J. Emeleus
- A.G.Sharpe

Pages 505- 532

Reference Books:

Ref. 1 Introduction to electrochemistry by Glasstone - 2nd edition.

Ref. 2 Concise inorganic chemistry by J.D. Lee - 5th edition.

Ref. 3 Inorganic Chemistry

- D.F. Shiver & P.W. Atkins
- C.H.Largeford ELBS - 2nd edition.

Ref. 4 Basic Inorganic Chemistry

- F.A. Cotton and Wilkinson, Wiely Eastern Ltd 1992.

Ref .5 Concept and model of inorganic chemistry by Douglas – Mc Daniels - 3rd edition.

Ref. 6 Chemistry by Raymond Chang - 5th edition

Ref. 7 New guide to modern valence theory by G.I. Brown - 3rd edition

Ref. 8 Co-ordination Compounds by Baselo and Pearson.

Ref. 9 Theoretical Inorganic Chemistry by day and Selbin.

Ref.10 Inorganic Chemistry by Sharpe - 3rd Edition

INORGANIC CHEMISTRY PRACTICALS

CH-348

A) Gravimetric estimations (Any 3)

1. Fe as Fe_2O_3
2. Nickel as Ni – DMG
3. Al as Aluminum oxide
4. Gravimetric estimation of Ba as $BaSO_4$ using homogeneous precipitation method.

B) Volumetric Estimations (Any 3)

1. Mn by volhard method
2. Analysis of Alkali mixture by Volumetric method
3. Estimation of % purity of given sample of Sodium Chloride
4. Analysis of Brass

C) Inorganic preparations (Any 3)

1. Preparation of $[Ni(NH_3)_6]^{2+}$
2. Preparation of Trioxalatoferrate and estimation of oxalate using permagnometry.
3. Preparation of $[Cu(NH_3)_4]SO_4$ and estimation of Copper Idometrically.
4. Preparation of Crystals of Potash alum and estimation of aluminum volumetrically.

D) Colorimetric Estimations (Any 2)

1. Iron
2. Cobalt
3. Titanium
4. Separation of Iron from aqueous solution by solvent extraction using 8-hydroxyquinoline in Chloroform and its colorimetric titration's

E) Separation of binary mixture of cations by Column Chromatography (2 mixtures)

F) Qualitative Analysis (6 mixtures including Borates and Phosphates)

STRUCTURE OF PRACTICAL EXAMINATION

Experiment	Marks
1. Qualitative analysis (Compulsory Experiment)	40
2. Gravimetric Experiment OR Volumetric Experiment OR Preparation OR Chromatography	30
3. Oral	10

Reference Books

Ref. 1 General Chemistry experiment – Anil J Elias (University press).

Ref. 2 Vogel textbook of quantitative chemical analysis G.H. Jeffery, J. Basset.

Ref. 3 Quantitative chemical analysis S. Sahay (S. Chand & Co.).

Ref. 4 Quantitative analysis R.A. Day, Underwood (prentice Hall).

Ref. 5 Practical Chemistry K.K. Sharma, D. S. Sharma (Vikas Publication).

Ref. 6 Vogel textbook of quantitative chemical analysis.

University of Pune
Syllabus for T. Y. B. Sc.
Organic Chemistry (CH-333),
First Term Semester III

1. **Organic Structures, nomenclatures, Properties and Reactivities (08)**
   Introduction, drawing organic molecules, naming organic compounds – use of systematic, (IUPAC), trivial (Common) and acronyms, structural effects and reactivity- Inductive, resonance (mesomeric), steric, hyperconjugation effects, tauto merism, hydrogen bonding and effect of these on strength of acids and bases.
   Ref. 7 & 8 relevant pages.

2.Stereochemistry of disubstituted cyclohexane (07)

Introduction,Disubstituted cyclohexane.Type 1:1,1disubstituted cyclohexane,Type2:1,2 disubstituted cyclohexane,Type 3:1,3-disubstituted cyclohexane,Type 4:1,4- disubstituted cyclohexane.Geometrical & Optical isomerism,Energy calculations.

Ref.1.Relevant pages.

3.Nucleophilic substitution at aliphatic Carbon (08)

Introduction,Nucleophiles & leaving groups, mechanism of nucleophilic substitution.The SN2 reaction:Kinetics , mechanism & stereochemistry(inversion).The SN1 reaction:Kinetics,mechanism & stereochemistry(Racemisation),stability of carbocation.

How to know whether a given reaction will follow SN1 or SN2 mechnism.Comparision of SN1 & SN2 reactions.SNi reactions.

Ref.1.Section 5.7 to 5.21,5.23 Pages 172-203 and 208 to 210

Ref.8.Relevant pages

4.Reactions of Carbon –Carbon double bond & triple bond (08)

a)Introduction to Carbon-Carbon double bond reactions.Examples of addition reactions.Mechanism of electrophilic addition to C=C bond.Hydrogenation ,Orientation & reactivity,Rearrangements(Support for formation of arbocation).AntiMarkavnokoff's addition(peroxide effect).Addition of halogens,Addition of hypohalous acids HOX, Oxymercuration –demercuration,Hydroxylation (formation of 1,2- iols).Hydroboration-Oxidation(Formation of alcohol),Hydrogenation (Formation of alkane), Ozonolysis (formation of aldehyde & ketones)

Ref.1.Sections 9.1,9.2,9.5,9.14,9.17,9.21,9.25,9.26 Pages 317-323,327-343,346-355,357,360.

b)Reactions of Carbon –Carbon triple bond-addition of hydrogen,halogens,halogen acids,water & formation of metal acetylides.

Ref.1pages 431-433

5.Reactions of Carbon –Oxygen double bond: (05)

Introduction,Structure of carbonyl group,reactivity of carbonyl group,addition of Hydrogen cyanide,alcohols,thiols,water,ammonia derivatives,Cannizzaro reaction.
Ref.1.Relevant pages

6)Oxidation & Reduction reactions (04)

a)Oxidation reactions using following reagents.

(i)CrO_3 (ii)$K_2Cr_2O_7$ (iii)SeO_2 (iv)HIO_4

b)Reduction reactions using following reagents

(i)Sn-HCl (ii)Na-C_2H_5OH (iii)$NaBH_4$ (iv)LiAl H_4.

Ref.2.Relevant pages

7 . Elimination Reactions (08)

a) 1,2- elimination reactions

b) Kinetics of dehydrogenation (duality of Mechanism)

c) E2 mechanism with evidences- Isotopic effect, element effect and absence of hydrogen exchange.

d) Orientation of E2 Mechanism.

e) E1 Mechanism with evidences.

f) Orientation of E1 Mechanism.

Ref 1-. Section 8.13 to 8.25 pages 290-310

Ref 2- Relevant Pages.

Reference Books:

1) Organic Chemistry by Morrison and Boyd 6th Edn
2) Organic Chemistry by Cram and Hammond.
3) Stereochemistry of Organic compounds by Eliel Tata Mc Graw Hill 1989.
4) Organic Chemistry by John Mc Murry Vth Edn. 1999
5) Organic Chemistry by Graham solomans
6) Organic Chemistry by I.L.Finar Vol.II Vth Edn.
7) Organic Chemistry by Clayden, Greeves, Warren and Wothers (Oxferd Press)
8) A guide book to reaction Mechanism by Peter Sykes Vth Edn.

Organic Chemistry (CH-343)
Semester IV: (Second Tearm)

1. **Aromatic Electrophilic and Nucleophilic Reactions (10)**
   A) Aromatic Electrophilic substitution reactions:-
   i) Introduction and general Mechanism.
   ii) Effect of substituent group (Orientation, o/p directing and meta directing groups)
   iii) Classification of subsitutent groups (activating and deactivating groups)
   iv) Mechanism of following reactions – Nitration, Sulphonation, Halogenation, Fridel-Craft's reactions, Diazo Coupling reactions.

   B) **Aromatic Nucleophilic Substitution Reactions-** SNAr, Benzyne with Examples.
   Ref-1 Section 15.1 to 15.19, 16.8, 16.9, 18.5 pages 517-544, 666, 667.
   Ref -2 Relevant pages.

2. **Carbanions and their reactions (06)**
   i) Formation and stability of Carbanions
   ii) Reactions involving carbanions and their mechanisms
   a) Aldol b) Claisen c) Dieckmann d) Perkin
   iii) Synthesis and Synthetic applications of-
   a) Malonic ester b) Acetoacetic ester c) Wittig reagent.
   Ref. 2 Relevant Pages

3. **Retrosynthetic analysis and applications (04)**
   a) Introduction, Different terms used – Disconnection, Sunthon, Synthetic equivalence, FGI, TM.
   b) One group disconnection with examples.
   c) Retrosynthesis and Synthesis of Following Target Molecules-
   i) Acetophenone ii) t-butylalcohol, iiii) Crotonaldehyde iv) Cyclohexene v) Cyclohexene-3-one vi) Benzoin vii) Cyclopentyl methanal viii) Benzylbenzoate ix) 2-Phenyl ethylbromide x) Benzyl diethyl malonate.
   Ref-3- Relevant pages Ref-4. Relevant pages

4. **Spectroscopic methods in structure determination of Organic compounds (22)**
   A) Introduction: i) Meaning of spectroscopy, nature of electromagnetic radiation, wave length, frequency, energy, amplitude, wave number, and their relationship, different units of measurement of wavelength frequency, different regions of electromagnetic radiations
   ii) Interaction of radiation with matter excitation of molecules with different energy levels, such as rotational, vibrational and electronic level.
   iii) Types of spectroscopy and advantages of spectroscopic methods.
   Ref-5. Sections 1.2, 1.3, 1.6, 1.7, 1.8, 1.10 pages 1-3, 7-11 or any other standard reference book.

B) Ultra Violet Spectroscopy

i) Introduction, Nature of U.V., Beer's law, absorption of U.V. radiation by organic molecule leading to different excitation. Terms used in U.V. Spectroscopy-
Chromophore, Auxochrome, Bathochromic shift, hypsochromic shift, hyperchromic and hypochromic effect.

ii) Effect of Conjugation on position of U.V. band.

iii) Calculation of max by Woodward and Fiser rules for dienes and enone sustems.

iv) Colour and visible spectrum.

v) Applications of U.V. Spectroscopy- Determination of structure, Determination of stereo chemistry (Cis and trans)

Ref-5. Section 2.1, 2.3, 2.7 to 2.15 pages 13-15, 18-38,

C) Infra red Spectroscopy

i) Introduction, Principle of I.R. Spectroscopy, Fundamental modes of vibrations (3N-6,3N-5) Types of vibrations, (Stretching, bending)

ii) Condition of absorption of I.R.radiations, vibration of diatomic molecules.

iii) Parts of I.R. Spectrum, fundamental group region, finger, print region.

iv) Characteristic of I.R. absorption of following functional groups-

a) Alkanes, alkenes, alkynes b) Alcohol and ethers c) Alkylhalides d) Carbonyl compounds (-CHO, C=O,-COOR-COOH) e) Amines and amides. f) Aromatic Compounds and their substitution Patterns.

v) Effect of following factors on I.R. absorption- Inductive effect, resonance effect, hydrogen bonding

vi) Application of I.R. Spectroscopy- a) Determination of structure, identification of functional group, comparison with finger print region b) Study of chemical reaction, c) Hydrogen bonding

Ref-5. Pages 46-51, 53, 54,72-81, 86.

D) NMR Spectroscopy (Only PMR)

i) Introduction, Principles of PMR Spectroscopy, Magnetic and nonmagnetic niclei, Precessional motion of nuclei without Mathematical details, Nuclear resonance, chemical shift, shielding, & deshielding.

ii) Measurement of Chemical shift, d- Scale and T-scale.

iii) TMS as reference and its advantages, peakarea, integration, spin-spin coupling, coupling constants, J-value (Only first order coupling be discussed)

Ref-5. Pages 95-98, 106-108

E) **Problems:-** Based on U.V., I.R. and NMR. Spectral Problem based on U.V., I.R. and NMR Data and relevant problems from Ref-1 and 9.

5) **Natural Products** **(06)**

A) Terpenoids:- i) Introduction, Isolation, Classification. ii) Citral- structure determination using chemical and spectral methods, Synthesis Citral by Barbier and Bouveault Synthesis.

B) Alkaloids:- i) Introduction, extraction , Purification, Some examples of Alkaloids and their natural sources. ii) Ephedrine- structure determination using comical and spectral methods, Synthesis of Ephedrin by Nagi.

Ref-6 &7. Relevant Pages.

Reference Books

1. Organic Chemistry by Morrison and Boyd. 6th Edn.
2. A guide book to reaction mechanism by Peter Sykes vth Edn.
3. Designing organic Synthesis by Stuart Warren 1983.
4. Organic Chemisrty by Cram and Hammond.
5. Absorption Spectroscopy of aOrgaind Molecules by V.M.Parikh 1974.
6. Organic Chemistry by Clayden , Greeves, Warren and Wothers.
7. Organic Chemisrty by I.L.Finar VolII vth Edn.

Organic Chemistry Practical (CH-349)

A) Separation of Binary Mixtures and Qualitative Analysis (Minium 8 Mixtures)

a) Solid-Solid (4 Mixtures)
b) Solid-Liquid (2 Mixtures)
c) Liquid-Liquid (2 Mixtures)

At list one Mixture from each of the following should be given-Acid-Base, Acid-Phenol, Acid-Neutral, Phenol-Base, Phenol-Neutral, Base-Neutral, Neutral- Neutral.

i) Separation of the Mixture should be done by chemical method only, ether separation should not be exercised.

ii) Name and structure of the separated components of the binary mixture is not necessary.

iii) Students are expected to record the- Type, Preliminary tests, Physical constants, elements and functional groups only.

iv) The purified samples of the separated components should be submitted.

B) Organic Estimations (Any Four)

a) Estimation of acetamide.
b) Estimation of Ethyl benzoate.
c) Determination of Molecular weight of Mono and Dibasic acids by Volumetric Methods
d) Estimation of Glucose.
e) Determination of acid value of the given oil.

C) Organic Preparations (Any Four)

a) Preparation of Quinone from Hydroquinone.
b) Preparations of p-iodo nitrobenzene from p-Nitro anali.
c) Preparation of p-Nitro acetanilide from acetanilide.
d) Preparation of dibenzylideneacetone from acetone.
e) Preparation of Bnaphthymethyl ether from Bnaphthol.

D) Preparation of Derivatives (Any Four)

a) Preparation of 2,4-DNP derivative aldehydes or Ketones.
b) Preparation of Semicarbazone derivative of aldehydes or Ketones.
c) Preparation of Oxime derivative of Ketones.
d) Preparation of Aryloxyacetic acid of Phenol.
e) Preparation of Acetylderavative of amine.

Note:-

1) The Preparation or Preparation derivative should be carried out on small skill the starting compound should not be given more than one given.
2) Double burette method should be used for titration.
3) Separation and qualitative analysis of the binary Mixtures should be carried out on microscale using microscale kits.
4) Puritiy of the sample in Preparation and derivative should be checked by thin layer Chromatography (TLC).

Reference Books

1) Practical Orgainc Chemistry by – A.I. Vogal.
2) Practical Orgainc Chemisrty by – O.P.Agarwal.

STRUCTURE OF PRACTICAL EXAMINATION

1. Binary Mixture separation and qualitative Analysis ----------40 Marks
2. Organic Estimation/ Preparation/ Preparation of derivative-------30 Marks
3. Oral ---------10 Marks

T. Y. B. Sc. Chemistry

Analytical Chemistry

Paper CH-334 Semester –III

Sr. No.	Topic	No. of Lectures
1.	Gravimetric Analysis	14
2.	Electrogravimetry	06
3.	Spectrophotometry	12
4.	Atomic Absorption Spectroscopy	06
5	Flame Emission Spectroscopy	06
6.	Nephelometry and Turbidometry	04

1. Gravimetric Analysis (14 lectures)

Common ion effect and solubility product principles
Conditions for good precipitation,
Factors affecting precipitation like acid, temperature, nature of solvent,
Super saturation and precipitation formation,
Precipitation from homogeneous solution and examples
Co-precipitation, post-precipitation and remedies for their minimization
Washing of precipitate and ignition of precipitate,
Brief idea about method of filtration and drying of precipitate,
Use of organic reagents in gravimetric analysis such as 8-hydroxy quinoline, α-nitroso-β-napthol, DMG, cupferron and oxime
Introduction to thermal methods of analysis,
Classification and different parameters measured in TGA
Factors affecting thermo gravimetric analysis

Ref. 1. Pg. 22-28, 30-33, 95, 107-114, 169-171, 403-404, 407-415
Ref. 3. Pg. 527-532

Aims and Objectives

Student should know,
1. Principles of common ion effect and solubility product

2. Formation of complex ion
3. Factors affecting on solubility of precipitation
4. Phenomenon of super saturation and precipitation formation
5. Meaning of co-precipitation and post precipitation
6. Choice of liquid for washing the precipitate
7. Precautions during filtration, drying and ignition of precipitate
8. Method of thermo gravimetric analysis
9. Different organic solvents used in gravimetric analysis
10 Different Factors affecting TGA Curve
11. Numerical Problems

2. Electro-gravimetric Analysis (06 lectures)

Introduction,
Theory of electro gravimetric analysis
Faradays Laws of electrolysis
Electrolytic Cell and Electrolysis Process
Use and care of the electrodes
Terminology used in electro gravimetric analysis
Decomposition potential
Electrode Reactions
Over potential
Completeness of deposition
Applications of Electrogravimetry
Electrolytic separation of copper and nickel
Numerical Problems

Aims and Objectives

Student should know,
1. Principles of electro deposition process
2. Faradays laws and deposition process
3. Electrolytic cell and its working with electrode reactions
4. Electrolytic separation of metals.
5. Determination of analyte by Faraday's Law

Ref. 1. Pg. 515-527,531-537
Ref. 6 Pg. 732-737

Spectrophotometry **(12 lectures)**

Introduction
Electromagnetic spectrum
Interaction of electromagnetic radiations with the matter
Mathematical Statement and derivation of Lambert's Law and Beer's Law
Terminology involved in spectrophotometric analysis
Instrumentation of single beam colorimeter
Instrumentation of single and double beam spectrophotometer
Principle of additivity of absorbance and simultaneous determination
Qualitative analysis- chromophore, auxochrome, bathochromic and hypsochromic shift, hyper and hypochomic shift
Spectrophotometric Titrations
Experimental Applications-
Structure of organic compounds
Structure of complexes
Quantitative analysis using Beer's law
Equilibrium constant of acid base indicator
Numerical Problems

Ref. 1. Pg. 693-705
Ref. 3 Pg. 144-153, 157-160, 170-174
Ref. 9. 264-269

Aims and Objectives

Student should know,

1. Principles of Spectrophotometric analysis and properties of electromagnetic radiations
2. Different Terms like absorbance, transmittance, and molar absorptivity
3. Mathematical Statement and derivation of Lambert's Law and Beer's Law
4. Different wavelength selectors and their importance
5. Instrumentation and working of single and double beam spectrophotometer
6. Additivity Principle
7. Different methods of color comparators
8. Applications
9. Numerical Problems

3. Atomic Absorption Spectroscopy (06 lectures)

Introduction and theory of atomic absorption spectroscopy
Instrumentation of single beam atomic absorption Spectrophotometer
Measurement of absorbance of atomic species by AAS
Spectral and Chemical Interferences
Qualitative and Quantitative Applications of AAS
Numerical Problems

Ref. 3. Pg. 321-342

Aims and Objectives

Student should know,
1. Atomic absorption spectroscopy as an analytical tool
2. Measurement of absorbance of atoms by AAS.
3. Interferences in atomic absorption spectroscopy
4. Applications and numerical problems

4. Flame Emission Spectroscopy (06 lectures)

Introduction and theory of atomic emission spectroscopy
Instrumentation of single beam flame emission spectrophotometer
Measurement of emission of atomic species
Interferences in emission spectroscopy
Methods of analysis- calibration curve method, Standard addition method, and internal standard method
Qualitative and Quantitative Applications of FES
Numerical Problems

Ref. 3. Pg. 321-322, 336-341, 364-370, 372-376

Aims and Objectives

Student should know,
1. Emission spectroscopy as an analytical tool
2. Measurement of emission of atomic species
3. Different methods of analysis
4. Application and numerical problems

5. Nephelometry and Turbidimetry (04 lectures)

Introduction

Principles and instrumentation of Nephelometric and Turbidimetric analysis

Difference between Nephelometric and Turbidimetric measurements

Choice between Nephelometry and Turbidimetry

Factors affecting Nephelometric and Turbidimetric measurements

Quantitative Applications

Numerical Problems

Ref.1. Pg.781-785

Ref.3. Pg.380-390

Aims and Objectives

Student should know,

1. Nephelometry and Turbidimetry as an analytical tool
2. Measurement of turbidance
3. Difference between Nephelometry and Turbidimetry
4. Application and numerical problems

T. Y. B. Sc. Chemistry Analytical Chemistry

Paper CH-344 Semester –IV

Sr. No.	Topic	No. of Lectures
1.	Polarography	08
2.	pH-Metry	05
3.	Chromatographic Analysis	08
4.	Electrophoresis	04
5	Gas Chromatography	07
6.	High Performance Liquid Chromatography	08
7.	Mass Spectrometry	08

1. Polarography (08 lectures)

Introduction to voltammetric methods of analysis
Principles of polarographic analysis
Dropping Mercury Electrode
Instrument and working of polarographic apparatus
Ilkovic equation and quantitative analysis
Polarogarm and chemical analysis,
Analysis of mixture of cations
Factors affecting polarographic wave
Quantitative Applications
Numerical Problems

Ref.6. 691-734

Aims and Objectives

Student should know,
1. Voltammetry and polarography as an analytical tool
2. Construction, working, advantages and disadvantages of DME
3. Different terms involved in Ilkovic equation
4. Determination of Zn and Cd from the mixture
5. Significance of the different terms involved.
6. Need of removal of dissolved oxygen from analyte solution
4. Applications and numerical problems

2. PH-metry (05 lectures)

Introduction, Potentiometric method of determination of pH
Comparison between pH-meter and Potentiometer
Electrode System- Construction and working of glass and calomel electrodes
Brief instrumentation of pH-meter and measurement of pH
Application-pH-metric titrations
Numerical Problems

Ref.1. Pg 562-575, 578-580, 598-501, 506-561

Aims and Objectives

Student should know,
1. Potentiometric method of determination of pH
2. Difference between pH-meter and Potentiometer
3. Construction and working of glass and calomel electrodes
4. Measurement of pH
5. Acid-base pH-metric titrations
6. Numerical Problems

3. Chromatographic Analysis (08 lectures)

Introduction and classification of chromatographic methods
Principle of chromatographic analysis with match box model
Theoretical plates and column efficiency
Theory, Principle, technique and applications of-
Column Chromatography,
Ion exchange Chromatography
Thin layer Chromatography
Paper Chromatography
Numerical Problems

Ref. relevant pages of references 1-9

Aims and Objectives

Student should know,
1. Principle of chromatographic methods
2. Relation between theoretical plates and column efficiency
3. Technique and applications of- Column Chromatography,
4. Technique and applications of- Thin layer Chromatography

5. Technique and applications of- Paper Chromatography
6. Technique and applications of- Ion exchange Chromatography
7. Numerical Problem

4. Electrophoresis (04 lectures)

Introduction
Principle and theory of electrophoresis
Different types of electrophoresis techniques
Moving Boundary Electrophoresis
Zone electrophoresis- Paper, Cellulose acetate and Gel electrophoresis
Applications of electrophoresis

Ref. 3 and Ref. 4 relevant pages

Aims and Objectives

Student should know,
1 Comparison between electrophoresis and chromatography
2. Principle and theory of electrophoresis
3. Different types of electrophoresis techniques
Applications of electrophoresis

5. Gas Chromatography (07 lectures)

Introduction, Theory, Principle, GSC and GLC
Separation mechanism involved in GSC and GLC
Instrumentation of Gas chromatography
Working of gas chromatography,
Gas chromatogram and qualitative-quantitative analysis
Applications of gas chromatography

Ref. 1. Pg. 167-174
Ref. 4. Pg. 454-464
Ref. 5 Pg. 624-640

Aims and Objectives

Student should know,
1 Principle of GSC and GLC analysis
2. Separation mechanism involved in GSC and GLC
3. Instrumentation- stationary phases, column types, detectors

4. Working of gas chromatographic apparatus.
4. Chromatogram and use in qualitative-quantitative analysis
5. Applications of gas chromatography

6. High Performance Liquid Chromatography (08 lectures)

Introduction, Need of liquid chromatography
Separation mechanism involved in adsorption and partition HPLC
Instrumentation and working of HPLC
Applications of HPLC
Introduction to supercritical fluid chromatography

Ref. 6. Pg. 529-545
Ref. 4. Pg. 178-183
Ref. 8. Relevant pages

Aims and Objectives

Student should know,
1 Need of liquid chromatography
2. Separation mechanism involved in adsorption and partition HPLC
3. Instrumentation and working of HPLC
4. Applications of HPLC
5. Advantages of supercritical fluid chromatography

7. Mass Spectrometry (08 lectures)

Introduction,
Instrumentation- electron impact ionization and chemical ionization,
Mass analyzers- Magnetic, double focusing and time of flight
Detectors- faraday's cup, dynode strip electron multiplier
Mass spectrum – terminology involved and chemical analysis,
Applications of mass spectrometry
Numerical problems

Ref. 1. Pg. 353-360
Ref. 4. Pg. 565-592
Ref. 5. Pg. 262-292
Ref. 9. Pg 647-679

Aims and Objectives

Student should know,

1. Electron impact ionization and chemical ionization process,
2. Function and working of different mass analyzers
3. Working of mass spectrometry
4. Mass spectrum and its use in chemical analysis,
5. Applications of mass spectrometry

List of References

Analytical Chemistry- Paper CH-334 and CH-344

1. Textbook of Quantitative Chemical Analysis- 3rd Edition, A. I. Vogel.
2. Principles of Physical Chemistry 4th edition – Prutton and Marron
3. Instrumental Methods of chemical analysis- Chatwal and Anand
4. Basic Concept of Analytical Chemistry-2nd edition S.M. Khopkar
5. Vogel's textbook of Quantitative Inorganic Analysis-4th edition
   Besset Denney, Jaffrey, Mendham
6. Instrumental Methods of chemical analysis- 6th edition
   Willard, Merritt, Dean and Settle
7. Analytical Chemistry by Skoog
8. Analytical Chemistry – Narkhede
9. Introduction to instrumental analysis- R.D. Braun

T.Y.B.Sc. Revised Syllabus 2010
Semester -III, First Term
CH-335 Industrial Chemistry

Topic No.	Title of topics	No. of Lectures
1	**General Aspects of Chemical Industry** Introduction, basic requirements of chemical industries, chemical production, raw materials, unit process and unit operations, Quality control, quality assurance, process control, research and development, process control, pollution control, human resource, safety measures, classification of chemical reactions, batch and continuous process, Conversion, selectivity and yield, copy right act, patent act, trade marks Ref. 2: Chapter 2 (relevant pages) Ref. websites:1. www.wikipedia.org/wiki/copyright_act_of1976 2. www.wikipedia.org/wiki/patent act 3. www.wikipedia.org/wiki/trademark	8
2	**Manufactue of basic chemicals** a. Ammonia: Physico-chemical principles involved, manufacture of NH_3 by modified Haber–Bosch process, uses of NH_3 b. Sulphuric acid: physico-chemical principles involved, manufacture of H_2SO_4 by contact process, uses of H_2SO_4 c. Nitric acid: physico-chemical principles involved, Manufacture of HNO_3 by Ostwald`s process, , uses of HNO_3 Ref.1 :P. No. 571-588, 618-640	8
3	**Fertilizer Industry** Introduction, importance of fertilizers, N,P,K ratio, micronutrients, organic manure, Vermi-compost, a. Nitrogenous fertilizers: Manufacture of urea, b. Phosphatic fertilizers: Manufacture of triple super phosphate c. Mixed fertilizers: Manufacture of mixed fertilizer Ref. 2: *P.No*. 23-276, 477-481, 589-610 Re.3: *P.No*. 337-407 Ref.4: *P.No*. 9-111	8
4	**Sugar Industry** Introduction, importance of sugar industry, Manufacture of cane sugar: raw material, extraction, clarification and concentration of cane juice, crystallization of sucrose, centrifugation, Utilization of by-products of sugar industries , testing and estimation cane sugar, estimation of reducing sugars and their significance (Munson-Walker method, Lene-Eynon method)	8

	Ref. 1: *P.No*. 664-674 Ref.2 : *P.No*.554-563 Ref. 3: *P.No*. 315-345 Ref. 4:*P.No*. 216-238	
5	**Fermentation Industry** Introduction, importance, Basic requirement of fermentation process, Factors favoring fermentation, fermentation operations. Manufacture of industrial alcohol:(Ethyl alcohol) from a) Molasses b) Food grains, c) from hydrocarbons d) manufacture of alcohol from fruits (wine) Grades of alcohols: Silence spirit, rectified spirit, absolute alcohol, proof spirit, denatured spirit, duty and duty free alcohol. Importance of power alcohol as fuel. Ref.1 *P.No*.483-495 Ref 2: *P.No.* 564-576 *Ref. 3: P*.No. 916-986 Ref. 4:*P.No*.337-351	8
6	**Pollution prevention and waste management** Introduction, importance of waste management, concept of atom economy, Terms involved in waste minimization: source reduction, recycling, product changes, source control, use and reuse, reclamation, assessment procedures, types of wastes, treatment and disposal of industrial waste. Treatment of wastes or effluents with organic impurities, Treatment of wastes or effluents with inorganic impurities. The nature, effect and treatment of some important chemical wastes-(Pulp and paper industries, soap and detergent industries and food processing industries). Ref. 1: P.No. 8-92 Ref.3: P.No. 15-30 Ref. www.wikipedia.org/atom economy	

Aims and objectives

1	**General Aspects of Chemical Industry** The students are expected to learn; Importance of chemical industry, meaning of the terms involved, comparison between batch and continuous process, knowledge of various industrial acts.
2	**Manufacture of basic chemicals** The students are expected to learn physico-chemical principles invoved in the manufacturing process, manufacture of basic chemicals with the help of flow sheet diagram, they should know the applications of these chemicals.
3	**Fertilizer Industry** The students are expected to learn importance of synthetic and natural fertilizers and NPK ratios, the various manufacturing processes with flow sheet diagram,
4	**Sugar Industry** The students are expected to learn importance of sugar industry, manufacture of direct consumption (plantation white) sugar with flow diagram. Cane juice extraction by various methods, clarification by processes like carbonation, suphitation, phosphotation etc. Concentration of juice by using multiple effect evaporator system, Crystallization of sucrose by using vacuum pan.
5	**Fermentation Industry** The students are expected to learn importance of fermentation industry Various methods of manufactures, manufacture of wine from grapes,
6	**Pollution prevention and waste management** The students are expected to learn all the problems of pollution and deposal of waste of various industries.

T. Y. B. Sc. Revised Syllabus 2010

Semester -IV, Second Term
CH-345 Industrial Chemistry

Topic No.	**Title of topics**	**No. of Lectures**
1	**Cement and ceramic industry:** a. **Cement industry:** Introduction, Importance, composition of portland cement, raw materials, proportioning of raw materials, manufacture of Portland cement by using modern vertical shaft kiln, rotary kiln verses modern vertical shaft kiln setting and Hardening of cement, reinforced concrete. Ref.1: *P.No*. 313-333 Ref. 2: *P.No173-176* Ref. 4: *P.No*.188-192 **b) Ceramic industry :** Introduction, Importance, types, properties, raw material, manufacture of ceramics, grinding of raw materials , mixing, body preparation using dry clay, clay slip, throwing, slip casting, pressing, extrusion, drying, firing, glazing and decoration. Special ceramic wares like porcelain and bon china, new ceramics Ref.1: *P.No*.270-289	**8**
2	**Glass industry** Introduction, importance, physical and chemical properties of glass, chemical reaction, manufacture of glass using tank furnace. Forming of glass :pressing, blowing, drawing, rolling, annealing, finishing, grading and gauging of glass articles Special glasses: coloured, safety, hard, borosilicate, optical, photosensitive, conducting, glass laminates. Ref. 1: *P. No*. 247-265 Ref.2: *P. No*. 197-212 Ref.4: *P. No*.160-171	**8**
3	**Dyes** Introduction, importance, qualities of good dye, color, color and chemical constitution, , Otto-Witt`s theory of color, resonance theory, molecular approach to color. Classification of dyes according their applications. Meaning of terms: chromophore, auxochrome, bathochromic (red) and hypsochromic (blue) shifts. Synthesis and uses of following dyes: Methyl orange, Rosaniline, crystal violet, phenolphthalein, Florescence, Alizarin, Indigo, pigments Ref.1: *P. No*.777-814 Ref.3: *P. No*.863-915 Ref.5 & 6: *Relevant pages*	**8**

4	**Soaps and detergents:** **a) Soap industry:** Introduction, importance, raw materials for soaps, manufacture soap, special soap products, toilet soap, super fatted soap, transparent soap, medicated soap, shaving soap and shaving cream, floating soap, cleansing powders**,** shampoos. b) Detergent industry: Meaning of the terms detergent and surfactants, emulsion and emulsifying agents, wetting and non-wetting, hydrophobic and hydrophilic nature, amphipathic structures, types of surfactants, raw materials for detergents, manufacture of detergents, washing action of soaps and detergents, detergent builders, additives. Ref.1: *P. No*.513-519, 686-694 Ref.2: *P. No*.529-549 Ref.3: *P. No*.1012-1049	**8**
5	**Pharmaceutical Industry** Introduction, importance, qualities of good drug, functional and chemotherapeutic drugs. Meaning of the terms: Prescriptions, doses, analgesic, antipyretic, diuretic, anesthetics, antibiotics, anti-inflammatory, anti-viral, tranquilizer, antiulser, antialargic and bronchodilators, cardiovascular, cold preparations, anti-hypertensive, cough preparation, anti-neoplastics, sedative and hypnotics, steroidal, contraceptive, histamine and antihistamine Synthesis and uses: paracetamol, sulphanilamide, benzocaine, aspirin, chloramphenicol. Ref.1: *P. No*.762-775 Ref.2: *P. No*.803-804, 818-822 Ref.3: *P. No*.987-1011	**8**
6	**Fuels** Introduction, importance, calorific value, determination of calorific value, criterion of selection of fuel, properties of liquid fuels-ignition temperature, flash point, fire point coak number, knocking and anti knocking, octen number, cetane number a. Solid fuels: coal, cocking of coal, high and low temperature carbonization of coal, distillation of coal tar coal chemicals b. Gaseous fuels: Advantages of gaseous fuels, artificial gaseous fuels- water gas and produce gas, LPG and bio-gas. Liquid fuels: Common liquid fuels, distillation of crude petroleum, Bio-diesel c) Fuel cell: Methanol and H_2-O_2 fuel cell Ref.1: *P. No*.96-167, Ref.2: *P. No*.70-85	**8**

Aims and Objectives

Topic No.	**Title of topics**
1	**Cement and ceramic industries:** The students are expected to learn importance of these industries, manufacture of cement by modern methods, various ceramic products, different procedure involved and technical ceramics
2	**Glass industry** The students are expected to learn about making of glass by different methods, various operations involved in the manufacture and compositions, properties and uses of special glasses.
3	**Dyes** The students are expected to learn about the various theories of color and chemical constitution, difference between dyes and pigments, Uses of pigments.
4	**Soaps and detergents :** The students are expected to learn various soap products, their manufacture, special soap products, importance of detergents, meaning of the terms involved in washing action of the soap and detergents.
5	**Pharmaceutical Industry** The students are expected to learn importance of this industry, meanings of the terms involved in diagnosis, prevention and curing of the diseases
6	**Fuels** The students are expected to learn importance of fuels, types of fuels, properties of fuels, preparation of bio-diesel

References

1. Industrial Chemistry-B.K. Sharma, Goyal publishing house, Mirut
2. Shreeves chemical process industries 5th Edition, G.T. Oustin, Mc Graw Hill
3. Riegel`s hand book of Industrial chemistry, 9th Edition, Jems A. Kent
4. Industrial chemistry –R.K. Das, 2nd Edition, 1976.
5. Organic Chemistry Vol 1, I.L. Finar
6. Organic Chemistry Vol 2, I.L. Finar

Nuclear Chemistry

Paper-CH-336-A

Topics	**No.of lectures**
1. The atomic nucleus, properties of nucleons and nuclei	07
2. Nuclear Models	12
3. Radioactivity	15
4. Nuclear Reactions	14
	48

1 The atomic nucleus, properties of nucleons and nuclei

The atom, elementary particles, subnucleons, quarks, classification of nuclides, nuclear stability-even odd nature , N/Z ratio, binding energy.

Nucleus, its size and shape, mechanical effects due to orbiting and spinng of nucleons, Magnetic quantum numbers, principal and radial quantum number.

Ref.1: pages 1 to 4,7 to 15 , 22 to30. 07

2.Nuclear Models

The Shell model, the periodicity in nuclear properties, salient features of Shell Model, merits of shell model, the liquid drop model, semiempirical binding energy equation, limitations of liquid drop model. 12

Ref.1 pages 76 to 107

Ref.2 pages 464 to 469

3.Radioactivity

Types of radioactive decay, general characteristics of decays, decay kinetics,

Alpha decay: Alpha active nuclides, the alpha energy spectrum,Geiger-Nuttals law The theory of alpha decay.

Beta decay: Types of beta decay, absorption and range through matter Fermi theory Of beta decay (mathematical details are not expected)

Gamma decay: Nuclear isomerism and isomeric transitions, internal conversion, Auger effect.

Ref.1 pages 117 to 124,140 to 144, 148 to 151, 174 to 179 15

4. Nuclear Reactions

Bethes notation, types of nuclear reactions, conservation of nuclear reaction Reaction cross-section, the compound nucleus theory, photonuclear reactions, Thermonuclear reactions.

Ref.1 pages 185 to 206, 222 to 226 14

Aims and objectives:

1 The atomic nucleus, properties of nucleons and nuclei:

The students are expected to know the following from this topic.

a) The atom, elementary particles,subnucleons and the quarks.
b) Classification of nuclides, isotopes, isobars, isotones and isomers.
c) Nuclear stability on the basis of even-odd nature of Z and N, N/Z ratio.

d) The binding energy
e) The nucleus, it's size and shape, mechanical effects due to orbiting and spinng of nucleons, Magnetic quantum numbers, principal and radial quantum number.

2. Nuclear Models.

By studying this topic students are expected to understand

a) The Shell model.
b) The liquid drop model
c) Semi-empirical mass equation

3. Radioactivity.

By studying this topic students are expected to understand

a) Types of radioactive decay, decay kinetics and their general characteristics.
b) Alpha decay, Beta decay and gamma decay
c) Nuclear isomerism, isomeric transitions, internal conversion, Auger effect.

4. Nuclear reactions:

The students are expected to understand,

a) Bethes notation
b) Different types of Nuclear reactions.

References:

1. Essentials of Nuclear Chemistry:Prof.H.J.Arnikar, 4^{TH} Edition,Wiley Estern
2. Source book of Atomic energy :Samuel Glasstone ,3^{rd} edition,East -West press

Nuclear Chemistry

Paper-CH-346-A

Topics	**No.of lectures**
1. Nuclear Fission	10
2. Nuclear Reactors	08
3. Nuclear Accelerators	08
4. Detection and measurement of Nuclear radiations	08
5. Applications of Radioactivity	10
6. Radiation Safety precautions	04
	48

1. Nuclear Fission

Discovery of Nuclear fission, The process of Nuclear fission, fission fragments, their mass distribution, fission energy ,fission cross-section and thresholds, fission neutrons, Theory of Nuclear fission. 10

Ref.1: pages 240 to 259

2. Nuclear Reactors

Fission energy, the natural Uranium reactor,the four factor formula, classification of reactors. Breeder reactors, Ref.1: pages 266 to 277, 08

3.Nuclear Accelerators:

Electrostatic Accelerators, The cockcroft-walton Accelerator,The Vande-Graft Accelerator, Cyclic Accelerator, linear Accelerator. 08

Ref: 2 Pages 290 to 305,325 to 330

4. Detection and measurement of Nuclear radiations .

Scintillation Counters , Semiconductor detectors, Neutron detectors.

Ref.2 Pages 211 to 222. 08

5. Applications of Radioactivity

Probing by isotopes, Typical reactions involved in the preparation of radioisotopes,Szilard-Chalmer reaction, Cow and milk system, Use of charged plates in the collection of radioisotopes, radiochemical principles in the use of tracers,

Analytical applications – Isotope Dilution Analysis, Neutron Activation Analysis, Radiometric Titrations

Ref.1 Pages 358 to 372, 391 to 397,400 to 401 10

6. Radiation Safety precautions

Safety standards, safe working methods, biological effects of radiations

Ref.3 Pages 322 to 328 04

References :

1.Essentials of Nuclear Chemistry:Prof.H.J.Arnikar, 4TH Edition,Wiley Estern

2.Source book of Atomic energy :Samuel Glasstone ,3rd edition,East -West press

3.Nuclear Physics by Irving Kaplan 2nd edition

4.Introduction to Nuclear physics and chemistry B.G.Harvey

Aims and objectives:

1. Nuclear Fission :

By studying this topic students are expected to understand

a) Discovery of nuclear fission
b) The process of nuclear fission
c) The charge distribution
d) Fission energy
e) Theory of nuclear fission

2. Nuclear Reactors

The students are expected to know the following from this topic

a) the natural Uranium reactor, The breeder reactor
b) the four factor formula
c) Classification of reactors. d) India's Nuclear Energy programme

3. Nuclear Accelerators:

The student should understand

a) Principle and working of various accelerators
b) What are the electrostatic accelerators?

4. Detection and measurement of nuclear radiations

The aims and objectives are as follows

a) Gaseous ionization and it's applications
b) Principle and working of Scintillation Counters , Semiconductor detectors, Neutron detectors

5. Applications of Radioactivity

The students are expected to know the following from this topic

a) The Probing by isotopes.
b) Typical reactions involved in the preparation of radioisotopes
c) Szilard-Chalmer reaction
d) Analytical applications – Isotope Dilution Analysis, Neutron Activation Analysis, Radiometric Titrations

6. Radiation Safety precautions

By studying this topic students are expected to understand

a) Biological effects of radiations, safety standards, safe working methods

POLYMER CHEMISTRY

Paper-CH-336-B

Topic	No of lectures
1.Introduction to Polymer Chemistry	05
2. Mechanism and Nomenclature of Polymers	03
3. Chemistry of Polymerisation	10
4. Polymerisation Techniques	08
5. Polymer Additives	07
6. Molecular Weights of Polymers	04
7. Mechanical Properties of Polymers	04
8. Polymer Reactions	07
Total	48

1. Introduction to Polymer Chemistry (05)

Brief History, Polymer definition, Preparation, Classification, Chemical bonding & Molecular forces in Polymers.

Ref 1 : Pages 1-14
Ref 2 : Pages 1-16
Ref 3 : Pages 1-12
Ref 7 : Pages 1-6

2. Mechanism and Nomenclature of Polymers (03)

a) Polymerisation Mechanism
b) Nomenclature of Polymers
   i) Based on sources
   ii) Based on structure (Non IUPAC)
   iii) IUPAC structure-based nomenclature system
   iv) Trade names

Ref 7 : Pages 6-17

3. Chemistry of Polymerisation (10)

a) Introduction
b) Chain Polymerisation : Free radical Polymerisation, Ionic polymerisation,Ionic polymerisation, Co-ordination polymerisation- Ziegler-Natta catalyst
c) Step Polymerisation : Polycondensation, Polyaddition- polymerisation,Ring opening polymerisation.

Ref. 1 : Pages 15-64
Ref. 2 : Pages 25-32, 49-56, 82-86, 88-89, 91-94
Ref. 3 : Relevant Pages
Ref. 5 : Pages 14-17, 273-289, 342-349

4. Polymerisation Techniques (08)

Bulk polymerisation, Solution polymerisation, Suspension polymerisation, Emulsion polymerisation, Melt polymerisation, Solution polymerisation, Interfacial condensation, Electrochemical polymerisation, Salient features of different polymerisation techniques.

Ref. 1 : Pages 71-79, 82-84
Ref. 2 : Pages 126-132
Ref. 5 : Pages 196-198
Ref. 7 : Pages 335-341, 173-175

5. Polymer Additives (07)

Filters & Reinforcement, Plasticisers, Antioxidants & Thermal Stabilizers, Ultraviolet stabilizers, Fire retardants, Colourants & other additives.

Ref. 3 : Pages 170-176
Ref. 4 : Pages 250-282

6. Molecular Weights of Polymers (04)

a) Average Molecular weight, Number Average & Weight Average Molecular weight, Molecular weight & degree of polymerisation, Practical significance of polymer molecular weights.
b) Molecular weight determination – End Group Analysis, Viscocity
c) Problems based on Number Average & Weight Average Molecular weight
Ref. 1 : Pages 86-89, 92, 96-98, 402-409

7. Mechanical Properties of Polymers (04)

Elasticity, Viscosity, Viscoelasticity
Ref. 6 : Pages 75-84

8. Polymer Reactions (07)

Introduction, Hydrolysis, Hydrogenation, Addition and Substitution reactions, Cross -linking reactions, Cure reactions.
Ref. 1 : Pages 291-297, 306-308, 311-321
Ref. 3 : Relevant Pages

Aims and Objectives

The students are expected to learn the following aspects of Polymer Chemistry

1) History of polymers.
2) Difference between simple compounds and polymers.
3) Terms-Monomer, Polymer, Polymerisation, Degree of polymerization,functionality.
4) Mechanisms of polymerization..
5) Polymerisation techniques.
6) Physical parameters of polymers eg. mol wt. viscosity etc.
7) Ingredients added to polymers.

Polymer Chemistry
Paper-CH-346-B

Topic	No of lectures
1. Polymer Degradation	04
2. Chemical and Geometrical structures of Polymer Molecules	03
3. Glass Transition Temperature and Heat Distortion Temperature (Softening Point)	05
4. Crystallinity in polymers	03
5. Analysis and testing of polymers	07
6. Some Important Polymers	08
7. Some Special Polymers	06
8. Polymer Processing	12
Total	48

1. Polymer Degradation **(4)**

Introduction, Types of degradation, Thermal degradation, Mechanical degradation, Photo degradation.

Ref 1 : Pages 262 – 277

2. Chemical and Geometrical structures of Polymer Molecules **(3)**

Ref 1 : Pages 136 – 140 , 142 – 149

3. Glass Transition Temperature and Heat Distortion Temperature (Softening Point) **(5)**

Definition, Factors influencing the Glass transition temperature, Glass transition temperature and molecular weight, Glass transition temperature and plasticizers, Glass Transition Temperature and Crystalline melting point (Tm), Importance of Glass transition temperature.

Ref 1 : Pages 150, 163 – 169 , 171 – 172, 219
Ref 5 : Relevant pages
Ref 9 : Page 306
Ref 10 : Pages 98,205

4. Crystallinity in polymers **(3)**

Introduction, Degree of Crystallinity, Crystallisability, crystallites, Factors affecting crystallisability, Effect of crystallinity on the properties of polymers.

Ref 1 : Pages 173-177, 180-183, 189-191

5. Analysis and testing of polymers **(7)**

a) Chemical analysis of polymers, degradation.
b) Spectrochemical methods : IR, NMR
c) Thermal analysis

d) Physical testing : mechanical properties, Thermal properties, Optical properties, Electrical properties, Chemical properties.
Ref 2 : Pages 141-143, 229-237, 242-252

6. Some Important Polymers (8)

Polypropylene, Polyacrylonitrile, Polyvinyl acetate and Polyvinyl alcohol, Polyisoprene, Polychloroprene, Phenol formaldehyde resin (Novalac), Urea formaldehyde & Melamine formaldehyde resins , Polyethylene glycol & Polypropylene glycol, Polyurethanes, Epoxy polymers. Silicone Polymers.
Ref 1 : Pages 217-218, 220, 229-231, 242-256
Ref 3 : Relevant Pages.

7. Some Special Polymers (6)

Polymer blends, Biomedical polymers, Biodegradable polymers, Liquid crystalline polymers, Thermally Stable polymers, Conducting polymers.
Ref.9 : Pages 718-720
Ref.10 : Pages 262-284, 281-283, 285-299
Ref 11 : Pages 179,185,197

8. Polymer Processing

a) Plastic Technology (4)

1) Molding 2) Extrusion 3) Other processing methods – Calendering, Casting, Coating, Foaming, Forming, Laminating & low pressure molding, Compounding.
Ref 2 : Pages 457-469, 474-475.
Ref 1 : Relevant pages

b) Fibre Technology (4)

1) Introduction, Textile & Fabric properties
2) Spinning- Melt spinning, Dry spinning , Wet spinning, Other spinning methods.
3) Fibre after treatments : Scouring, Lubrications, Sizing, Dyeing, Finishing, Texture yarns, Nonwoven fabrics.

Ref 2 : Pages 486-501
Ref 1 : Relevant pages

c) Elastomer Technology (4)

1) Introduction, Vulcanisation
2) Reinforcement
Ref 1 : Pages 506-518
Ref 2 : Relevant pages

Aims and Objectives

The students are expected to learn the following aspects of Polymer Chemistry

1) What is polymer degradation.
2) Chemical and geometric structures of polymers.
3) Important polymers like polyethylene, PVC, polystyrene, polyvinyl alcohol, teflon, Resisns, nylon, epoxy polymers, etc.
4) Uses of polymers.
5) Role of polymer industry in the economy.
6) Advantages of polymers.
7) Some Special polymers
8) What is polymer processing.

REFRERENCE BOOKS

1. Polymer Science by V.R.Gowarikar, N.V.Vishvanathan, Jaydev Shreedhar
   New Age International Ltd. Publisher 1996.
2. Textbook of Polymer Science by Fred Billmeyer, 3rd Edn.
   A Wiely-Interscience Publication John Wiely & Sons New York 1984.
3. Introductory Polymer Chemisrty by G.S.Misra
   New Age International Ltd. Publisher 1996.
4. Introduction to Polymer Chemistry by Raymond Saymour
   International Student Edn. 1971.
5. Polymer Chemistry by Malcom P. Stevens
   Oxford University Press 1990.
6. Inorganic Polymers by G.R.Chatwal
   Himalaya Publishing House 1st Edn.1996
7. Principles of Polymerisation gy George Odian
   3rd Edn. John Wiely & Sons New York.
8. Polymer Cemistry by M.G.Arora, M.Singh.
9. Introduction to Polymer Science and Technology by S.D. Dawande.
10. Principle of Polymer Science by P. Bahadur, N.V.Sastry.
11. Polymer Science – A Text Book by V.K.Ahluwalia, A. Mishra

T.Y. B.Sc Revised Syllabus 2010
Semester III (First Term)
CH-336-C
INTRODUCTION TO BIOCHEMISTRY AND MOLECULAR BIOLOGY

I Cell Biochemistry: **(5)**

Introduction to Cell, Unicellular and Multicellular organisms, Distinguishing features of Prokaryotic and Eukaryotic cell. Structure and function of Cell membrane, Mitochondria, Endoplasmic reticulum, Golgi complex, Lysosomes, Peroxisomes, Plant cell wall and chloroplast. Concepts of Biomolecules.

II Carbohydrates: **(8)**

Introduction, Biological importance, Classification- Monosacccharides (aldoses, ketoses), Fischer and Haworth projection formula of Glucose, Fructose, Anomers, Epimers, reducing and non reducing sugars, mutarotation, reactions of glucose with phenyl hydrazine, oxidizing agents, reducing agents. Glycosidic bonds, Disaccharides (Maltose, Lactose, Sucrose), Homo and Heteropolysaccharides (starch, glycogen, cellulose, Hyaluronic acid).

III Lipids: **(3)**

Introduction, Biological importance, Classification. Simple ,compound and derived lipids. Structure of saturated and unsaturated fatty acids, structure of phospholipids (lecithin, cephalin, lipositol), structure of sphingomyelin and cholesterol. Saponification Value, Acid value, Iodine number, Rancidity.

IV. Amino acids: **(8)**

Structure of amino acids, classification of amino acids- based on R group, nutritional requirement (essential and nonessential), standard and non standard, polar and nonpolar. Isoelectric pH, zwitter ions, titration curve of glycine. Reactions of amino acid with Sanger's reagent, Edman's reagent, dansyl chloride and dabsyl chloride. Peptide bond and its features.

V. Proteins: **(4)**

Introduction, biological functions, classification- based on structure, function and composition. Structural organization of proteins- primary, secondary, tertiary and quarternary structures(general overview).

VI: Enzymes: **(5)**

Classification., enzyme specificity, coenzymes and cofactors. features of active site. Factors affecting enzyme activity- substrate concentration, pH, temperature, and enzyme concentration.. MM equation, LB equation (derivation not required) and significance of Km. Enzyme inhibition-competitive, non competitive and uncompetitive with suitable examples.

VII Biochemical techniques. **(8)**

Principles, working and applications of dialysis, - Paper chromatography, Thin layer chromatography, column chromatography- gel filtration, ion exchange, affinity. Electrophoresis- paper and gel (Agarose, Native and SDS- PAGE). Centrifugation.

VIII Vitamins and Coenzymes: **(4)**

Classification- Fat soluble and water soluble vitamins (source, biological functions and deficiency disorders), coenzyme forms of vitamin B complex.

IX. Homones: **(3)**

Definition, classification based on biochemical nature, location and mechanism of action. cAMP as second messenger.

T.Y. B.Sc Revised Syllabus 2010
Semester IV (Second Term)
CH-346-C

INTRODUCTION TO BIOCHEMISTRY AND MOLECULAR BIOLOGY

I. Metabolism: **(3)**

Definitions of catabolism and anabolism, ATP as high energy compound, other high energy compounds.

II. Glycolysis and TCA cycle: **(7)**

Aerobic and anaerobic glycolysis- structures of intermediates, various enzymes involved and energetics. Fate of pyruvate, pyruvate dehydrogenase complex. TCA cycle- enzymatic reactions and energetics.

III. β-oxidation of fatty acids: **(4)**

Transportation of fatty acids with the help of carnitine, **β** -oxidation of palmitic acid in mitochondria and its energetics.

IV. Amino acid metabolism: **(4)**

Significance of transamination, deamination, decarboxylation reactions of amino acids. Urea cycle.

V. Electron Transport Chain and Oxidative Phosphorylation: **(6)**

Location of Electron carriers, Electron transport chain, Chemiosmotic hypothesis,Proton gradient ,Oxidative phosphorylation.

VI. Nucleic acid: **(7)**

Nucleosides, Nucleotides, Polynucleotides.Differnce between DNA and RNA. Watson and Crick model of DNA. DNA as genetic material (Macleod and Mcarty, Hershey and Chase experiments). RNA and its types. Central dogma of molecular biology.

VII. DNA replication: **(6)**

Semiconservative model of replication (Messelson and Stahl experiments). Brief account of initiation, elongation and termination of DNA replication in prokaryotes. Distinguishing features of DNA polymerase I, II and III.

VIII. Transcription: **(4)**

Brief account of initiation, elongation and termination of transcription in prokaryotes. RNA polymerase.

IX. Translation: **(3)**

Genetic code and its features. Brief account of initiation, elongation and termination of translation in prokaryotes**.**

X. Introduction to genetic engineering: **(4)**

Basic concepts, Principle and Steps involved in gene cloning. Applications of genetic engineering-insulin production, Bt cotton, gene therapy

Reference Books

1 Lehninger, Principles of Biochemistry, by Nelson and Cox Macmillan Publisher fourth edition.
2 Biochemistry, by L. Stryer, W.H. Freeman, San Francisco, third edition.
3 Harpers Biochemistry.
4 Biochemistry by Rastogi
5 Biochemistry by Conn and Stumph

Aim and Objectives

The student is expected to know

a. Understanding of cell types and structure ,function of various cell organelles
b. Concepts of biomolecules, their chemistry and significance in living organisms (carbohydrates, lipids ,aminoacids and proteins).
c. Understanding of enzymes as biocatalysts and their specificity, kinetics and various types of inhibitions
d. Vitamins ,their metabolic role and deficiency.
e. Basic concepts of endocrinology.
f. Understanding of cellular metabolism and energetics.
g. Concepts of biological oxidation
h. Understanding of nucleic acid types, structure and events involved in replication of DNA, transcription , translation process and its significance.
i. Overview of genetic engineering, basic concepts and applications of gene cloning.

University of Pune
Syllabus Revision Meeting (18th January, 2010)

T. Y. B. Sc. (CHEMISTRY)
Environmental Chemistry CH-336-D
Year 2010-2011

Semester-III (FIRST TERM: 48 lectures)

Chapter 1: Concepts and scope of Environmental Chemistry (02)

1.1 Introduction
1.2 Terminologies
1.3 Units of concentration
1.4 Segments of Environment

Ref. 1: P 1-5
Ref. 3: P 8-9

Aims and objectives:
Students should know that

i) To achieve sustainable development it is necessary to study environment systematically and to discover remedial measures.

Chapter 2: Atmosphere (08)

2.1 Composition and structure of atmosphere
2.2 Evolution of Atmosphere
2.3 Earth radiation balance
2.4 Chemical and photochemical reactions in atmosphere
2.5 Chemistry of O_3, SO_x, NO_x and chlorides in atmosphere

Ref. 1: P 13-24, 25-33
Ref. 3: P 45, 46, 59, 60

Aims and objectives:
Students should know;

i) Composition and division of atmosphere based on lapse rate.
ii) The long process consisting of chemical and biological evolution taking place over 3 billion years which led to present state of atmosphere
iii) The mechanism by which earth maintains a steady state by absorbing solar energy and emitting equal amount of energy.

iv) The characteristics of chemical and photochemical reactions in atmosphere.
v) The sources and sinks of O_3, SO_x, NO_x and chlorides in atmosphere, their impact on environment and influence of human activities on these natural phenomena.

Chapter 3: Air Pollution (12)

3.1 Primary air pollutants
3.2 Sources, sinks, and control of CO, SO_x, NO_x and HC.
3.3 Sampling of air
3.4 Particulate matter: inorganic and organic
3.5 Smog: reducing and photochemical
3.6 Radioactivity in atmosphere
3.7 Effect of atmosphere pollution on biosphere and corrosion
3.8 Chemistry of some air pollution incidents, London smog (1952, 1957), TCDD- Italy (1976), Bhopal (1984)

Ref. 1: 123-129, 142-151, 153-157, 158, 159-163, 172-174, 183, 105

Aims and objectives:
Students should know

i) Five primary air pollutants
ii) the natural and anthropogenic sources and sinks and control of CO, SO_x, NO_x, HC and SPM
iii) Use of catalytic converter as control of CO and NO_x
iv) CO_2, solid organic particles and secondary air pollutants as sink for HC and acid rain as sink for SO_x
v) The composition and chemical processes involved in organic and inorganic particles formation.
vi) Two types of smog: reducing and oxidizing, formation of secondary pollutants during oxidizing photochemical smog formation
vii) Natural and manmade sources of radioactivity
viii) The effect of various air pollutants in biosphere and corrosion caused by air pollutants.
ix) The key reaction responsible for the air pollution incidents enlisted

Chapter 4: Hydrosphere (04)

4.1 Water resources
4.2 Physical chemistry of sea water: composition, equilibria, pH, pE
4.3 Aquatic environment and stratification of water bodies.
4.4 Complexation in natural and waste water
4.5 Humic substances
4.6 Microbially mediated aquatic reactions, nitrogen cycle, iron and

manganese bacteria

Ref. 1: P 56-62, 187-190, 66-72

Ref. 3: P 231, 232

Aims and Objectives:

Students should know

i) Various water resources, their characteristics in brief and their susceptibility to contaminations
ii) Abnormal properties of water, elemental composition of sea-water.
iii) That sea water equilibria are influenced by interaction with atmosphere, biosphere and sediments.
iv) Explanation for constant pH of sea water
v) pE as parameter indicative of aerobic/anaerobic conditions prevailing in the water
vi) Complexation as important chemical phenomenon responsible for solubalising large quantities of chemicals in natural and waste water
vii) Approximate composition, origin and properties of humic substances influencing characters of natural and waste water.
viii) That aquatic chemicals reactions are mediated by microorganisms, algae as producers and fungi and bacteria as reducers. The four important microbially mediated transformations in nitrogen cycle. Students should know about Fe and Mn bacteria causing oxidation of Fe(II) and oxidation and reduction of Mn species in water.

Chapter 5: Water Pollution (16)

5.1 Classification of water pollutants
5.2 Organic pollutants
5.3 Pesticides : Classification, persistence, biodegradation
5.4 Detergents
5.5 Eutrophication
5.6 Marine pollution
5.7 Oil pollution
5.8 Inorganic pollutants : Acid mine drainage, remedial measures, sediments and radioactive material
5.9 Thermal pollution
5.10 Water quality parameters for drinking, surface and irrigation
5.11 Sampling and monitoring water quality parameters: pH, D.O. (Winkler Method), COD, TOC, Total hardness, free chlorine.
5.12 Chemical specification of Hg, Pb, As
5.13 Chemistry of some water pollution cases: Minamata, arsenic, calamity in West Bengal/Indian rivers

Ref. 1: P 190-202, 111, 203, 204, 215, 205, 208, 210, 213, 226, 230, 237, 242, 252, 258, 260, 262, 264, 284, 288, 290, 297, 305, 97, 98, 101, 102

Ref. 2: P 443-456, 104, 105, 130

Ref. 3: 224-226

Aims and objectives:

Students should know

i) Classification of water pollutant into five categories
ii) Constituent of organic pollutants
iii) Classification of pesticides with examples
iv) The correlation between properties of pesticides and their persistence and biodegradability with reference to DDT, BHC, Aldrin, Organophsphates and carbonates
v) The type of surfactants, role of builders, the problems associated with use of ABS and solution of these provided by LAS and NTA
vi) The composition of oil, its pathways, oil spills and gravity of marine pollution.
vii) About the decay process of the natural water bodies and influence of human activities to accelerates this through eutrophication etc.
viii) The range of inorganic pollutants and their invironment in aquatic reactions like redox equilibria, colloid formation, eutrophication etc.
ix) The problem of acid mine drainage (similar to acid rain) resulting from mining activity, role of air oxidation and microbial reactions, remedial measures.
x) Sediments as most extensive inorganic pollutants of surface waters, anthropogenic causes of its enhancements, human activities responsible for radioactive pollution.
xi) Thermal pollution and its ecological effect
xii) Water quality parameters for drinking, surface and irrigation water.
xiii) Sampling procedures (spot sampling and composite sampling), pre concentration techniques, need for preservation
xiv) Principle, procedure and application of monitoring techniques for the mentioned water quality parameters.
xv) The biological activity like toxicity of an element varies with its chemical form i.e. species.
xvi) Three approaches to a chemical specification and interrelation amongst various species of Hg, Pb and As and their toxicity.
xvii) Know chemical transformation of Hg that led to minamata incidence, cause of As calamity and remedial measures in west Bengal, extent and nature of pollution of rivers Ganga and Damodar

Chapter 6: Environmental Health and Toxicology (06)

6.1 Types of environmental health hazards,
6.2 Soil toxicology,
6.3 Toxic chemicals, organic and inorganic chemicals in the soil,
6.4 Pesticides and human health,
6.7 Geological hazards of Earthquakes, Volcanoes, Floods, Land slides, Erosion

Ref. 5: 351-352, 363-365
Ref. 6: P 175, 179, 180, 265-269
Aims and Objectives;
Students should know;

i) definition of health and disease in terms of major environmental factors that affect humans
ii) soil toxicology and its causes
iii) understand the difference between toxic and hazardous chemicals
iv) types of environmental hazards and toxic chemicals
v) pesticides and their effects on human health
vi) recognize the geological hazards of earthquakes, volcanoes, floods, land slides and erosion etc.

Reference Books:

1: Environmental Chemistry – A. K. De,
5th Edition (New age international publishers)
2: Environmental Chemistry – J. W. Moore and E. A. Moore
(Academic Press, New York)
3: Environmental Chemistry – A. K. Bhagi and C. R. Chatwal
(Himalaya Publishing House)
4: Analytical Chemisry – G. D. Christian
4th Edition (John Wiley and Sons)
5: Toxicology principles and methods – M. A. Subramaniam,
MJP Publisher, Chennai
6: Principles of environmental science, inquiry and applications – Willium P. Cunningham and Mary Ann Cunningham,
Tata McGraw-Hill Publishing company limited

T. Y. B. Sc. (CHEMISTRY)

Environmental Chemistry CH-336-D

Semester-IV (SECOND TERM : 48 lectures)

Chapter 1: Water treatment and effluent management (08)

1.1 Domestic sewage, waste water treatment: primary, secondary and tertiary treatments, aerobic, anaerobic and upflow anaerobic sludge bed treatment processes

1.2 Industrial waste water treatment i) filtration method ii) ion-exchange method iii) membrane techniques: ultrafiltration, reverse osmosis and electrodialysis

1.3 Treatment of drinking water

Aims and Objectives:

Students should know that;

i) need and importance of water treatment
ii) the difference between domestic and industrial waste water treatment
iii) various methods used for water treatment

Chapter 2: Lithosphere and solid waste management (04)

2.1 Composition of lithosphere and types of soil.

2.2 Organic and inorganic components of soil

2.3 Acid base and ion exchange reactions in soil and pH of soil

2.4 Chemistry of disposal of solid waste i) sanitary landfills ii) incinerators iii) pyrolysis

Ref. 1: P 74-79, 82-88

Ref. 2: P 305-311, 322-331

Ref. 3: P293-303

Aims and Objectives:

Students should know that;

i) the composition and constituents of lithosphere and soil
ii) the chemistry involved in various soil processes
iii) important methods and problems in disposal of solid waste

Chapter 3: Instrumental methods in environmental analysis (20)

3.1 Atomic absorption spectroscopy: basic principle and working, HC lamp as source, flames and furnaces as cells, working curve, application to determination of Hg, As, Be, Zn, Ag, Pb, Mn, Fe, Cu, Cr, Cd

3.2 Gas chromatography: basic principle and working, requirements of carrier gas and simple, packed columns, capillary columns, retention time, detectors based on thermal conductivity, electron capture and flame ionization, GC—MS application to detection and determination of CO, HC and pesticides

3.3 HPLC: use for nonvolatile solutes, principle, working with respect to column, packing material, solvent and detectors, application to determination of pesticides, PAH as metabolites

3.4 Spectrophotometry: determination of NOx, SO_2 (Dasgupta method), NH_3, CN, PO_4, Cd, Pb, hg by their chemical transformation into appropriate coloured compound and measurement at corresponding max value.

3.5 Chemiluminescence: determination of NOx and O_3.

3.6 Non Despersive IR spectrometry of determination of CO

3.7 Ion selective electrodes: basic principle and working, solid state membrane electrode, glass and fluoride, liquid ion-exchange electrode for NO3 and dissolved oxygen (D. O.)

Ref. 1: 80, 174-178, 180, 184, 185, 254-255, 274, 280-281, 260-262, 263, 270, 282, 284, 314-316, 320, 322-335

Ref. 2: 409-411, 420, 456-461, 471-475, 304-307

Aims and Objectives:

Students should know that;

i) various instrumental techniques for environmental analysis.
ii) Selection of appropriate techniques for a pollutant

Chapter 4: Natural resources, energy and environment (06)

4.1 Natural resources: wood, coal and mineral resources

4.2 Cleaner coal combustion by coal conversion: synthane gasifier, methanol, gasohol, solvent refined coal, magneo hydrodynamic generator

4.3 Non conventional energy sources: solar, nuclear fission and fusion, dihydrogen-dioxygen fuel cell, green gas technology.

Ref. 1: P 338-343, 345-352
Ref. 2: P 105-110, 125-153

Aims and Objectives:
Students should know that;

i) importance of natural resources
ii) methods to achieve cleaner coal combustion
iii) non-conventional energy sources

Chapter 5: Green House Effect and Global Warming (04)

5.1 Introduction
5.2 Green house gases
5.3 Radiative forcing
5.4 Sources and sinks of CO_2
5.5 Causes of fluctuations in global temperature
5.6 Global warming and climate changes
5.7 Implications of climate changes

Ref. 5: P 90-99

Aims and Objectives:
Students should know;

i) the meaning of green house effect and global warming
ii) how the green house effect is produced
iii) green house coefficient
iv) green house gases and their relative contribution
v) radiative forcing, global warming potential (GWP)
vi) sources and sinks of CO_2
vii) causes of fluctuations occurring in global temperature
viii) implications of climate changes

Chapter 6: Ozone Layer: The earth protective umbrella (06)

6.1 Creation of ozone layer
6.2 Mechanism of ozone depletion
6.3 Probing the ozone shield and ozone hole
6.4 Effects of ozone depletion

6.5 Chloroflourocarbons (CFCs)
6.6 Stability and reactions of CFCs
6.7 Harmful effects of CFCs
6.8 CFCs substitutes
6.9 Remedial steps.

Ref. 5: P 107-123

Aims and Objectives:
Students should know;

i) the meaning of ozonosphere and ozone umbrella
ii) formation of ozone
iii) mechanism of ozone depletion
iv) probing the ozone shield and ozone hole
v) effects of ozone depletion
vi) chlorofluorocarbons (CFCs)
vii) stability and reactions of CFCs
viii) Harmful effects of CFCs
ix) Remedial steps of to discourage the use of CFCs

Reference Books:

1: Environmental Chemistry – A. K. De,
5^{th} Edition (New age international publishers)
2: Environmental Chemistry – J. W. Moore and E. A. Moore
(Academic Press, New York)
3: Environmental Chemistry – A. K. Bhagi and C. R. Chatwal
(Himalaya Publishing House)
4: Analytical Chemisry – G. D. Christian
4^{th} Edition (John Wiley and Sons)
5: Environmental Chemistry – H. Kaur
2^{nd} Edition 2007, Pragati Prakashan, Meerut, India

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T.Y. B.Sc. Revised Syllabus June 2010
Agriculture Chemistry
CH 336-E Semester III (First Term)
Syllabus

Chapter I – Introduction to agricultural Chemistry (02)

1.1 Role of agriculture chemistry
1.2 Scope and importance of agricultural chemistry
1.3 Agricultural chemistry and other science

Chapter II – Soil Chemistry (08)

2.1 Definition of soil, Soil components-mineral component, organic matter or humus, soil atmosphere, soil water, soil microorganism
2.2 Physical properties of soil- soil texture, soil structure, soil colour, soil temp, soil density, porosity of soil.
2.3 Surface soil and sub-soil
2.4 Chemical properties of soil, soil reactions and solutions
2.5 Factor controlling soil reaction, buffering capacity, importance of buffer action in agriculture, ion exchange

Ref 1- Pagers 8-12, 92-94, 98-113, 116-146
Ref 3- Pages 28-50

Chapter III – Problematic Soil and Soil testing (06)

3.1 Acid soil- formation of acid soil, effect of soil acidity of soil, reclaimation of acidic soil
3.2 Alkali Soil- formation of alkali soil, reclaimation of alkali soil
3.3 Classification of alkali soil- saline soil, saline alkali soil, non-saline alkali soil
3.4 Calcurous soils
3.5 Introduction to soil testing
3.6 Objectives of soil testing
3.7 Phases of soil testing- collection of soil sample, analysis in the laboratory and fertilizer applications

Ref 1- 345-370, Ref 3- 301-312, Ref 4- 135-147 and 150-159

Chapter IV- Quality of Irrigation Water (08)

4.1 Sources of Water- Atmospheric water, Surface Water, Stored Water, Ground Water
4.2 Impurities in Water, Water quality, related problems in public health, environment and agriculture
4.3 Analysis of irrigation Water (ppm, meq/lit.epm)
4.4 Dissolved constituents and their functions
Major constituents- Ca, Mg, Na, K, Carbonate, bicarbonate, sulfate, Chloride and nitrate
Minor constituents- B, Si, nitrite, Sulfide and fluoride
4.5 Water quality standard- total soluble salt (TSS), sodium adsorption ratio (SAR), Exchangeable sodium percentage (ESP), Residual sodium carbonate, salinity classes for irrigation water

Ref 8- Pages 293-309

Chapter V- Plant Nutrients (08)

5.1 Need of plant nutrients, forms of nutrients updates, nutrient absorption by plants
5.2 Classification of essential nutrients
5.2.1 Primary nutrients (N, P, K), its role and deficiency symptoms in plants
5.2.2 Secondary nutrients, (Ca, Mg, S), its role and deficiency symptoms in plants
5.2.3 Micronutrients, General functions of micronutrients (Zn, Fe, Mn, Cu, B, Mo, Cl)
5.3 Effect of environmental condition, nutrient uptake

Ref 3- Pages 207-241, Ref 4- Pages 176-195, Ref 7- pages 287-300

Chapter VI- Fertilizers and Manures (08)

Fertilizers

6.1 Introduction, Classification of fertilizers
6.2 Nitrogenous fertilizers
6.3 Phosphatic fertilizers
6.4 Potassic fertilizers
6.5 Complex fertilizers
6.6 Mixed fertilizers
6.7 Time and methods of fertilizers
6.8 Factors affecting efficiency of fertilizers
6.9 Vermicompost preparation, effect of vermicompost on soil fertility

Manures

6.10 Introducation, Definition and classification of manures
6.11 Effect of bulky organic manures on soil, farm yard manures (FYM), Factors affecting on FYM, method of preparation, losses during handling and storage
6.12 Biogas plant. Human waste, sewage and sludge, types of sludge, carbon nitrogen ratio, sewage irrigation and uses
6.13 Green manuring, types of green manuring, characteristics, advantages and disadvantages of green manuring

Ref 2- Pages 205-213, Ref 3- 90-112, 137-149

Chapter VII- Protection of Plants (08)

Pesticide Classification and mode of action

7.1 Insecticide- Definition, Classification, chemical properties, elemental composition, mode of action of synthetic and plant originated compounds organophosphates, malathion, parathion, carbamates
7.2 Fungicides- Definition, Classification, Chemical properties, mode of action of S & Cu fungicides
7.3 Herbicides- Definition,, Classification, composition, mode of action of Selective and non-selective herbicides.

Ref 6- Relevant Pages

Learning Objectives of Agriculture Chemistry
After studying this course, student is expected to

1. Know the role of agriculture chemistry and its potential
2. Understand basic concept of soil, properties of soil & its classification on the basis of pH
3. Know the different plant nutrients, Their functions and deficiency symptoms
4. Understand importance of manures as compared to chemical fertilizers'
5. Understand the importance of green manuring
6. Have the knowledge of the use of proper the plants
7. Know various techniques to protect the plants
8. Have the knowledge of various pesticides, insecticides, fungicides and herbicides
9. Identify the problematic soil and recommend method for their reclamation
10. Have the knowledge of quality irrigation water, water quality standard and analysis of irrigation water

Reference Books

1. A text book of soil science (Recise Ed) J.A. Daji, Revised by J.R. Adam, N.D. Patil, Media promoters and publishers, Mumabi, 1996
2. Text book of soil science, T.D. Biswas, S.K. Mukharjee, Tata McGraw Hill Publishing company, New Delhi
3. Introduction to Agronomy and soil, water management, V.G. Vaidya, K.R. Sahashtra Buddhe (Continental Prakashan)
4. Principals of soil science, M.M. Rai, Millian complex of India, Bombay, 1977
5. Manures and fertilizers (sixth ed), K.S. Yawalkar, J.P. Agarwal and Bokde, Agri-horticulture publishing house, Nagpur, India
6. Chemistry of insecticides and fungicides, U.S. Sree ramula (2^{nd} Ed), oxford and IBH Publishing company, New Delhi
7. Fundamentals of soil sciences, C.E. Millar and L.M. Turk, Bio-Tech- New Delhi (1^{st} Ed 2001)
8. Soil, Plant, Water and fertilizer analysis, P.K. Gupta, Published by Agro Botanica

T.Y.B.Sc. Revised Syllabus June 2010
Dairy Chemistry
CH – 346-E Semester – IV (Second Term)

Chapter I – Market Milk (08)

Introduction, Definition, constituents of milk of different species such as cow, buffalo, goat, etc., Chemical composition of milk of Indian breed and foreign breeds of cow, factor affecting composition of milk, characteristics of milk of different mammals, physicochemical properties of milk, acidity, pH, density, specific gravity, colour and flavor of milk, food and nutritive value of milk.

Microbiology of milk, growth of microorganism, stages of growth, product of microbial growth, destruction of microorganisms growth.

Ref 1 chap I relevant pages, Ref 2 pages 9-26, Ref 6 – relevant pages

Chapter II – Common Dairy Processes (06)

(Manufacture, storage and packaging)

Cream separation- Basic principles, gravity creaming water dilution and centrifugal creaming method, construction of centrifugal separator, factors affecting percentage of fat, speed of machine, temp. of milk, rate of inflow amount of flushing water formation of separator slime Pasteurization of milk, flow sheet diagram, process receiving milk, preheating filtration, clarification, cooling and storage raw milk, standardization, pasteurization, homogenization,packing and storage, uses of milk.

Ref 1.- Relevant pages.

Chapter- III Special milks (08)

1. Sterilized milk- Definition, method of manufacture in detail, Advantages and disadvantages.
2. Homogenized milk,- Definition, merits and demerits factor influencing homogenization, Process of manufacture.
3. Soft curd milk- Definition, characteristics, method of preparation of soft curd milk.
4. Flavored milk- Definition, types, method of manufacture flow sheet diagram.
5. Vitaminised / irradiated milk- - Definition, method of manufacture.
6. Fermented milk- Definition, method of manufacture.
7. Standardized milk- Definition, method of manufacture.

Ref 1 Chap II relevant pages.

Chapter IV- Milk proteins, Carbohydrates and Vitamins. (08)

1. Milk proteins- importance of proteins found in the milk-casein, albumin and globulin, composition, nomenclature, properties and uses.
2. Carbohydrates- importance of lactose, classification, properties, nutritive value of lactose use of lactose.
3. Vitamins- importance, definition, properties nutritive value of vitamins, Vit-A, Vit-B, B_2, B_6, B_{12}, Vit-C (Ascorbic acid) & Vitamin-D.
4. Food and nutritive value of milk, milk & public health.

Ref-2 Pages 11,12,33 to 38, 42 to 49, 51 to 53

Chapter V- Preservatives & Adulterants in milk (06)

1. Preservation of milk- Introduction, Common preservatives are used.
2. Adulterants- Introduction, Modes of Adulteration and their detection such as skimming, addition of separated milk, skim milk, Water, Starch and cane sugar.

Ref -2 Pages 78-81

Chapter VI- Milk Products (08)

Cream, Butter, Cheese and Ice-Cream.

1. **Cream**- Definition, Classification, Composition, Food & Nutritive value, Physicochemical properties, Manufacture and uses of cream.
   Ref-1 117, 118, 121 & 142
2. **Butter**- Definition, Classification, Composition, Food & nutritive value, Physicochemical properties, Manufacture and uses of Butter selection of milk/cream. Preheating of milk, Separating of milk, neutralization of cream, Pasteurization of cream, Cooking & ageing, repending of cream, salting of butter, washing of butter, packaging & Storage, use of butter.
   Ref -1 Pages 143, 144, 145 to 158 & 173
3. **Cheese**- Definition, Classification, Food & nutritive value, properties, Manufacture and uses of cheese.
   Ref -1 Pages 224, 227, 229 to 242 & 267
4. **Ice-cream**- Definition, Classification, Composition, Food & Nutritive value, Manufacture, packing, hardening & Storage, uses of Ice-cream.
   Ref -1 Pages182, 183, 184, 193,223

Chapter VII- Dried milk products. (04)

Introduction, butter milk powder, whey powder, cream powder, infact milk powder, Shrikand powder, Ice-cream mix powder, cheese powder
Ref-1 Pages 357 to377

Learning Objectives-

The students are expected to study "Dairy Chemistry" in view of-

1. Knowing importance of the subject from the point of rural economy.
2. Knowing the composition of milk, its food & nutritive value

3. Understanding the Microbiology of the milk
4. Understanding various preservation and adulterants, various milk proteins and their role for the human body.
5. Knowing various milk products, their composition, manufacture and uses.

References-

Ref- 1: Qutline of Dairy Technology- Oxfored University press By- Sukumar De. (Edition-1983)
Ref- 2: Dairy Chemistry and Animal Nutrition- M.M. Rai, Kalyani, Publishers, New Delhi 3rd Edition, 1980
Ref- 3: Fundamentals of Dairy Chemistry- B.H. Webb, A.H. Hohsson, J.A. Alford, CBB Publishers and Distributors.
Ref- 4: Milk and Milk Products- C.H. Eckles, H. Macy, Tata McGraw Hikk Publishing Company Ltd.
Ref- 5: Chemistry and Testing of Dairy Products- H.V. Athertion, J.A. New Lander, CBS, Publishers and Distributors.
Ref-6: Dairy Microbiology, Dr. K.C. Mahanta Omsons Publication New Delhi.