

**B.Sc I yr BIOLOGICAL CHEMISTRY
SEMESTER WISE SYLLABUS
(For the batch admitted in 2021-2022)**

SEMESTER II

(BCH 201 W)

Unit-I (Inorganic Chemistry)

15 h (1 hr/week)

S2-I-1: p-block elements - I

7 h

Group-13: Structure of diborane and higher Boranes (B_4H_{10} and B_5H_9), Boron nitrogen compounds ($B_3N_3H_6$ and BN), Lewis acid nature of BX_3 .
Group - 14: Carbides - Classification - ionic, covalent, interstitial - Structures and reactivity. Industrial applications. Silicones - Classification - straight chain, cyclic and cross-linked.
Group - 15: Nitrides - Classification - ionic, covalent and interstitial. Reactivity - hydrolysis. Reactions of hydrazine, hydroxyl amine, phosphazenes.

S2-I-2: Chemistry of Zero group elements

2 h

Isolation of noble gases (chemico - physical method), Structure, bonding and reactivity of Xenon compounds - Oxides, Halides and Oxy-halides. Clathrate compounds and Anomalous behavior of He (II).

S2-I-3: Theory of Quantitative Analysis

6h

Volumetric Analysis: Introduction, standard solutions, indicators, end point, titration curves, Types of titrations: i) neutralization titration- principle, theory of acid base indicators, titration curves and selection of indicators- strong acid - strong base, strong acid - weak base, weak acid - strong base and weak acid - weak base. Theory of redox titrations - internal ($KMnO_4$) and external indicators - use of diphenylamine and ferroin indicators. Theory of complexometric titrations - use of EBT, Murexide and Fast sulphone black indicators. Role of pH in complexometric titrations. Precipitation titrations - theory of adsorption indicators.

Gravimetric analysis- Introduction, nucleation, precipitation, growth of precipitate, filtration and washing, drying and incineration of precipitate, co-precipitation and post precipitation. Determination of Ni^{2+} .

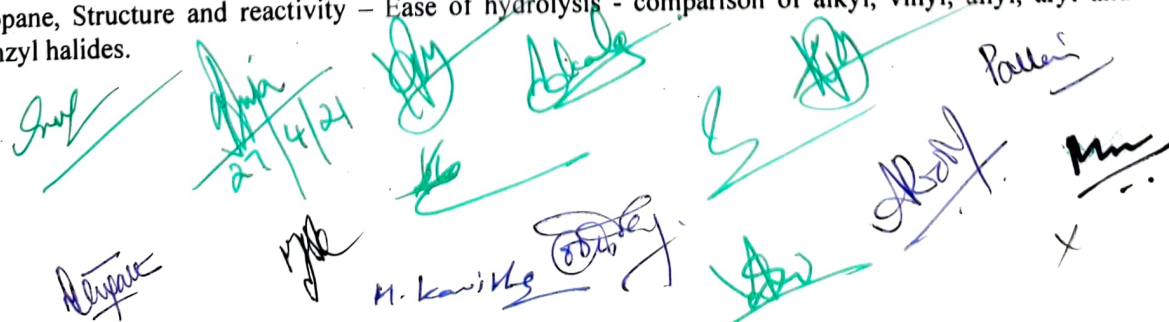
UNIT - II (Organic chemistry)

15 h (1 hr/week)

S2-O-1: Halogen compounds

4 h

Nomenclature. Classification: alkyl (primary, secondary, tertiary), aryl, aralkyl, allyl, vinyl, benzyl. Chemical reactivity - reduction, formation of $RMgX$, Nucleophilic substitution reactions - classification into S_N^1 and S_N^2 . Mechanism and energy profile diagrams of S_N^1 and S_N^2 reactions. Stereochemistry of S_N^2 (Walden Inversion) 2-bromobutane, S_N^1 (Racemisation) 1-bromo-1-phenyl propane, Structure and reactivity - Ease of hydrolysis - comparison of alkyl, vinyl, allyl, aryl and benzyl halides.



Unit III

1. Principles of physical chemistry by Prutton and Marron.
2. Text Book of Physical Chemistry by Soni and Dharmahara.
3. Text Book of Physical Chemistry by Puri and Sharma.
4. Text Book of Physical Chemistry by K. L. Kapoor.
5. Physical Chemistry through problems by S.K. Dogra.
6. Text Book of Physical Chemistry by R.P. Verma.

Unit IV

1. Text Book of Biochemistry by Rama Rao.
2. Biochemistry by Satyanarayana.
3. Text book of Biochemistry by Dr. A. C. Deb.

Laboratory Course

Paper II (BCH 251 W) - Quantitative Analysis

45hrs (3h/week)

Acid - Base titrations

- Estimation of Carbonate in Washing Soda.
- Estimation of Bicarbonate in Baking Soda.
- Estimation of Carbonate and Bicarbonate in the Mixture.
- Estimation of Alkali content in Antacid using HCl.
- Estimation of NH_4^+ by Back titration.

Redox Titrations

- Determination of Fe(II) using $\text{K}_2\text{Cr}_2\text{O}_7$.
- Determination of Fe(II) using KmnO_4 with sodium oxalate as primary standard.
- Determination of Cu(II) using $\text{Na}_2\text{S}_2\text{O}_3$ with $\text{K}_2\text{Cr}_2\text{O}_7$ as primary standard.

Complexometric Titrations

- Estimation of Mg^{2+}
- Estimation of Cu^{2+}

References:

1. Lab manual for UG students prepared by Department of Chemistry, University College for Women, Koti, Hyd.
2. Vogel's Quantitative Inorganic Analysis by Svehla.

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M.S.R.
डॉ.एम.एस. राधिका, पीएचडी (पोषण)
Dr. M.S. RADHIKA, PhD (Nutrition)
वैज्ञानिक-ई (उप निदेशक) व विभागाध्यक्ष
Science-E & Head of the Department
आहारविज्ञानविभाग, आईसीएमआर-राष्ट्रीयपोषणसंस्थान
Department of Dietetics, ICMR-National Institute of Nutrition
जामे-उस्मानिया (पोस्ट), सिकंदराबाद-500 009, भारत
Jamal-Osmania (PO), Secunderabad-500 007, INDIA

B.Sc II yr BIOLOGICAL CHEMISTRY
SEMESTER WISE SYLLABUS
(For the batch admitted in 2020-2021)

SEMESTER IV (BCH 401 W)
(Paper-IV)

Unit-I (Inorganic Chemistry)

15 h (1 hr/week)

S4-I-1: Coordination Compounds-I

6 h

Simple inorganic molecules and Coordination complexes. Nomenclature – IUPAC rules.

1. Coordination number, coordination geometries of metal ions, types of ligands.
2. Brief review of Werner's theory, Sidgwick's electronic interpretation and EAN rule and their limitations. Valence bond theory (VBT) – postulates and application to a) tetrahedral complexes - $[\text{Ni}(\text{NH}_3)_4]^{2+}$, $[\text{NiCl}_4]^{2-}$ and $[\text{Ni}(\text{CO})_4]$ b) square planar complexes $[\text{Ni}(\text{CN})_4]^{2-}$, $[\text{Cu}(\text{NH}_3)_4]^{2+}$, $[\text{PtCl}_4]^{2-}$ c) octahedral complexes $[\text{Cr}(\text{NH}_3)_6]^{3+}$, $[\text{Fe}(\text{CN})_6]^{4-}$, $[\text{Fe F}_6]^{4-}$, $[\text{Co}(\text{NH}_3)_6]^{3+}$, $[\text{CoF}_6]^{3-}$. Limitations of VBT.
3. Isomerism in coordination compounds, stereo isomerism - a) geometrical isomerism in i) square planar metal complexes of the type $[\text{MA}_2\text{B}_2]$, $[\text{MA}_2\text{BC}]$, $[\text{M}(\text{A}-\text{B})_2]$, $[\text{MABCD}]$. ii) Octahedral metal complexes of the type $[\text{MA}_4\text{B}_2]$, $[\text{M}(\text{A}-\text{A})_2\text{B}_2]$, $[\text{MA}_3\text{B}_3]$ using suitable examples. b) Optical isomerism in i) tetrahedral complexes $[\text{MABCD}]$. ii) Octahedral complexes $[\text{M}(\text{A}-\text{A})_2\text{B}_2]$, $[\text{M}(\text{A}-\text{A})_3]$ using suitable examples. Structural isomerism: ionization, linkage, coordination ligand isomerism using suitable examples.

S4-I-1: Coordination Compounds-II

9 h

Crystal field theory (CFT) - Postulates of CFT, splitting patterns of d-orbitals in Octahedral, tetrahedral, square planar with suitable examples. Crystal field stabilization energies and its calculations for various d_n configurations in octahedral complexes. High Spin & Low Spin complexes. Colour and Magnetic properties of transition metal complexes. Calculations of magnetic moments, spin only formula. Detection of complex formation - basic principles of various methods- change in chemical properties, solubility, colour, pH, conductivity, magnetic susceptibility.

Hard and soft acids bases (HSAB) - Classification, Pearson's concept of hardness and softness, application of HSAB principles - Stability of compounds / complexes, predicting the feasibility of reaction. Thermodynamic and kinetic stability of transition of metal complexes. Stability of metal complexes –stepwise and overall stability constant and their relationship and chelate effect determination of composition of complex by Job's method and mole ratio method.

Applications of coordination compounds: Applications of coordination compounds a) in quantitative and qualitative analysis with suitable examples b) in medicine for removal of toxic metal ions and cancer therapy.

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श्री. टी. टी. शर्मा, अध्यापक (रसायन)
Dr. M. S. RAJHIKA, PhD (Nutrition)
संशोधन एवं शिक्षण के क्षेत्र में विशेषज्ञता
राष्ट्रीय पोषण अनुसंधान परिषद, दिल्ली
राष्ट्रीय पोषण अनुसंधान परिषद, दिल्ली
Department of Dietetics & Nutritional Medicine of Nutrition
श्री. श्री. श्री. (डी. टी. टी.) शर्मा, अध्यापक (रसायन)
जम्मू-उत्तराखण्ड (पी), सेक्टर-डाल-550 007, INDIA

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UNIT – III (Physical Chemistry)

15 hr (1h / week)

S4-P-1: Chemical Kinetics

11 h

Introduction to chemical kinetics, rate of reaction, variation of concentration with time, rate laws and rate constant. Factors influencing reaction rates: effect of concentration of reactants, effect of temperature, effect of pressure, effect of reaction medium, effect of radiation, effect of catalyst with simple examples. Order of a reaction.

First order reaction, derivation of equation for rate constant. Characteristics of first order reaction. Units for rate constant. Half- life period, graph of first order reaction, Examples- Decomposition of H_2O_2 and decomposition of oxalic acid, Problems.

Pseudo first order reaction, Hydrolysis of methyl acetate, inversion of cane sugar, problems. *Second order reaction*, derivation of expression for second order rate constant, examples -

Saponification of ester, $2O_3 \rightarrow 3O_2$, $C_2H_4 + H_2 \rightarrow C_2H_6$. Characteristics of second order reaction, units for rate constants, half- life period and second order plots. Problems

Zero order reaction: derivation of rate expression, examples i) combination of H_2 and Cl_2 to form HCl , ii) thermal decomposition of HI on gold surface, characteristics of zero order reaction, units of k , half-life period and graph, problems.

Determination of order of reaction: i) method of integration, ii) half life method, iii) Vant-Hoff differential method iv) Ostwald's isolation method.

Kinetics of complex reactions (first order only): opposing reactions, parallel reactions, consecutive reactions and chain reactions (only brief discussion). Effect of temperature on reaction rate, Arrhenius equation. Temperature coefficient. Determination of energy of activation from Arrhenius equation and by graphical method, problems. Simple collision theory based on hard sphere model, explanation of frequency factor, orientation or steric factor. The transition state theory (elementary treatment).

S4-P-2: Photochemistry

4 h

Introduction to photochemical reactions, Difference between thermal and photochemical reactions, Laws of photo chemistry - Grotthus Draper law, Stark-Einstein's Law of photochemical equivalence. Quantum yield. Examples of photo chemical reactions with different quantum yields. Photo chemical combinations of H_2-Cl_2 and H_2-Br_2 reactions, reasons for the high and low quantum yield. Problems based on quantum efficiency. Consequences of light absorption. Singlet and triplet states. Jablonski diagram. Explanation of internal conversion, inter- system crossing, phosphorescence, fluorescence.

UNIT – IV (Biochemistry)

15 hr (1 hr/week)

S4-B-1: Carbohydrates

4 h

Classification and nomenclature of carbohydrates.

Structure of monosaccharides- (+) glucose as an example of aldo hexoses and (-) fructose as example of ketohexoses. Stereoisomerism and optical isomerism of sugars (Glucose). Structural elucidation of Glucose and Fructose.

Reactions of Glucose due to aldehyde group and fructose due to ketone group. Reactions of glucose and fructose due to hydroxyl groups. Mutarotation of Glucose.

Important derivatives of monosaccharides and disaccharides (structure, occurrence and functions of important ones).

Disaccharides - nomenclature and structures of sucrose, maltose, cellobiose.

Polysaccharides - occurrence, structural features and biological function of

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Unit II

1. Text book of Organic Chemistry by Morrison and Boyd.
2. Text book of Organic Chemistry by Graham Solomons.
3. Fundamentals of Organic Synthesis and retrosynthetic analysis by Ratna Kumar Kar.
4. Organic synthesis by Dr. Jagadamba Singh and Dr. L.D.S. Yadav.
5. Stereochemistry of Organic Compounds by D. Nasipuri.
6. Organic Chemistry by Clayden, Greeves, Warren and Wothers.

Unit III

1. Principles of Physical Chemistry by Prutton and Marron.
2. Text Book of Physical Chemistry by Soni and Dharmahara.
3. Text Book of Physical Chemistry by Puri, Sharma and Pattania.
4. Text Book of Physical Chemistry by R.P. Verma. Text Book of Physical Chemistry by K. L. Kapoor.
5. Physical Chemistry through problems by S.K. Dogra.
6. Elements of Physical Chemistry by Lewis Glasstone.
7. Industrial Electrochemistry, D. Pletcher, Chapman & Hall.

Unit IV

1. Biochemistry by Lehninger.
2. Schaum's series of Biochemistry.
3. Biochemistry by Satyanarayana.
4. Text book of Biochemistry by Dr. A. C. Deb.
5. Text book of Organic Chemistry by Morrison and Boyd.
6. Text book of Organic Chemistry by Graham Solomons.
7. Biochemistry by Voet & Voet.

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डॉ. एम.एस. राधिका, पीएचडी (पोषण)
Dr. M.S. RADHIKA, Ph.D (Nutrition)
वैज्ञानिक-ई (उप निदेशक) व विभागाध्यक्ष
Science-E & Head of the Department
आहारविज्ञानविभाग, आईसीएनआर-राष्ट्रीयपोषणसंस्थान
Department of Dietetics, ICMR-National Institute of Nutrition
जम्शे-उस्मानिया (पोस्ट), सिकंदराबाद-५००००७, भारत
Jamai-Osmania (PO), Secunderabad-500 007, INDIA

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Paper IV (BCH 451 W)- Organic Chemistry

45hrs (3h/week)

Laboratory Course

Qualitative Analysis of Organic Compounds:

Qualitative analysis: Identification of organic compounds through the functional group analysis - ignition test, Determination of melting points/boiling points, solubility test, functional group tests and preparation of suitable derivatives of the following: Carboxylic acids, phenols, amines, urea, thiourea, carbohydrates, aldehydes, ketones, amides, nitro hydrocarbons, ester and naphthalene.

References:

1. Lab manual for UG students prepared by Department of Chemistry, University College for Women, Koti, Hyd.
2. Vogel's Text Book of Practical Organic Chemistry, Fifth Edition, Pearson's Education.
3. Practical Organic Chemistry by Mann and Saunders, 1974, Longmann Publications.

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B.Sc. Chemistry II Year Semester - IV
Skill Enhancement Course- III (SEC - III) (2 Credits)

Materials and their Applications

Unit – I: Types of Materials

15 h (1hr/week)

Introduction: Materials and their importance. Classification of Materials, Advanced materials and their need. **Types of Materials:** Metals, ceramics, polymers and composites; Nature of bonding (Type of bond present). **Types and applications of metal alloys:** Classification- ferrous and non-ferrous alloys. **Ferrous alloys** -types and their applications. **Non-ferrous alloys** – Cu, Al, Ti alloys, their applications and super alloys.

Field Work- Collection of Metal Alloy Samples.

Types and Applications of Ceramics: Classification of Ceramics based on their application- glasses, clay products, refractories, abrasives, cements, and advanced ceramics. **Glasses:** Compositions and Characteristics of Some of the Common Commercial Glasses; Properties and applications of glass ceramics - preparation of charts depicting various types of glass and their use. **Clay products:** Structural clay products and the white wares. **Refractories:** Compositions of four Common Ceramic Refractory Materials, fireclay, silica, basic refractories ex. MgO and special refractories ex. Alumina and Zirconia **Cements:** Classification, preparation of cement and the setting process; quick setting cements; applications.

Field Work- Visit to industries and collection of samples of materials

Unit – II: Types of Polymers and Applications

15 h (1hr/week)

Classification of Polymeric materials based on application: Coatings, adhesives, films, foams with examples **Polymer Additives:** Fillers, Plasticizers, Stabilizers, Colorants, Flame Retardants with examples.

Advanced Materials: Types of advanced materials - semiconductors, bio-compatible materials, smart materials, advanced polymeric materials and nano-engineered materials. **Biocompatible materials:** Definition. Materials used as biomaterials and their properties. Metals and alloys used in bone and joint replacement. **Filling and restoration materials** – dental cements, dental amalgams, dental adhesives.

Field Work- Visit to Dental Clinics and interaction with Doctors regarding materials used in Dental treatments.

Smart materials: Shape memory alloys- definition and examples (Ni-Ti alloys, Cu based alloys), applications. **Conducting polymers:** - Introduction, electrically conducting polymers and their uses (polyaniline, polypyrrole, polyacetylene and polythiophene).

References

1. William D. Callister, Materials Science and Engineering - An Introduction, John Wiley & Sons, Inc, 2006.
2. Material science by Kakani and Kakani.
3. Sujata V., Bhat., —BiomaterialsI, Narosa Publication House, New Delhi,2002.
4. M. V. Gandhi and B. S. Thompson, —Smart Materials and StructuresI, Chapman and Hall, London, First Edition, 1992.
5. Duerig, T. W., Melton, K. N, Stockel, D. and Wayman, C.M., —Engineering aspects of Shape memory Alloys, Butterworth – Heinemann, 1990.
6. Conducting Polymers, Fundamentals and Applications A Practical Approach Authors: Chandrasekhar, Prasanna Ashwin-Ushas Corp., Inc. Kluwer Academic Publishers. Boston

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B.Sc. Chemistry II Year Semester IV
Skill Enhancement Course- IV (SEC - IV) (2 Credits)
Chemistry of Cosmetics and Food Processing

Unit-I: Chemistry of Cosmetics and Perfumes **15 Hrs**

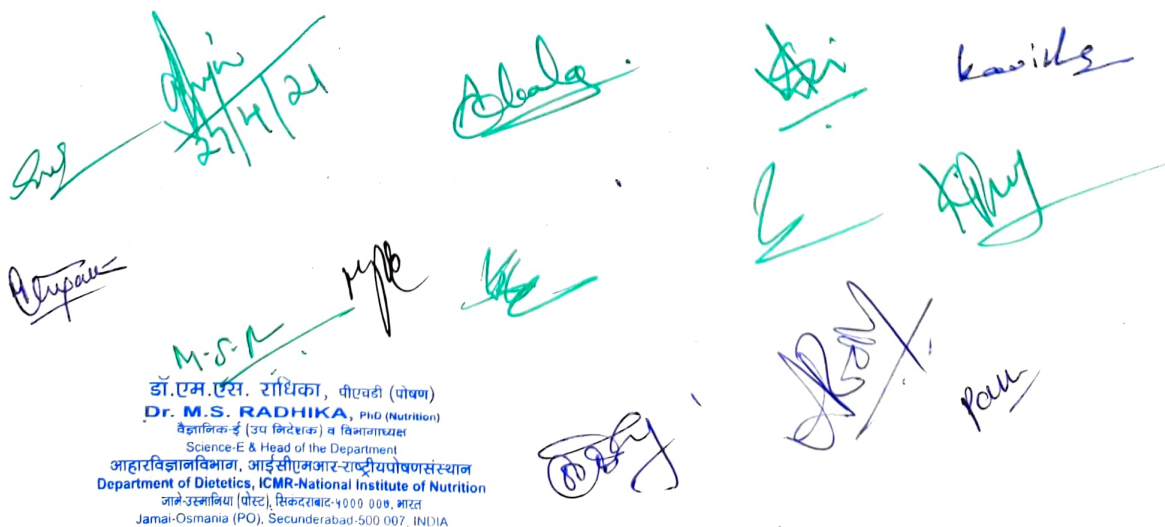
A general study including preparation and uses of the following: Hair dye, hair spray, shampoo, sunscreen lotions, lipsticks, talcum powder, nail enamel, creams (cold, vanishing and shaving creams), antiperspirants and artificial flavours. Essential oils and their importance in cosmetic industries with reference to eugenol, geraniol, sandalwood oil, eucalyptus, 2-phenyl ethyl alcohol. Demonstration experiments or illustration of experimental procedures through charts for the preparation of talcum powder, shampoo and vanishing cream. Analysis of deodorants and antiperspirant - Aluminum, Zinc, Boric acid, Chloride and Sulphide.

Unit-II: Food Processing and Food Adulteration **15 Hrs**

Food processing: Introduction, methods for food processing, additives and preservatives. Food processing- impact on nutrition, analysis of calcium in milk by complexometric titration, spectrophotometric analysis of iron in foods, Spectrophotometric identification and determination of caffeine and benzoic acid in soft drinks. Field Work -Visit to Food Industries. Food adulteration: Adulterants in some common food items and their identification: Pulses, chilli powder, turmeric powder, milk, honey, spices, food grains and wheat flour, coffee powder, tea leaves, vegetable oil, ghee, ice creams, tomato sauce. Field Work-Collection of adulterated food samples, demonstration of a minimum of five experiments for testing adulterants in food items.

References

1. E. Stocchi: Industrial Chemistry, Vol -I, Ellis Horwood Ltd.UK.
2. P.C. Jain, M. Jain: Engineering Chemistry, Dhanpat Rai & Sons, Delhi
3. Sharma, B.K. & Gaur, H. Industrial Chemistry, Goel Publishing House, Meerut(1996).
4. Rameen Devi, Food Processing and Impact on Nutrition, Sc J Agric Vet Sci., AugSep2015; 2(4A):304-311.
5. W.A. Poucher, Perfumes, Cosmetics and Soaps(1993).
6. Srilakshmi, Food Science. Edition: 3rd (2004).
7. Lillian Hoagland Meyer, Food chemistry(2008).
7. Handbook of Analysis and Quality Control for Fruit and Vegetable Products, S.Ranganna, Tata McGraw-Hill Education, 1986 -Food.
8. Fundamental concepts of applied chemistry J.C Ghosh, S. Chand and Co, Ltd, NewDelhi.
9. Applied Chemistry K .Bhagavathi Sundhar, MJP publishers.


डॉ. एम.एस. राधिका, पीएचडी (पोषण)
Dr. M.S. RADHIKA, PhD (Nutrition)
वैज्ञानिक-ई (उप निदेशक) व विभागाध्यक्ष
Science-E & Head of the Department
आहारविज्ञानविभाग, आईसीएनआर-राष्ट्रीयपोषणसंस्थान
Department of Dietetics, ICMR-National Institute of Nutrition
जामे-उस्मानिया (पोस्ट), सिकंदराबाद-500 008, भारत
Jamai-Osmania (PO), Secunderabad-500 007, INDIA

B.Sc. Chemistry III Year
Semester –VI, BC 601
Optional for Biological Chemistry Stream
Advanced Chemistry - V

60Hrs

Unit-I (Inorganic Chemistry)

15 Hrs

S6-O-I-1: Inorganic Reaction Mechanisms

4h

Labile and inert complexes, Thermodynamic and kinetic stability, ligand substitution reactions – S_N^1 and S_N^2 in Octahedral complexes; substitution reactions of square planar complexes – Trans effect and applications of trans effect. Reactions of tetrahedral complexes - Hydrolysis of silicon halides ($SiCl_4$) and phosphorous oxides (P_2O_5).

S6-O-I-2: Boranes and Carboranes:

2 h

Definition of clusters. Structures of boranes and carboranes- Wade's rules, Closo ($B_6H_6^{2-}$), Nido (B_5H_9), Arachno Boranes (B_4H_{10}) and Carboranes ($C_2B_{10}H_{12}$).

S6-O-I-3: Symmetry of molecules

5 h

Introduction, Symmetry operations and symmetry elements in molecules. Definition of Axis of symmetry types of C_n , Plane of symmetry (σ_h , σ_v , σ_d), Centre of symmetry and Improper or Rotation-reflection axis of symmetry (S_n). Explanation with examples.

S6-O-I-4: Non – aqueous solvents

4 h

Classification and characteristics of a solvent. Reactions in liquid ammonia – physical properties, auto-ionisation, examples of ammonium acids and ammonium bases. Reactions in liquid ammonia – precipitation, neutralization, solvolysis, solvation - solutions of metals in ammonia, complex formation, redox reactions. Reactions in HF – auto-ionisation, reactions in HF – precipitation, acid – base reactions, protonation.

Unit-II (Organic Chemistry)

15 Hrs

S6-O-O-1: Pericyclic Reactions

5 h

Concerted reactions, Molecular orbitals of ethene, 1,3-butadiene and allyl radical. Symmetry properties, HOMO, LUMO, Thermal and photochemical pericyclic reactions. Types of pericyclic reactions – electrocyclic, cycloaddition and sigmatropic reactions – one example each and their explanation by FMO theory.

S6-O-O-2: Synthetic Strategies

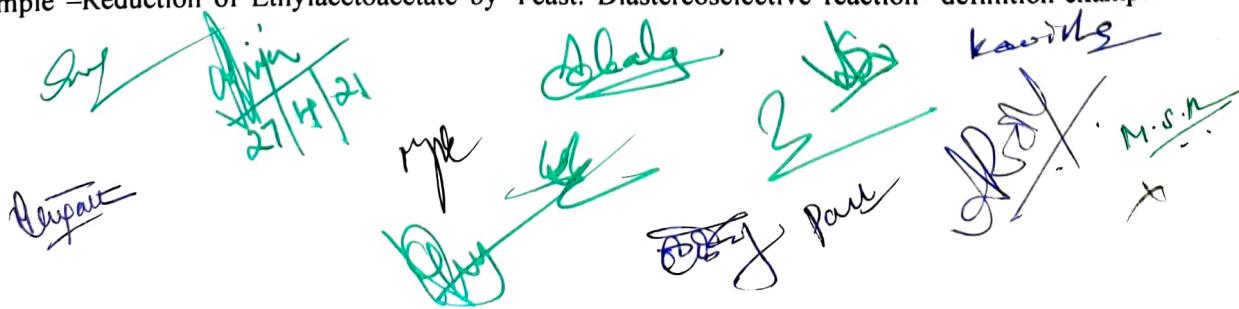
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Terminology – Target molecule (TM), Disconnection approach – Retrosynthesis, Symbol, Synthons, Synthetic equivalent (SE), Functional group interconversion (FGI), Linear and Convergent synthesis. Retrosynthetic analysis of the following molecules: 1) acetophenone 2) cyclohexene and 3) 2-phenylethanol.

S6-O-O-3: Asymmetric synthesis

5 h

Definition and classification of stereoselective reactions: substrate, product stereoselective reactions, enantio and diastereo selective reactions. Stereospecific reaction – definition –example – dehalogenation of 1,2-dibromides induced by iodide ion. Enantioselective reactions – definition – example –Reduction of Ethylacetoacetate by Yeast. Diastereoselective reaction- definition-example:



Acid catalysed dehydration of 1-phenylpropanal and Grignard addition to 2-phenyl propanal. Definition and explanation of enantiomeric excess and diastereomeric excess.

Unit III (Physical Chemistry)

15 Hrs

S6-O-P--1: Polymers

15 h

Definition of polymers – natural polymers and synthetic polymers examples classification as plastics, fibers, elastomers.

Thermosetting, thermoplastic polymers. Branched, cross-linked and co-polymers.

Definition of polymerization - addition and condensation polymerization with examples. Explanation: chain polymerization, step polymerization, co-polymerization and co-ordination polymerization. Kinetics of free radical polymerization. Tacticity, atacticity, stereo specific synthesis- Zeigler- Natta catalyst.

Molecular weight definitions - number average and weight average molecular weight, Problems. Determination of molecular weight of polymers using viscosity method, Osmometric method.

Preparation and industrial applications of polyethylene, poly vinyl chloride (PVC), nylon –66, teflon, polyacrylonitrile and terelene.

Introduction to biodegradability and examples of biodegradable polymers.

Unit IV: (General Chemistry)

15 Hrs

S6-O-G--1: Electroanalytical Methods

15 h

Types of Electroanalytical Methods.

- I) Interfacial methods – a) Potentiometry: Principle, Electrochemical cell, Electrodes- Indicator and (ii) Reference electrodes – Normal Hydrogen Electrode, Quinhydrone Electrode, Saturated Calomel Electrode. Numerical Problems. Application of Potentiometry – Assay of Sulphanilamide
- b) Voltammetry – three electrode assembly; Introduction to types of voltametric techniques, micro electrodes, Over potential and Polarization.

II) Bulk methods – Conductometry, Conductivity Cell, Specific Conductivity, Equivalent Conductivity. Numerical Problems. Applications of conductometry. Estimation of Cl – using AgNO_3 . Determination of Aspirin with KOH.

Recommended Text Books and Reference books:

Unit I

1. Concise Inorganic Chemistry by J. D. Lee, Third Edition, Van Nostrand Reinhold Company(1977)
2. Basic Inorganic Chemistry by F. A. Cotton, G. Wilkinson and Paul L. Gaus, Third Edition, Wiley Publishers (2001).
3. Inorganic Chemistry Principles of Structure and Reactivity by James E. Huhey, E.A. Keiter and R.L. Keiter, Fourth Edition, (2006)
4. Chemistry of the Elements by N. N. Greenwood and A. Earnshaw Pergamon Press (1989).
5. Inorganic Chemistry by Shriver and Atkins, Third Edition, Oxford Press (1999).
6. Principles of Inorganic Chemistry by Puri, Sharma and Kalia Vishal Publications (1996).
7. Group Theory and Spectroscopy by F. A. Cotton.

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8. Textbook of Inorganic Chemistry by R Gopalan, Universities Press, (2012).

Unit II

1. Text book of Organic Chemistry by Morrison and Boyd, Person(2009)
2. Text book of Organic Chemistry by Graham solomons, Wiley(2015)
3. Fundamentals of Organic Synthesis and Retrosynthetic analysis by Ratna Kumar Kar, NCBA,(2014)
4. Organic Synthesis by Dr. Jagadamba Singh and Dr. L. D. S. Yadav, Pragati Prakashan, 2010
5. Stereochemistry of Organic Compounds by D. Nasipuri, New Academic Science Limited, 2012
6. Organic Chemistry by Clayden, Greeves, Warren and Wothers, Oxford University Press, 2001.
7. Fundamentals of Asymmetric Synthesis by G. L. David Krupadanam, Universities Press(2014)

Unit III

1. A Text book on 'Materials and their Applications', First Edition, Authors: Dr Mudvath Ravi,
2. Gopu Srinivas, Putta Venkat Reddy, Vuradi Ravi Kumar, Battini Ushaiah.
3. Materials Science and Engineering An Introduction by William D. Callister, Jr. John Wiley & Sons, Inc.
4. Material Science by Kakani and Kakani New Age International Pvt Ltd, 2004
5. Sujata V., Bhat., —Biomaterials, Narosa Publication House, New Delhi, 2002
6. M. V. Gandhi and B. S. Thompson, —Smart Materials and Structures, Chapman and Hall, London, First Edition, 1992.
7. Duerig, T. W., Melton, K. N, Stockel, D. and Wayman, C.M., —Engineering aspects of Shape-memory Alloys, Butterworth – Heinemann, 1990.
8. Chandrasekhar, Prasanna Ashwin-Ushas Conducting Polymers, Fundamentals and Applications - A Practical Approach Authors: Corp., Inc. Kluwer Academic Publishers. Boston.

Unit IV

1. D. A. Skoog, F. J. Holler, T. A. Nieman, Principles of Instrumental Analysis, Engage earning India Ed.
2. D. A. Skoog, D. M. West, F. J. Holler, Fundamentals of Analytical Chemistry, Sixth Edition, Saunders College Publishing, Fort worth (1992).
3. Willard, H. H., Merritt, L. L., Dean, J. & Settoe, F. A. Instrumental Methods of Analysis. 7th Edition. Wadsworth Publishing Co. Ltd., Belmont, California, USA, 1988.
4. Harris, D. C. Quantitative Chemical Analysis, W. H. Freeman. 2007.
5. Dean, J. A. Analytical Chemistry Notebook, McGraw Hill.
6. Analytical Chemistry 7th Edition by Gary D. Christian (2004).

Dr. M. S. Radhika, PhD (Nutrition)
Science-E & Head of the Department
आहारविज्ञानविभाग, आईसीएनआर-राष्ट्रीयपोषणसंस्थान
Department of Dietetics, ICMR-National Institute of Nutrition
जामे-उस्मानिया (पोस्ट), सिकंदराबाद-500 008, भारत
Jamal-Osmania (PO), Secunderabad-500 007, INDIA

B.Sc. III yr BIOLOGICAL CHEMISTRY
SEMESTER WISE SYLLABUS
(For the batch admitted in 2019-2020)
SEMESTER VI **BC 606**
Discipline Centric Elective A

UNIT I

15 hrs

S6-ID-1: Bioinorganic Chemistry

Essential and toxic metal ions:

Biological significance of Na, K, Mg, Ca, Fe, Co, Ni, Cu, Zn and chloride (Cl⁻).

Toxic metal ions As, Hg & Pb

Oxygen transport and storage:

Need for oxygen carriers in aerobic organisms. Structure of Hb, Mb and coordination chemistry of Fe in deoxy forms and oxy forms. Co-operativity in hemoglobin and its biological significance. Role of globin chain.

Removal of CO₂ by Carbonic Anhydrase:

Structure of active site. Mechanism of reversible hydration of CO₂. Role of metal ion.

Fixation of CO₂ by Photosynthesis:

Structure of chlorophyll – Coordination of Mg. Overview of light and dark reactions. Electron transport via – Z scheme in light reactions, Calvin cycle and synthesis of sucrose (brief treatment).

Fixation of N₂ fixation by Nitrogenase enzyme:

Structure of Nitrogenase enzyme. Coordination of dinitrogen to enzyme and its activation and reduction to ammonia. Mechanistic aspects and role of metal ions. Haber's process (brief treatment).

UNIT -II

15h

S6-ID-2: Bioenergetics

Principles of thermodynamics and their applications in biochemistry- introduction, thermodynamic state functions, first and second laws of thermodynamic system thermodynamics, concept of free energy, standard free energy. Endergonic and exergonic reactions, ATP and other energy rich phosphates. Biological redox reactions(only introduction). Structure of mitochondria and its electron transport chain. Inhibitors of electron transport. Coupling of electron transport to ATP synthesis. Inhibitors and uncouplers of oxidative phosphorylation. P/O ratio and its significance

UNIT - III

S6-ID-3: Principles and applications of Analytical techniques

8h

Blotting Techniques-southern blot, northern blot and western blot, DNA finger printing technique, Hybridoma technology.

DNA sequencing: Maxam-Gilberts method and Sangers dideoxy nucleotide method.

S6-ID-4: Biochemical techniques

7h

Polymer chain reaction(PCR) – principle & applications, Tracer techniques- Radio isotopes, units of radio activity, half life, β and γ emitters, use of radio active isotopes in biology.

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UNIT - IV

S6-ID-5: Chemistry and Metabolism of Nucleic acids

12h

Structural components of nuclei acids-sugars, purines, pyrimidines, nucleosides and nucleotides, Watson and crick model of DNA. UV absorption and denaturation of DNA, RNA. Types of RNA and their roles. DNA as genetic material-Expt of Griffith, Avery, Hershey and Chase. Nucleotide metabolism-biosynthesis of purines and pyrimidines, Catabolism of purines and pyrimidines, Gout.

References

1. Biochemistry by Lehninger.
2. Biochemistry by Stryer.
3. Schaum's series of Biochemistry.
4. Biochemistry by Satyanarayana.
5. Lipponac's series of Biochemistry.
6. Gene Biotechnology by Joghdan.
7. Biotechnology by B.D. Singh.
8. Biochemistry by Voet & Voet.
9. Molecular Biotechnology by Glick.
10. Industrial Microbiology by Casida.

Singh
27/4/21
Prasad

Sharma

Sharma

Sharma

Sharma

Kavitha

mpa

M.S.R.

डॉ. एम. एस. राधिका, पीएचडी (पोषण)
Dr. M.S. RADHIKA, PhD (Nutrition)
वैज्ञानिक-ई (उप निदेशक) व विभागाध्यक्ष
Science-E & Head of the Department
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Department of Dietetics, ICMR-National Institute of Nutrition
जामे-उस्मानिया (पोस्ट), सिकंदराबाद-500 008, भारत
Jamai-Osmania (PO), Secunderabad-500 007, INDIA

Sharma

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Prasad

Laboratory Course
PAPER- VI (BCH 651 W)

45h (3h/week)

Semester VI

1. Determination of Cholesterol by colorimetric method.
2. Determination of Creatinine by Job's method using colorimeter.
3. Determination of RNA by Orcinol method.
4. Determination of DNA by Diphenylamine method.
5. Thin layer chromatography of amino acids and carbohydrates.
6. Determination of Riboflavin by fluorimetry.
7. Determination of Thiamine by fluorimetry.
8. Estimation of Glucose by Benedict's quantitative method.

Project Work:

Quantitative estimations of biological samples (vegetable/animal sources)

NOTE: 5 marks will be awarded to project work instead of regular practical assessment.

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डॉ. एम. एस. राधिका, पीएचडी (पोषण)
Dr. M. S. RADHIKA, PhD (Nutrition)
वैज्ञानिक-ई (उप निदेशक) व विभागाध्यक्ष
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Department of Dietetics, ICMR-National Institute of Nutrition
जामे-उस्मानिया (पोस्ट), सिकंदराबाद-500 004, भारत
Jamar-Osmania (PO), Secunderabad-500 007, INDIA

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B.Sc. CBCS BIOLOGICAL CHEMISTRY

Theory Model Question Paper For

Semester I, II, III, IV

Time :3Hrs. Max. Marks : 80

Note: Answer eight questions from Part-A and all questions from Part-B. Each question carries 4 marks in Part-A and 12 marks in Part-B.

Part-A (8 x 4 = 32 Marks)

(Short Answer Type)

Write any Eight questions of the following

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.
- 8.
- 9.
- 10.

Part-B (4 x 12 = 48 Marks)
(Essay Answer Type)

Answer all Questions

1 a)

(OR)

b)

a)

(OR)

b)

a)

(OR)

b)

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Pallavi

M.S.R.

डॉ.एम.एस. राधिका, पीएचडी (पोषण)
Dr. M.S. RADHIKA, PhD (Nutrition)
वैज्ञानिक-ई (उप निदेशक I व विभागाध्यक्ष)
Science-E & Head of the Department
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Department of Diabetics, ICMR-National Institute of Nutrition
जामे-उस्मानिया (पोस्ट), सिकंदरबाद-500 075, आंध्र
Jama-i-Osmania (PO), Secunderabad-500 075, A.P.

B.Sc. CBCS BIOLOGICAL CHEMISTRY
Practical Model Question Paper For
Semester I, II, III, IV, V & VI

Time: 3Hrs

Max. Marks :50

SEMESTER	External (Marks)	Internal (Marks)	Total (Marks)
I	40	10	50
II	40	10	50
III	40	10	50
IV	40	10	50

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guy

Department of Chemistry
University College for Women
Kofl. Hyderabad-95.

B.Sc. I yr BIOLOGICAL CHEMISTRY
SEMESTER WISE SYLLABUS

(For the batch admitted in 2021-2022)

SEMESTER I
(Paper-I)

(BCH 101 W)

Unit-I (Inorganic Chemistry)

15h (1 hr/week)

S1-1-1: Chemical Bonding

8 h

Ionic solids - lattice and solvation energy, solubility of ionic solids, Fajan's rule, polarity and polarizability of ions. VSPER Theory - Common hybridization - sp, sp², sp³, sp³d, sp³d² and sp³d³, shapes of molecules. Molecular orbital theory: Shapes and sign convention of atomic overlapping, σ and π orbitals. Modes of bonds. Criteria for orbital overlap. LCAO concept. Concept of Types of molecular orbitals - bonding, anti-bonding and non-bonding. MOED of homonuclear diatomics - H₂, N₂, O₂, O₂²⁻, F₂ (unhybridized diagrams only) and heteronuclear diatomics CO, CN⁻, NO, NO⁺ and HF. Bond order, stability and magnetic properties.

S1-1-2: General Principles of Inorganic Qualitative Analysis

7 h

Anion analysis: Theory of sodium carbonate extract, classification and reactions of anions- CO₃²⁻, Cl⁻, Br⁻, SO₄²⁻, PO₄³⁻, BO₃³⁻, CH₃COO⁻, NO₃⁻. Interfering ions. Cation Analysis: Principles involved - Solubility product, common ion effect, general discussion for the separation and identification of group I individual cations (Hg₂²⁺, Ag⁺, Pb²⁺) with flow chart and chemical equations. Principle involved in separation of group II & IV cations. General discussion for the separation and identification of group II (Hg₂²⁺, Pb²⁺, Bi³⁺, Cd²⁺, Sb³⁺), III (Al³⁺, Fe³⁺), IV (Mn²⁺, Zn²⁺) individual cations with flow chart and chemical equations. Hydrolysis concept for the precipitation of Group V cations. General discussion for the separation and identification of group V individual cations (Ba²⁺, Sr²⁺, Cd²⁺) with flow chart and chemical equations. Theory of flame test. Identification of Group VI cations (Mg²⁺, NH₄⁺).

UNIT - II (Organic Chemistry)

15h (1 hr/week)

S1-O-1: Structural Theory in Organic Chemistry

5 h

Bond polarization: Factors influencing the polarization of covalent bonds, electronegativity - inductive effect. Application of inductive effect (a) Basicity of amines (b) Acidity of carboxylic acids (c) Stability of carbonium ions. Resonance - Mesomeric effect, application to (a) acidity of phenol (b) acidity of carboxylic acids and (c) basicity of anilines. Stability of carbocations, carbonions and free radicals. Hyper conjugation and its application to stability of carbonium ions, Free radicals and alkenes.

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Rohit
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Rohit

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Dr. M. S. RADHIKA, M.Phil, M.Sc.

Rohit

H. Venkatesh

Department of Chemistry
National Institute of Nutrition
Jamna-Osmania Road, Hyderabad-500 082, India.

S1-O-2: Acyclic Hydrocarbons

6 h

Alkanes—IUPAC Nomenclature of Hydrocarbons. Methods of preparation: From Grignard Reagent, Kolbe synthesis. Chemical reactivity - inert nature, free radical substitution, Halogenation example-reactivity, selectivity and orientation.

Alkenes - Preparation of alkenes (with mechanism) (a) by dehydration of alcohols (b) dehydrohalogenation of alkyl halides (c) by dehalogenation of 1,2 dihalides, Zaitsev's rule. Properties: Anti-addition of halogen and its mechanism. Addition of HX, Markonikov's rule, addition of H₂O, HOX, H₂SO₄ with mechanism and addition of HBr in the presence of peroxide (anti - Markonikov's addition). Oxidation (cis-additions) - hydroxylation by KMnO₄, OsO₄, Peracids (via epoxidation), hydroboration, ozonolysis - location of double bond. Dienes - Types of dienes, reactions of conjugated dienes - 1,2 and 1,4 addition of HBr to 1,3 - butadiene and Diel's - Alder reaction.

Alkynes— Preparation by dehydrohalogenation of vicinal dihalides, dehalogenation of tetrahalides. Physical Properties, Chemical reactivity - electrophilic addition of X₂, HX, H₂O (tautomerism), Oxidation (formation of enediol, 1,2diones and carboxylic acids), and reduction (Metal - ammonia reduction, catalytic hydrogenation).

Aromatic Hydrocarbons

4h

Introduction to aromaticity: Huckel's rule - Benzene, Naphthalene and Anthracene. Reactions - General mechanism of electrophilic substitution, mechanism of nitration, sulphonation and halogenation, Friedel Craft's alkylation and acylation. Orientation of aromatic substitution - Definition of ortho, para, and meta directing groups. Ring activating and deactivating groups with examples. Orientation - (i) activating groups: Amino, methoxy and alkyl groups (ii) Deactivating groups - nitro, nitrile, carbonyl, carboxylic acid, sulphonic acid and halo groups.

UNIT - III (Physical Chemistry)

15 h (1 hr/week)

S1-P-1: Atomic Structure and Elementary Quantum Mechanics

3 h

Black body radiation, heat capacities of solids, Rayleigh Jeans law, Planck's radiation law, photoelectric effect, Limitations of Classical Mechanics, Compton effect, De Broglie's hypothesis. Heisenberg's uncertainty principle.

S1-P-2: Gaseous State

5 h

Deviation of real gases from ideal behaviour. Van der Waals equation of state. Critical phenomenon. PV isotherms of real gases, continuity of state. Andrew's isotherms of CO₂. The Van der Waal's equation and critical state. Derivation of relationship between critical constants and van der Waal's constants. Experimental determination of critical constants. The law of corresponding states, reduced equation of states. Joule Thomson effect and inversion temperature of a gas. Liquefaction of gases: i) Linde's Method based on Joule Thomson effect ii) Claude's Method based on Adiabatic expansion of a gas.

S1-P-3: Liquid State and Solutions

4 h

Intermolecular forces, structure of liquids (qualitative description). Structural differences between solids, liquids and gases. Surface tension and its determination using stalagmometer. Viscosity of a liquid and determination of coefficient of viscosity using Ostwald viscometer. Effect of temperature on

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surface tension and coefficient of viscosity of a liquid (qualitative treatment only). Liquid crystals, the mesomorphic state: Classification of liquid crystals in to Smectic and Nematic, Application of liquid crystals.

Solutions

Liquid - liquid mixtures, ideal liquid mixtures, Raoult's and Henry's laws. Non ideal systems. Azeotropes: $\text{HCl-H}_2\text{O}$ and $\text{C}_2\text{H}_5\text{OH} - \text{H}_2\text{O}$ systems. Fractional distillation. Partially miscible liquids: Phenol - Water, Trimethyl amine - Water and Nicotine - Water systems.

Unit IV (Biological Chemistry)

15 h (1 hr/week)

SI-B-1: Chemical aspects of Food and Nutrition

8 h

Chemical composition of Human body. Energy yielding nutrients and Calorific value of carbohydrates, fats and proteins. Determination of Calorific value of foodstuffs by Bomb Calorimeter. Basic metabolic rate & factors effecting its specific dynamic action of food. Energy requirement & Recommended Daily Allowance (RDA) for children, pregnant & lactating women & normal adults.

SI-B-2 Essential Elements

7 h

Sources, absorption, biochemical functions, deficiency states of Na, K, Ca, Mg, P, S, Cl, F, I, B, Se, Fe, Zn, Cu, V, Cr, Mn, Co, Mo. Sources, physiological functions, deficiency states, recommended daily allowances of amino acids, lipids and vitamins. Protein malnutrition & its consequences.

References

Unit - I

1. Principles of Inorganic Chemistry by Puri, Sharma and Kalita, Vishal Publications 1996.
2. Concise Inorganic Chemistry by J.D. Lee, Third Edition.
3. Basic Inorganic Chemistry by F. A. Cotton, G. Wilkinson and Paul L. Gaus, Third Edition. Wiley Publishers 2001.
4. Vogel's Text Book of Quantitative Analysis by G.H. Jeffery and J Bassett,
5. J. Mendham and R.C. Denney Fifth Edition, Addison Wesley Longman Inc. 1999.

Unit - II

1. Text book of Organic Chemistry by Morrison and Boyd.
2. Text book of Organic Chemistry by Graham Solomons.
3. Text book of Organic Chemistry by Bruice Yuranis Powla.
4. Text book of Organic Chemistry by P. L. Soni.
5. General Organic chemistry by Sachin Kumar Ghosh.

Unit III

1. Principles of Physical Chemistry by Prutton and Maron.
2. Text Book of Physical Chemistry by Soni and Dharmahara.
3. Text Book of Physical Chemistry by K. L. Kapoor.

श्री डॉ. एन. सी. राधिका, अतिरिक्त (अभ्यास)
Dr. M. S. RADHIKA, Asst. Professor
सहायक प्राध्यापिका, आहार एवं पोषण विभाग
Assistant Professor, Department of Dietetics and Nutrition
संस्कृत विश्वविद्यालय, आहार एवं पोषण संशोधन संस्थान
Sanskrit University, Research Institute of Nutrition
जयपुर-ओरिसा (पी. ओ. बॉक्स- 751 007), ओरिसा

- Physical Chemistry through problems by S.K. Dogra.
- Text Book of Physical Chemistry by R.P. Verma.
- Elements of Physical Chemistry by Lewis Glasstone.

Unit IV

- Nutritional Biochemistry by Dr. S. Ramakrishnan.
- Fundamentals of Food & Nutrition by Sumati R. Mudambai & M. V. Rajagopal.
- Food & Nutrition by Swaminathan.
- Animal Physiology by A. K. Berry.
- Text Book of Biochemistry by Rama Rao.

Laboratory Course

(BCH 151 W)

Paper I - Qualitative Analysis - Semi Micro Analysis of Mixtures 45h (3 h / week)

Analysis of two anions (one simple and one interfering) and two cations in the given mixture.

Anions: CO_3^{2-} , SO_3^{2-} , S^{2-} , Cl^- , Br^- , I^- , CH_3COO^- , NO_3^- , PO_4^{3-} , BO_3^{3-} , SO_4^{2-}

Cations: Hg_2^{2+} , Ag^+ , Pb^{2+}

Hg_2^{2+} , Pb^{2+} , Bi^{3+} , Cd^{2+} , Cu^{2+} , As_3^{+5+} , Sb_3^{+5+} , $\text{Sn}^{2+/4+}$

Al^{3+} , Cr^{3+} , Fe^{3+}

Zn^{2+} , Ni^{2+} , Co^{2+} , Mn^{2+}

Ba^{2+} , Sr^{2+} , Ca^{2+}

Mg^{2+} , NH_4^+

References:

- Lab Manual for UG students prepared by Department of Chemistry, University College for Women, Kothi, Hyd.
- Qualitative analysis by Welcher and Hahn.
- Vogel's Qualitative Inorganic Analysis by Svehla.

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 Middle row: *gof*, *gof*, *gof*, *gof*, *gof*
 Bottom row: *gof*, *gof*, *gof*, *gof*, *gof*
 Right side: *kanis*, *kanis*, *kanis*, *kanis*, *kanis*

Dr. M. S. RADHIKA, PhD (Nutrition)

Department of Dietetics, ICMR-National Institute of Nutrition
 Jamnagar, Gujarat, India. Phone: 4001 019, ext 403

**B.Sc. II yr BIOLOGICAL CHEMISTRY
SEMESTER WISE SYLLABUS**

(For the batch admitted in 2020-2021)

**SEMESTER III
Paper-III**

(BCH 301 W)

Unit-I (Inorganic Chemistry)

15 h (1 hr/week)

S3-I-1 p-block Elements -II

6 h

Oxides: Types of oxides (a) Normal - acidic, basic amphoteric and neutral (b) Mixed (c) sub oxide (d) peroxide e) superoxide. Structure of oxides of C, N, P, S and Cl - reactivity, thermal stability, hydrolysis.

Oxy acids: Structure and acidic nature of oxyacids of B, C, N (HNO₂, HNO₃, H₂N₂O₂, HNO₄) P (H₃PO₂, H₃PO₃) S (H₂SO₃, H₂SO₄, H₂S₂O₃, H₂SO₅, H₂S₂O₈) P, S, Cl and I. Redox properties of oxyacids of Nitrogen: HNO₂ (reaction with FeSO₄, KMnO₄, K₂Cr₂O₇), HNO₃ (reaction with H₂S, Cu), HNO₄ (reaction with KBr, Aniline), H₂N₂O₂ (reaction with KMnO₄). Redox properties of oxyacids of Phosphorus: H₃PO₂ (reaction with HgCl₂), H₃PO₃ (reaction with AgNO₃, CuSO₄) Redox properties of oxyacids of Sulphur: H₂SO₃, H₂SO₃ (reaction with KMnO₄, K₂Cr₂O₇), H₂SO₄ (reaction with Zn, Fe, Cu), H₂S₂O₃ (reaction with Cu, Au), H₂SO₅ (reaction with KI, FeSO₄), H₂S₂O₈ (reaction with FeSO₄, KI). Redox properties of oxyacids of Chlorine.

Interhalogens- Classification- general preparation- structures of AB, AB₃, AB₅ and AB₇ type and reactivity

Poly halides- Definition and structure of ICl₂⁻, ICl₄⁻ and I₃.

Pseudohalogens: Comparison with halogens.

S3-I-2: Chemistry of d-block elements

5 h

Characteristics of d-block elements with special reference to electronic configuration variable valence, magnetic properties, catalytic properties and ability to form complexes. Stability of various oxidation states and E.M.F. Comparative treatment of second and third transition series with their 3d analogues. Study of Ti, Cr and Cu triads. Titanium triad – electronic configuration and reactivity of +3 and +4 states – oxides and halides. Chromium triad – reactivity of +3 and +6 states. Copper triad – reactivity of +1, +2 and +3 states.

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S3-I-3: Chemistry of f-block elements:

4 h

Chemistry of Lanthanides: Position in periodic table, Electronic structure, oxidation state, ionic and atomic radii- lanthanide contraction- cause and consequences, anomalous behavior of post lanthanides - complexation - type of donor ligands preferred. Magnetic properties - paramagnetism. Colour and spectra, f-f transitions – occurrence and separation – ion exchange method, solvent extraction.

Chemistry of actinides- general features – electronic configuration, oxidation state, actinide contraction, colour and complex formation. Comparison with lanthanides.

UNIT – II (Organic Chemistry)

15 hr (1h / week)

S3-O-1: Carboxylic acids and derivatives

5h

Introduction, Nomenclature, Preparation: a) Hydrolysis of Nitriles, amides and esters. b) Carbonation of Grignard reagents. Special methods of preparation of Aromatic Acids - Oxidation of Arenes. Physical properties- hydrogen bonding, dimeric association. Chemical properties – Reactions involving H, OH and COOH groups - salt formation, anhydride formation, Acid halide formation, Esterification (mechanism) & Amide formation. Reduction of acid to the corresponding primary alcohol *via* ester or acid chloride. Degradation of carboxylic acids by Huns Diecker reaction, Schmidt reaction (Decarboxylation). Arndt – Eistert synthesis, Halogenation by Hell – Volhard - Zelensky reaction. Carboxylic acid Derivatives – Hydrolysis and Ammonolysis of acid halides, Acid anhydrides and esters (mechanism of ester hydrolysis by base and acid). Hydrolysis and dehydration of amides.

S3-O-2: Nitrohydrocarbons

3h

Introduction, Nomenclature and classification of Nitro hydrocarbons, Structure, Tautomerism of Nitroalkanes leading to aci and keto forms, Preparation of Nitroalkanes. Reactivity - halogenation, reaction with HNO_2 (Nitrous acid), Nef reaction, reduction. Aromatic Nitrohydrocarbons: Preparation of Nitrobenzene by Nitration.

Physical properties, chemical reactivity – Reduction of Nitrobenzenes in different media.

S3-O-3: Amines, Cyanides and Isocyanides

7 h

Introduction, Nomenclature, Amines: classification into 1° , 2° , 3° Amines and Quarternary ammonium compounds. Preparative methods – Ammonolysis of alkyl halides, Gabriel synthesis, Hoffman's bromamide reaction (mechanism). Reduction of Amides and Schmidt reaction. Physical properties. Use of amine salts as phase transfer catalysts. Chemical Properties: a) Alkylation b) Acylation c) Carbylamine reaction d) Hinsberg separation. Reaction with Nitrous acid of 1° , 2° , 3° (Aliphatic and aromatic amines). Electrophilic substitutions of Aromatic amines – Bromination and Nitration, oxidation of aryl and 3° Amines, diazotisation. Diazonium salts: Preparation with mechanism. Synthetic importance – a) Replacement of diazonium group by – OH, X (Cl) - Sandmeyer and Gatterman reaction, by fluorine (Schiemann's reaction), by iodine, CN, NO_2 , H and aryl groups. Coupling Reaction of diazonium salts. i) with phenols ii) with anilines. Reduction to phenyl hydrazines.

Cyanides and isocyanides: Structure. Preparation of cyanides from a) Alkyl halides b) from amides c) from aldoximes. Preparation of isocyanides from Alkyl halides and Amines. Properties of cyanides and isocyanides, a) hydrolysis b) addition of Grignard reagent iii) reduction iv) oxidation.

UNIT – III (Physical Chemistry)

15 hr (1h / week)

S3-P-1: Thermodynamics-I

10 h

Introduction to Thermodynamics- First law of thermodynamics statement- various forms mathematical expression. Zeroth law of thermodynamics - State function and path functions. Energy as a state function and exact differential. Work of expansion and heat absorbed as path function.

Expression for work of expansion, sign convention problems on first law. Heat changes at constant pressure and heat changes at constant volume. Enthalpy. Heat capacities at constant pressure and constant volume. Derivation of $C_p - C_v = R$. Isothermal adiabatic processes. Reversible and irreversible processes. Reversible change and maximum work. Derivation of expression for maximum work for isothermal reversible process. Problems. Internal energy of an ideal gas. Joules experiment. Joule-Thompson coefficient. Adiabatic changes in ideal gas, derivation of equation, $PV^\gamma = \text{constant}$. P-V curves for isothermal and adiabatic processes. Heat of a reaction at constant volume and at constant pressure, relation between ΔH and ΔV . Variation of heat of reaction with temperature. Kirchhoff's equation and problems. Limitations of first law and need for second law. Statement of second law of thermodynamics. Cyclic process. Carnot's theorem, Carnot's cycle. Derivation of efficiency of heat engine. Problems.

S3-P-2: Thermodynamics-II

5 h

Entropy: Definition from Carnot's cycle. Entropy as a state function. Entropy as a measure of disorder. Sign of entropy change for spontaneous and non- spontaneous processes & equilibrium processes. Entropy changes in i). Reversible isothermal process, ii). Reversible adiabatic process, iii). Phase change, iv). Reversible change of state of an ideal gas. Problems. Entropy of mixing of ideal gases. Third law of thermodynamics - significance - Free energy Gibb's function (G) and Helmholtz's function (A) as thermodynamic quantities. Concept of maximum work and network ΔG as Criteria for spontaneity. Derivation of equation $\Delta G = \Delta H - T\Delta S$. Significance of the equation. Gibb's equations and Maxwell relations. Variation of G with P, V and T.

Unit – IV (General Chemistry)

15 h (1hr/week)

S3-G-1: Metal Carbonyls and Organometallic Chemistry

4h

Metal Carbonyls: Preparation and properties of $Ni(CO)_4$. Structural features of $Ni(CO)_4$, $Fe(CO)_5$, $Fe_2(CO)_9$, $Fe_3(CO)_{12}$ and $Cr(CO)_6$ – 18 Valence electron rule.

Definition, nomenclature and classification of organometallic compounds. Methods of preparation, properties and applications of alkyl and aryl compounds of Li, Mg and Al.

S3-G-2: Green Chemistry

6h

Introduction: Definition, Basic Principles: Prevention of waste, maximum incorporation of reactants, prevention or minimization of Hazardous products. Designing safe chemicals, Energy requirements for synthesis, Selection of solvents, Selection of starting materials, use of protecting groups, Use of catalysts, Biodegradable products.

[Handwritten signatures and dates in green and black ink, including "27/4/21" and "Alkane"]

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डॉ. एम. एस. राधिका, पीएचडी (पोषण)
Dr. M.S. RADHIKA, PhD (Nutrition)
वैज्ञानिक-ई (उप निदेशक) व निभागाध्यक्ष
Science-E & Head of the Department
आहारविज्ञानविभाग, आईसीएमआर-राष्ट्रीयपोषणसंस्था
Department of Dietetics, ICMR-National Institute of Nutr
जामे-उस्मानिया (पोस्ट), सिकंदराबाद-500 009, भारत
Jamai-Osmania (PO), Secunderabad-500 007, INDIA

- Green Reagents: Poly NBS
- Green Catalyst: Use of clay as catalyst in Acylation reaction.
- Microwave induced synthesis: Introduction, Ex: Hydrolysis of Benzyl chloride.
- Ultrasound assisted Green Synthesis: Introduction, Ex: Cannizzaro reaction.
- Biocatalyzed Green Synthesis: Synthesis of Semi-synthetic penicillin.

S3-G-3: Dilute Solutions & Colligative Properties

5h

Dilute Solutions, Colligative Properties, Raoult's law, Relative lowering of vapour pressure, molecular weight determination. Osmosis - laws of osmotic pressure, its measurement, determination of molecular weight from osmotic pressure. Elevation of boiling point and Depression of freezing point. Derivation of relation between molecular weight and elevation in boiling point and depression in freezing point.

References

General Reference: B.Sc I Year Chemistry : Semester II, Telugu Academy publication, Hyd.

Unit I

- Principles of Inorganic Chemistry by Puri, Sharma and Kalia Vishal Publications 1996.
- Concise Inorganic Chemistry by J.D. Lee 3rd Edition.
- Basic Inorganic Chemistry by F.A. Cotton, G. Wilkinson and Paul.L. Gaus 3rd Edition. Wiley Publishers 2001.
- Chemistry of the elements by N.N. Greenwood and A. Earnshaw Pergamon Press 1989.
- Inorganic Chemistry by Shriver and Atkins 3rd Edition. Oxford Press 1999.
- Inorganic Chemistry Principles of structure and reactivity by James E. Huhey,
- E.A. Keiter and R.L. Keiter 4th Edition.
- Textbook of inorganic chemistry by R Gopalan.

Unit II

- Organic Chemistry by Morrison and Boyd.
- Organic Chemistry by Graham Solomons.
- Organic Chemistry by Bruce Yuranis Powla.
- Organic Chemistry by L. G. Wade Jr.
- Organic Chemistry by M. Jones, Jr
- Organic Chemistry by John McMurry.
- Organic Chemistry by Soni.
- General Organic chemistry by Sachin Kumar Ghosh.
- Organic Chemistry by C N Pillai.
- Organic Chemistry by Jain & Sharma.

Unit III

1. Physical chemistry by P W Atkins
2. Principles of physical chemistry by Prutton and Marron.
3. Text Book of Physical Chemistry by Soni and Dharmahara.
4. Text Book of Physical Chemistry by Puri and Sharma
5. Text Book of Physical Chemistry by K. L. Kapoor
6. Physical Chemistry through problems by S. K. Dogra.
7. Elements of Physical Chemistry by Lewis and Glasstone.

Unit IV

1. Principles of Inorganic Chemistry by Puri, Sharma and Kalia Vishal Publications 1996.
2. Concise Inorganic Chemistry by J.D. Lee 3rd Edition.
3. Basic Inorganic Chemistry by F.A. Cotton, G. Wilkinson and Paul L. Gaus 3rd Edition. Wiley Publishers 2001.
4. Green Chemistry by V. K. Ahluwalia.
5. New Trends in Green Chemistry – V. K. Ahluwalia and M. Kidwai.
6. Physical chemistry by P W Atkins
7. Principles of physical chemistry by Prutton and Marron.
8. Text Book of Physical Chemistry by Soni and Dharmahara.
9. Text Book of Physical Chemistry by Puri and Sharma

Laboratory Course

Paper III {BCH 351 W} - Organic Chemistry

45hrs (3h/week)

Synthesis of Organic Compounds:

- Acylation: Preparation of Aspirin and Benzanilide.
Aromatic electrophilic substitution: Nitration: Preparation of *m*-dinitro benzene.
Three component coupling: One pot synthesis of dihydropyrimidinone
Halogenation: Preparation of *p*-bromo acetanilide, 2,4,6-tribromo phenol
Oxidation: Preparation of Benzoic acid
Esterification: Preparation of *n*-Butyl acetate.
Methylation: Preparation of β - Naphthyl methyl ether (Naroline).
Condensation: Preparation of Benzilidene aniline.
Diazotisation: Azo-coupling of β -Naphthol.

Microwave assisted synthesis of Asprin – DEMO (demonstration only)

References:

1. Lab manual for UG students prepared by Department of Chemistry, University College for Women, Koti, Hyd.
2. Practical Organic Chemistry by Mann and Saunders, 1974, Longmann Publications.
3. Comprehensive Practical Organic Chemistry – Preparation and Quantitative Analysis by V. K. Ahluwalia and Renu Aggarwal, Orient Black Swan Publishers, 2004.

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Alpaca
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mu
Palu
Kavitha
Mn

डॉ. एम.एस. राधिका, पीएचडी (पोपो)
DR. M.S. RADHIKA, PhD (Nutrition)
वैज्ञानिक (उप निदेशक) व विभागाध्यक्ष
Science-E & Head of the Department
आहारविज्ञानविभाग, आईसीएमआर-राष्ट्रीयपोषण
Department of Dietetics, ICMR-National Institute of
जाने-उस्मानिया (पोस्ट), सिकंदराबाद-५०० ००४, भारत
Jamai-Osmania (PO), Secunderabad-500 007, IN

B.Sc. Chemistry II Year Semester-III
Skill Enhancement Course- I (SEC-I) (2 Credits)
Rules in Chemistry Laboratory and Lab Reagents

Unit I: Laboratory Safety Rules and Regulations **15 h (1 hr/week)**

General rules and regulations for lab safety: Minimizing Risks of Hazards, Personal Protective Equipment (PPE) - Hair, Dressing for the Laboratory, Eye Protection, Eyewash fountain, Gloves, Laboratory Protocols, Labeling Chemicals, Careful reading of labels Prevention of Inhaling Harmful Chemicals, Guide to Chemical Hazards, Chemical Spills etc. Accidents use of fire extinguisher and first aid kit in the laboratory, safety symbols- Preparation of the charts by the students and display of charts in chemistry labs. Calibration of fractional weights, calibration of glass ware - burette, pipette, standard flask, Normality/Molarity and specific gravity of concentrated acids – Preparation of dilute solutions (Numerical problems). Precautions to be taken in the preparation of dilute acids and bases. Preparation of stock solutions of salts with specific examples. Properties of primary standard salt and preparation of standard solution. Good laboratory practices-maintenance of observation book and record.

UNIT 2: Preparation of Lab Reagents **15 h (1 hr/week)**

Preparation of indicators and use of indicators in volumetric analysis- acid base titrations, redox titrations, precipitation titrations and complexometric titrations. Role of an indicator in detecting end point (Phenolphthalein, Methyl orange, Methyl-red, Potassium Chromate, Diphenylamine, EBT, Murexide, etc). Preparation of buffers – pH 10 ammonical buffer and acetate buffer solutions. Preparation of commonly used reagents : Ammonium hydroxide solution, Ammonium molybdate reagent, Ammonium hydrogen phosphate solution, Bayer's reagent, Benedict's solution, Bromine water, Dimethyl glyoxime reagent, 2,4-Dinitrophenyl hydrazine reagent, Eriochrome black-T reagent Fehling solution, Ferric chloride solution, Ferrous sulphate solution, Iodine solution, Molisch's reagent, Nessler's reagent, Neutral FeCl₃, Schiff's reagent, Silver nitrate solution, Sodium carbonate solution , Sodium hydroxide (Caustic soda) solution, Starch solution, Tollen's reagent. (reference work and submission of assignments). Charts preparation depicting course content.

RECOMMENDED BOOKS

1. Vogel's Text Book of Quantitative Chemical Analysis, 5th edition.
2. Vogel's Text Book of macro and semimicro qualitative inorganic analysis. G. Svehla, 5th edition.
3. edition.
4. Chemistry Reagent Manual Prepared by Chemistry Department, SGTB Khalsa College under
5. DBT's Star College Scheme, University of Delhi (Available: online)
6. American Chemical Society Safety in Academic Chemistry Laboratories 8th edition.

[Course objectives (CO)]: To improve the skills of students in the application of theory and practical knowledge. To fill the gap between theory and practicals. To train the students in understanding laboratory safety rules and to improve the skills in preparation of laboratory reagents]

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Department of Diagnostics, ICMR-National Institute of Nutrition
Jamal-Osmania (PO), Secunderabad-500 007, INDIA

B.Sc. Chemistry II Year Semester III
Skill Enhancement Course- II (SEC -II) (2 Credits)
REMEDIAL METHODS FOR POLLUTION, DRINKING WATER AND SOIL
FERTILITY STANDARDS

UNIT I: Remedial Methods for Pollution Prevention and control of air pollution
15 h (1hr/week)

Ozone hole-causes and harm due to ozone depletion. The effect of CFCs in Ozone depletion and their replacements. Global Warming and Greenhouse Effect Precautions to control global warming. Deleterious effect of pollutants - Endangered Monuments- acid rain. Precautions to protect monuments. Sources of Radiation pollution - Chernobyl accident and its Consequences. Radiation effect by the usage of cell phones and protection tips. Deleterious effects of cell phone towers and health hazards.

Sources of water pollution-(i). Pollution due to pesticides and inorganic chemicals, (ii). Thermal pollution (iii). Ground water pollution (iv). Eutrophication.

Methods for control of water pollution and water recycling. Dumping of plastics in rivers & oceans and their effect on aquatic life. Determination of (i) Dissolved Oxygen and (ii) Chemical Oxygen Demand in polluted water - Illustration through charts (or) demonstration of experiments. Sources of soil pollution (i). Plastic bags, (ii) Industrial and (iii) Agricultural sources. Control of soil pollution. Environmental laws in India. Environmental benefits of planting trees.

UNIT II: Drinking Water and Soil Fertility Standards and Analysis
15 h (1 hr/week)

Water Quality and Common Treatments for Private Drinking Water Systems: Drinking Water Standards-Primary Drinking Water Standards: Inorganics, Organics and Volatile Organic Chemicals. Secondary Drinking Water Standards-Inorganics and Physical Problems. Water Testing. Mineral Analysis. Microbiological Tests, Pesticide and Other Organic Chemical Tests. Principle involved in Water Treatment Techniques. (i) Reverse osmosis (ii) Disinfection methods such as chlorination, ultraviolet light, ozonation etc (iii) Chemical oxidation and (iv) Ion exchange (water softeners). Visit to nearby drinking water plants and interaction at sites.

Introduction to Soil Chemistry.- Basic Concepts. Effect of pH on nutrient availability. Macronutrients and their effect on plants.-Carbon, Hydrogen, Oxygen, Nitrogen and Phosphorus other macronutrients- Calcium, Magnesium and Sulfur. Micronutrients and their effect on plants. Boron ($B_4O_7^{2-}$), Copper (CO_3^{2-}), Iron (Fe^{2+} , Fe^{3+}), Manganese (Mn^{2+}), Molybdenum (MoO_4^{2-}), Zinc (Zn^{2+}), Cobalt (Co^{3+}), Chlorine (Cl) and Others. Determination of soil nitrogen by Kjeldahl method.- Illustration through charts (or) demonstration of experiment. Visit to nearby agricultural farms and interaction with farmers. Discussion with farmers on the use of Soil Analysis Kits.

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Below it, the name "Anurag" is written in blue ink.
To the right, "Ravi" is written in blue ink.
Further right, "Vijay" is written in blue ink.
Below "Anurag", "Ravi", and "Vijay", there are several green checkmarks and scribbles.
At the bottom right, "Kavitha" is written in blue ink.
Other names like "Mr." and "Mrs." are partially visible.

References

1. Remedial Methods for Pollution, Drinking Water and Soil Fertility Standards, Author: Dr G. Vanjatha.
2. Remedial methods for pollution, drinking water and soil fertility standards, Telugu version, Authors: Dr N. Yogi Babu, Dr. G. Vanajatha and M.Srilatha.
3. Environmental Pollution,download.nos.org/333courseE/10.pdf
4. CFC Replacements,butane.chem.uiuc.edu/pshapley/Environmental/L21/3.html
5. Effects of Acid Rain on Buildingswww.air-quality.org.uk/12.php
6. Acid Rain Effects - Buildings - Chemistry chemistry.elmhurst.edu/vchembook/196buildings.html
7. Determination of dissolved oxygen (DO) www.cutm.ac.in/pdf/env%20engg%20lab%20manual.pdf
8. Determination of chemical oxygen demand of wastewater www.pharmaguideline.com > quality control >test
9. How to protect national heritage -ways to protect monuments www.youthkiawaaz.com/2011/03/how-to-protect-national-heritage/.
10. Chernobyl nuclear power plant accident - NRC www.nrc.gov/reading-rm/doc- collections/factsheets/chernobyl-bg.pdf
11. Side-effects of harmful radiation from mobile phones and towers pib.nic.in/newsite/printrelease.aspx?relid=116304
12. Cell Phone Radiation Protection - Highly Effective Tips https://www.electricsense.com/775/how-to-protect-yourself-from-cell-phone-radiation/
13. Chemical Waste that Impact on Aquatic Life or Water Quality blog.idrenvironmental.com/chemical-waste-that-impact-on-aquatic-life-or-waterquality
14. Trees and Your Environment - Clean Air Gardening www.cleanairegardening.com/plantingtrees
15. water quality and common treatments for private drinking water .extension.uga.edu/publications/detail.html?number=b939
16. Soil chemistryhttps://casfs.ucsc.edu/about/publications/Teaching-Organic-Farming/PDFdownloads/2.2-soil-chemistry.pdf
17. Soil Analysis-Determination of Available Nitrogen. - Amrita Virtual Lab vlab.amrita.edu/?sub=2&brch=294&sim=1551&cnt=1

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डॉ.एम.एस. राधिका, पीएचडी (पोषण)
Dr. M.S. RADHIKA, PhD (Nutrition)
वैज्ञानिक-ई (उप निदेशक) व विभागाध्यक्ष
Science-E & Head of the Department
आहारविज्ञानविभाग, आईसीएमआर-राष्ट्रीयपोषणसंस्थान
Department of Dietetics, ICMR-National Institute of Nutrition
जाम्हेर-उस्मानिया (पोस्ट), सिकंदराबाद-५००००७, भारत
Jamai-Osmania (PO), Secunderabad-500 007, INDIA

B.Sc. III yr **BIOLOGICAL CHEMISTRY**
SEMESTER WISE SYLLABUS
(For the batch admitted in 2019-2020)
SEMESTER V
Discipline Centric Elective A
Biochemistry

BC 506

UNIT-I

S5-DCEI-1: Enzymes and Enzyme catalysis

15 h

Importance of enzymes, nomenclature, classification with examples. Properties of enzymes. Concept of halo, apo-enzymes, cofactors - small organic molecules, metal ions. Nature of non- enzymatic and enzymatic catalysis. Isoenzymes, and multimeric enzyme complexes. Enzyme assay and units of activity). Specificity of enzymes.

Basic mechanisms for increase rates by enzymes: general acid base catalysis, covalent catalysis. Mechanism of catalysis of carboxypeptidase, chymotrypsin. Concept of turnover, Allosteric enzymes, Structure and nature of active site. Factors affective enzyme activity-Enzyme concentration, substrate concentration, P^H , temperature. Formation of enzyme-substrate complex. Enzyme inhibition-competition, non-competitive and un-competitive exhibition.

UNIT -II

S5- DCEI-2: Metabolism of Biomolecules.

15h

1. Carbohydrate metabolism

6h

Reactions and energetics of glycolysis,. Reactions and energetics of TCA cycle. Regulation of glycolysis and TCA cycle. Reactions and physiological significance of pentose phosphate path way. Major disorders of carbohydrate metabolism with respect to diabetes.

2. Amino acid metabolism

6h

Reactions of amino acids- Transamination, Decarboxylation, oxidative deamination, Urea cycle. Fate of the carbon skeleton of amino acids- Glycogenic and ketogenic amino acids. Metabolism of phenylalanine, tyrosine, cysteine and valine.

3. Lipid Metabolism

3 h

Denovo synthesis of fatty acids. β – oxidation of fatty acids (Knoop’s theory) – activation of fatty acid, transport of fatty acids into mitochondria and β – oxidation. ATP yield from fatty acid oxidation – even and odd number chain fatty acids. Formation of Ketone Bodies (brief treatment).

UNIT-III

S5- DCEII-3: Endocrinology & Signal Transduction.

15h

Endocrinology: Hormones: Definition and classification based on structure with examples, function and regulation of hormones of hypothalamus, pituitary, thyroid, adrenal, parathyroid, gonads, pancreas, placenta and gastrointestinal. Feedback inhibition and control.

Signal Transduction:Transduction by intracellular receptors, cell surface receptors(ion channels, catalytic receptors) and receptor involving secondary messenger molecules-CAMP, calcium and inositol- Mechanism of action.

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UNIT-IV

S5-DCEI-4: Clinical Biochemistry

15 h

8 h

Importance of enzyme changes in diseases - SGOT, SGPT, LDH, Acid and Alkaline Phosphates. Glucose tolerance test. Liver function tests - jaundice, hepatitis. Renal function tests - glomerulonephritis. Atherosclerosis and Coronary Heart Disease - contributory factors, formation and nature of plaque. Major vaccines and their uses.

S5-DCEI-5: Blood and Biochemistry of Blood Coagulation

7h

Introduction, Functions of Blood, Blood volume, Blood Groups, Blood Transfusion, Blood Composition, Physical Characteristics of Blood. RBC, WBC and Platelets. Blood Coagulation, Inhibitors of Coagulation. Fibrinolysis. Blood clotting Factors. Plasma Proteins. Formation of Plasma Proteins, Functions of Plasma proteins.

References

1. Biochemistry by Lehninger.
2. Biochemistry by Stryer.
3. Schaum's series of Biochemistry.
4. Biochemistry by Sathyanarayana.
5. Biochemistry- A case oriented approach by Montgomery.
6. Tietz Fundamentals of Clinical Chemistry.
7. Lipponacs series of biochemistry.
8. Biochemistry by Mathews.
9. Biochemistry by Voet and Voet.
10. Lecture notes on clinical biochemistry by A.F Smith.

Suraj
27/11/21

Abhishek

E

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Deepak

Balaji

YJB

Star

Star

Kavitha

Star

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Ms

डॉ.एम.एस. राधिका, पीएचडी (पोषण)
Dr. M.S. RADHIKA, PhD (Nutrition)
वैज्ञानिक-ई (उप निदेशक) व विभागाध्यक्ष
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Department of Dietetics, ICMR-National Institute of Nutrition
जामे-उस्मानिया (पोस्ट), सिकंदराबाद-५०० ००९, भारत
Jamai-Osmania (PO), Secunderabad-500 007, INDIA

Generic Elective BS 501
Molecular Biology

UNIT-I

SS-DCEII-1: DNA replication & Transcription

15h

1. DNA Replication:

DNA replication in prokaryotes-conservative, semiconservative and dispersive types. DNA polymerases, other enzymes and protein factors involved in replication. Mechanism of replication, Inhibitors of replication.

8h

2. Transcription:

7h

Transcription RNA polymerase, promoters, initiation, elongation and Termination of RNA synthesis, Inhibitors of Transcription, Reverse transcriptase, post transcriptional modifications.

UNIT-II

SS-DCEII-2: Translation & Transgenic Technology

15 h

1. Translation

8h

- Genetic Code: Basic features of genetic code, biological significance of degeneracy, Wobble Hypothesis, gene within gene and overlapping genes.
- Mechanism of translation: Ribosome structure, A & P sites, charged to RNA, initiator codon, Shine-Dalgarno consensus sequence, formation of initiation complex, role of elongation factors and release factors. Inhibitors of protein synthesis, post translational modifications

2. Transgenic technology:

7h

Animal biotechnology-cells and cell lines, media for cell culture and equipment. Production of viral vaccines, Transgenic animals. Plant biotechnology-plant cell culture, plant protoplast isolation and protoplast fusion, plant viruses as vectors, Ti plasmid as vector and transgenic plants.

UNIT-III

SS-DCEII-3: Immunology

15h

Innate and acquired immunity. Introduction to antigen, antibody, hapten and antigenic determinant(epitope). Structure of antibody, classification of immunoglobulins, functions of antibody, antibody diversity- Factors and principles, antigen-antibody reactions: agglutination, immune precipitation, immunodiffusion. Primary and secondary response. Lymphocytes-cellular and humoral immunity, T and B cells (outlines).

UNIT-IV

SS-DCEII-4: Recombinant DNA technology

15 h
8h

Tools of r-DNA technology-Enzymes(Restriction endonucleases, ligase, phosphatases, reverse transcriptase, polynucleotide kinases, terminal transferases, S1 nucleases and RNAase H), steps in DNA cloning, cloning vectors- plasmids, Ti plasmids, cosmids, Lambda phages, shuttle vectors, expression vectors. Application of recombinant DNA technology e.g., insulin and human growth hormones.

SS-DCEII-5: Industrial microbiology

7h

Fermentation: surface, submerged, batch, continuous down stream processing, production

Handwritten notes:
Ant
Penicillin
Bacteria
Mould
Beer
Wine
Milk
Cheese
Yoghurt
Butter
Curd
Kamdhenu

Fermentation, basic design of fermentor-oxygen supply, aeration, agitation, control of commercially important products like alcohol, penicillin, amylase.

References

1. Biochemistry by Lehninger.
2. Biochemistry by Stryer.
3. Schaum's series of Biochemistry.
4. Biochemistry by Satyanarayana.
5. Biochemistry - A case oriented approach by Montgomery.
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श्री. एम. एस. राधिका, अध्यक्ष (धर्म)
Dr. M. S. RADHIKA, Head (Honorary)
Head of the Department
Science & Head of the Department
अनुसंधान विभाग, आर. एन. आर. राष्ट्रीय संस्थान
Department of Dietetics, All India Institute of Nutrition
अनुसंधान विभाग, आर. एन. आर. राष्ट्रीय संस्थान
Department of Dietetics, All India Institute of Nutrition
Jammu - Chinnari (PO), Secunderabad-500 007, INDIA

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Laboratory Course

Paper V (BCH 551 W)

45hrs (3h/week)

1. Estimation of Protein by Biuret method.
2. Determination of Reducing Sugars by DNS reagent.
3. Determination of Acid Value of fats/oils.
4. Determination of sodium, Potassium, Calcium and Lithium ions by Flame Photometry.
5. Determination of Tyrosine by Nitrosonaphthol method.
6. Determination of saponification number in oil sample.
7. Determination of Iodine Value in oil sample.
8. Extraction of Starch from Potato.

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डॉ.एम.एस. राधिका, पीएचडी (पोषण)
Dr. M.S. RADHIKA, PhD (Nutrition)
वैज्ञानिक-ई (उप निदेशक) व विभागाध्यक्ष
Science-E & Head of the Department
आहारविज्ञानविभाग, आईसीएमआर-राष्ट्रीयपोषणसंस्थान
Department of Dietetics, ICMR-National Institute of Nutrition
जामे-उस्मानिया (पोस्ट), सिकंदराबाद-500 008, भारत
Jamai-Osmania (PO), Secunderabad-500 007, INDIA

B.Sc. CBCS BIOLOGICAL CHEMISTRY
Theory Model Question Paper For
Semester I, II, III, IV

Time : 3Hrs. Max. Marks : 80

Note: Answer eight questions from Part-A and all questions from Part-B. Each question carries 4 marks in Part-A and 12 marks in Part-B.

Part-A (8 x 4 = 32 Marks)
(Short Answer Type)

Write any Eight questions of the following

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.
- 8.
- 9.
- 10.

Part-B (4 x 12 = 48 Marks)
(Essay Answer Type)

Answer all Questions

1 a) (OR)

b) (OR)

b) (OR)

a) (OR)

b) (OR)

a) (OR)

b) (OR)

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Handwritten signature "Kavish" in black ink.

डॉ. एम. एम. राधिका, चीफ़ (स्त्री)
Dr. M.S. RADHIKA, PhD (Nutrition)
अधीक्षक (स्त्री) भारतवासी अनुसंधानकर्ता
Science & Head of the Department
आहार व पोषण विभाग, आर.डी.ए. राष्ट्रीय पोषण संस्थान
Department of Diets, ICNR-National Institute of Nutrition
अनुसंधान भवन, बी.ए. रोड, बी.ए. रोड, अजमेर-305 007, INDIA
Janak Chaurasia (P.O), Secunderabad-500 007, INDIA

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B.Sc. CBCS BIOLOGICAL CHEMISTRY
Practical Model Question Paper For
Semester I, II, III, IV, V & VI

Time: 3Hrs

Max. Marks :50

SEMESTER	External (Marks)	Internal (Marks)	Total (Marks)
I	40	10	50
II	40	10	50
III	40	10	50
IV	40	10	50

Singh
27/11/21

Abula

Atyapak

mya

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Paceni

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Kasid

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M.S.

डॉ. एम.एस. राधिका, पीएचडी (पोषण)
Dr. M.S. RADHIKA, PhD (Nutrition)
वैज्ञानिक-ई (उप निदेशक) व विभागाध्यक्ष
Science-E & Head of the Department
आहारविज्ञानविभाग, आईसीएनआर-राष्ट्रीयपोषणसंस्थान
Department of Dietetics, ICMR-National Institute of Nutrition
जामे-उस्मानिया (पोस्ट), सिकंदराबाद-500 009, भारत
Jamai-Osmania (PO), Secunderabad-500 009, INDIA