



RAFFLES UNIVERSITY, NEEMRANA, ALWAR (RAJASTHAN)
Japanese Zone, National Highway-8, Neemrana-307105
Tel.: +91-9214205555 www.rafflesuniversity.edu.in

(Syllabus and Scheme of Studies w. e. f. 2016-17 onwards)

B. Sc. (Six –Semester Course)



RAFFLES

UNIVERSITY

DEPARTMENT OF CHEMISTRY
SCHOOL OF BASIC AND APPLIED SCIENCES
RAFFLES UNIVERSITY, NEEMRANA, ALWAR (RAJASTHAN)
SCHOOL OF BASIC AND APPLIED SCIENCES

Department of Chemistry
(Syllabus and Scheme of Studies w. e. f. 2016-17 onwards)
B. Sc. I Year (I Semester)

Schedule per week Lectures: 2

Examination Time : 3 Hrs

Maximum Marks:

50(20+30)

Subject : Inorganic Chemistry

Paper Code : CH-

101

Note: Examiner will set nine questions and the students will be required to attempt five questions in all, Question number one is compulsory containing six short answer types' questions covering the entire syllabus and will be of 1 mark. Further examiner will be set two questions from each unit and the students will be required to attempt one question from each unit which will be of 6 marks each.

UNIT-I

Atomic Structure: Idea of de-Broglie matter waves, Heisenberg uncertainty principle, atomic orbital's, quantum numbers, Aufbau and Pauli exclusion principles, Hund's multiplicity rule. Electronic configurations of the elements, radial and angular wave functions and probability distribution curves, shapes of s, p, and d orbitals.

UNIT-II

Periodic Table: General principles of periodic table, effective nuclear charge, Slater's rules. and Atomic ionic radii, ionization energy, electron affinity and electronegativity definition, methods of determination or evaluation, trends in periodic table (s & p block elements).

UNIT-III

Covalent Bond: Valence bond theory and its limitations, directional characteristics of covalent bond, various types of hybridization and shapes of simple inorganic molecules and ions (BeF_2 , BF_3 , CH_4 , PF_5 , SF_6 , IF_7 , SO_4^{2-} , ClO_4^{-1}) Valence shell electron pair repulsion (VSEPR) theory to NH_3 , H_3O^+ , SF_4 , ClF_3 , ICl_2^- and H_2O . MO theory of heteronuclear (CO and NO) diatomic molecules, bond strength and bond energy, percentage ionic character from dipole moment and electronegativity difference.

UNIT-IV

Ionic Solids: Ionic structures (NaCl , CsCl , ZnS (Zinc Blende), CaF_2) radius ratio effect and coordination number, limitation of radius ratio rule, lattice defects, semiconductors, lattice energy (mathematical derivation excluded) and Born- Haber cycle, solvation energy and its relation with solubility of ionic solids, polarizing power and polarisability of ions, Fajan's rule.

Suggested books:

1. Inorganic Chemistry, by Malik, Tulji Madan, S.Chand . & company.
2. A text book of Inorganic Chemistry, O P Tandon, G R Bathla Pulication pvt Ltd

3. Inorganic Chemistry, by James E. Huheey, E.A. Keiter, R. L. Keiter, O. K. Medhi
4. Concise Inorganic Chemistry, by J. D. Lee, Oxford

SCHOOL OF BASIC AND APPLIED SCIENCES

Department of Chemistry

(Syllabus and Scheme of Studies w. e. f. 2016-17 onwards)

B. Sc. I Year (I Semester)

Schedule per week Lectures: 2

Examination Time	: 3 Hrs	Maximum	Marks:
50(20+30)			
Subject	: Organic Chemistry	Paper Code	: CH-103

Note: Examiner will set nine questions and the students will be required to attempt five questions in all, Question number one is compulsory containing six short answer types questions covering the entire syllabus and will be of 1 marks. Further examiner will be set two questions from each unit and the students will be required to attempt one question from each unit which will be of 6 marks each.

UNIT-I

Structure and Bonding: Localized and delocalized chemical bond, vander Waals interactions, and resonance conditions, resonance effect and its applications, hyperconjugation, inductive effect, Electromeric effect & their comparison.

Stereochemistry of Organic Compounds-I: Concept of isomerism. Types of isomerism. Optical isomerism, elements of symmetry, molecular chirality, enantiomers, stereogenic centre, optical activity, properties of enantiomers, chiral and achiral molecules with two stereogeniccentres, diastereomers, threo and erythro diastereomers, meso compounds, resolution of enantiomers, inversion, retention and racemization.

UNIT-II

Stereochemistry of Organic Compounds-II: Relative and absolute configuration, sequence rules, R & S systems of nomenclature, Geometric isomerism, determination of configuration of geometrical isomers, E & Z system of nomenclature, Conformational isomerism conformational analysis of ethane and n-butane, conformations of cyclohexane, axial and equatorial bonds, Newman projection and Sawhorse formulae, Difference between configuration and conformation.

UNIT-III

Mechanism of Organic Reactions: Curved arrow notation, drawing electron movements with arrows, half-headed and double-headed arrows, homolytic and heterolytic bond breaking. Types of reagents – electrophiles and nucleophiles. Types of organic reactions. Energy considerations. Reactive intermediates carbocations, carbanions, freeradicals, carbenes, arynes and nitrenes (formation, structure & stability). Assigning formal charges on intermediates and other ionic species.

UNIT-IV

Alkanes and Cycloalkanes: IUPAC nomenclature of branched and unbranched alkanes, the alkyl group, classification of carbon atoms in alkanes. Isomerism in alkanes, sources, methods of formation (with special reference to Wurtz reaction, Kolbe reaction, Corey-

House reaction and decarboxylation of carboxylic acids), physical properties. Cycloalkanes nomenclature, synthesis of cycloalkanes and their derivatives– photochemical (2+2) cycloaddition reactions, dehalogenation of dihalides, pyrolysis of calcium or barium salts of dicarboxylic acids, Baeyer's strain theory and its limitations, theory of strainless rings.

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Department of Chemistry
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B. Sc. I Year (I Semester)

Schedule per week Lectures: 2

Examination Time	: 3 Hrs	Maximum	Marks:
50(20+30)			
Subject	: Physical Chemistry	Paper Code	: CH-
105			

***Note:** Examiner will set nine questions and the students will be required to attempt five questions in all, Question number one is compulsory containing six short answer types questions covering the entire syllabus and will be of 1 marks. Further examiner will be set two questions from each unit and the students will be required to attempt one question from each unit which will be of 6 marks each.*

UNIT-I

Gaseous States: Maxwell's distribution of velocities and energies (derivation excluded) Calculation of root mean square velocity, average velocity and most probable velocity. Collision diameter, collision number, collision frequency and mean free path. Deviation of Real gases from ideal behaviour. Derivation of Vander Waal's Equation of State, its application in the calculation of Boyle's temperature (compression factor) Explanation of behavior of real gases using Vander Waal's equation.

UNIT-II

Critical Phenomenon: Critical temperature, Critical pressure, critical volume and their determination. PV isotherms of real gases, continuity of states, the isotherms of Vander Waal's equation, relationship between critical constants and Vander Waal's constants. Critical compressibility factor. The Law of corresponding states. Lequifaction of gases.

UNIT-III

Liquid States: Structure of liquids. Properties of liquids – surface tension, viscosity vapour pressure and optical rotations and their determination.

UNIT-IV

Solid State: Classification of solids, Laws of crystallography – (i) Law of constancy of interfacial angles (ii) Law of rationality of indices (iii) Law of symmetry. Symmetry elements of crystals, Definition of unit cell & space lattice. Bravais lattices, crystal system. X-ray diffraction by crystals. Derivation of Bragg equation. Determination of crystal structure of NaCl, KCl.

Liquid crystals: Difference between solids, liquids and liquid crystals, types of liquid crystals, Applications of liquid crystals.

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Schedule per week Practical: 6

Examination Time : 4 Hrs

Maximum Marks: 50

(20+30)

Subject : Chemistry Lab-I

Paper Code : CH-

107

UNIT-I (Inorganic)

Volumetric Analysis

- 1. Redo titrations:** Determination of Fe^{2+} , $\text{C}_2\text{O}_4^{2-}$ (using KMnO_4 , $\text{K}_2\text{Cr}_2\text{O}_7$)
- 2. Iodometric titrations:** Determination of Cu^{2+} (using standard hypo solution).
- 3. Complexometric titrations:** Determination of Mg^{2+} , Zn^{2+} by EDTA.

UNIT-II (Physical)

1. To determine the specific reaction rate of the hydrolysis of methyl acetate/ethyl acetate catalyzed by hydrogen ions at room temperature.
2. To prepare arsenious sulphide sol and compare the precipitating power of mono, bi and trivalent anions.

UNIT-III (Organic)

1. Preparation and purification through crystallization or distillation and ascertaining their purity through melting point or boiling point
 - (i) Iodoform from ethanol (or acetone)
 - (ii) *m*-Dinitrobenzene from nitrobenzene (use 1:2 conc. HNO_3 H_2SO_4 mixture if fuming HNO_3 is not available)
 - (iii) *p*-Bromoacetanilide from acetanilide
 - (iv) Dibenzalacetone from acetone and benzaldehyde
 - (v) Aspirin from salicylic acid

Distribution of marks

1. UNIT-I	10 (6+4) marks
2. UNIT-II	10 (6+4) marks
3. UNIT-III	10 (6+4) marks
4. Viva-voce	10 (6+4) marks
5. Lab Record	10 (6+4) marks

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B. Sc. I Year (II Semester)

Schedule per week Lectures: 2

Examination Time	: 3 Hrs	Maximum	Marks:
50(20+30)			
Subject	: Inorganic Chemistry	Paper Code	: CH-
102			

Note: Examiner will set nine questions and the students will be required to attempt five questions in all, Question number one is compulsory containing six short answer types questions covering the entire syllabus and will be of 1 marks. Further examiner will be set two questions from each unit and the students will be required to attempt one question from each unit which will be of 6 marks each.

UNIT-I

Hydrogen Bonding & Vander Waals Forces: Hydrogen Bonding-Definition, Types, effects of hydrogen bonding on properties of substances, application Brief discussion of various types of Vander Waals Forces. Metallic Bond and Semiconductors Metallic Bond- Brief introduction to metallic bond, band theory of metallic bond Semiconductors- types and applications.

UNIT-II

s-Block Elements: Comparative study of the elements including, diagonal relationships, salient features of hydrides (methods of preparation excluded), solvation and complexation tendencies including their function in biosystems.

Chemistry of Noble Gases: Chemical properties of the noble gases with emphasis on their low chemical reactivity, chemistry of xenon, structure and bonding of fluorides, oxides & oxyfluorides of xenon.

UNIT-III

p-Block Elements: Emphasis on comparative study of properties of p-block elements (including diagonal relationship and excluding methods of preparation).

Boron family (13th gp): Diborane-properties and structure (as an example of electron-deficient compound and multicentre bonding), Borazene-chemical properties and structure Trihalides of Boron – Trends in few is acid character structure of aluminium (III) chloride.

Carbon Family (14th group): Catenation, p– d bonding (an idea), carbides, fluorocarbons, silicates (structural aspects), silicons – general methods of preparations, properties and uses.

UNIT-IV

Nitrogen Family (15th group): Structures of oxides of N, P. oxyacids–structure and relative acid strengths of oxyacids of N and P. Structure of white, yellow and red phosphorus

Oxygen Family (16th group): Oxyacids of sulphur – structures and acidic strength H₂O₂ structure, properties and uses.

Halogen Family (17th group): Basic properties of halogen, interhalogens, types, properties, hydro and oxyacids of chlorine – structure and comparison of acid strength

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B. Sc. I Year (II Semester)

Schedule per week Lectures: 2

Examination Time : 3 Hrs

Maximum Marks:

50(20+30)

Subject : Organic Chemistry

Paper Code :

CH-104

Note: Examiner will set nine questions and the students will be required to attempt five questions in all, Question number one is compulsory containing six short answer types questions covering the entire syllabus and will be of 1 marks. Further examiner will be set two questions from each unit and the students will be required to attempt one question from each unit which will be of 6 marks each.

UNIT-I

Alkenes: Nomenclature of alkenes, mechanisms of dehydration of alcohols and dehydro-halogenation of alkyl halides, The Saytzeff rule, Hofmann elimination, physical properties and relative stabilities of alkenes. Chemical reactions of alkenes and mechanisms involved in hydrogenation, electrophilic and free radical additions, Markownikoff's rule, hydroboration-oxidation, oxymercurationreduction, ozonolysis, hydration, hydroxylation and oxidation with KMnO₄,

UNIT-II

Arenes and Aromaticity: Nomenclature of benzene derivatives, Aromatic nucleus and side chain. Aromaticity: the Huckel rule, aromatic ions, annulenes up to 10 carbon atoms, aromatic, antiaromatic and non aromatic compounds. Aromatic electrophilic substitution general pattern of the mechanism, mechanism of nitration, halogenation, sulphonation, and Friedel-Crafts reaction. Energy profile diagrams ; Activating , deactivating substituents and orientation.

UNIT-III

Dienes and Alkynes: Nomenclature and classification of dienes isolated, conjugated and cumulated dienes. Structure of butadiene, Chemical reactions 1, 2 and 1, 4 additions (Electrophilic & free radical mechanism), Diels-Alder reaction, Nomenclature, structure and bonding in alkynes. Methods of formation. Chemical reactions of alkynes, acidity of alkynes. Mechanism of electrophilic and nucleophilic addition reactions, hydroboration-oxidation of alkynes,

UNIT-IV

Alkyl and Aryl Halides: Nomenclature and classes of alkyl halides, methods of formation, chemical reactions. Mechanisms and stereochemistry of nucleophilic substitution reactions of alkyl halides, SN^2 and SN^1 reactions with energy profile diagrams. Methods of formation and reactions of aryl halides, The addition elimination and the elimination-addition mechanisms of nucleophilic aromatic substitution reactions. Relative reactivities of alkyl halides vs allyl, vinyl and aryl halides

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B. Sc. I Year (II Semester)

Schedule per week Lectures: 2

Examination Time : 3 Hrs

Maximum Marks:

50(20+30)

Subject : Physical Chemistry

Paper Code :

CH-106

Note: Examiner will set nine questions and the students will be required to attempt five questions in all, Question number one is compulsory containing six short answer types questions covering the entire syllabus and will be of 1 marks. Further examiner will be set two questions from each unit and the students will be required to attempt one question from each unit which will be of 6 marks each

UNIT-I

Kinetics-I: Rate of reaction, rate equation, factors influencing the rate of a reaction concentration, temperature, pressure, solvent, light, catalyst. Order of a reaction, integrated rate expression for zero order, first order, second and third order reaction. Half life period of a reaction. Methods of determination of order of reaction,

UNIT-II

Kinetics-II: Effect of temperature on the rate of reaction-Arrhenius equation. Theories of reaction rate –Simple collision theory for unimolecular and bimolecular collision, Transition state theory of Bimolecular reactions.

UNIT-III

Electrochemistry-I: Electrolytic conduction, factors affecting electrolytic conduction, specific, conductance, molar conductance, equivalent conductance and relation among them, their variation with concentration. Arrhenius theory of ionization, Ostwald's Dilution Law, Debye- Huckel-Onsager's equation for strong electrolytes (elementary treatment only) Transport number, definition and determination by Hittorfs methods, (numerical included),

UNIT-IV

Electrochemistry-II: Kohlrausch's Law, calculation of molar ionic conductance and effect of viscosity temperature & pressure on it. Application of Kohlrausch's Law in calculation of conductance of weak electrolytes at infinite dilution. Applications of conductivity **Measurements:** determination of degree of dissociation, determination of K_a of acids determination of solubility product of sparingly soluble salts, conductometric titrations. Definition of pH and pKa, Buffer solution, Buffer action, Henderson – Hazel equation, Buffer mechanism of buffer action.

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B. Sc. I Year (II Semester)

Schedule per week Practical: 6

Examination Time : 4 Hrs
(20+30)

Maximum Marks: 50

Subject : Chemistry Lab-II
108

Paper Code : CH-

UNIT-I (Inorganic)

Volumetric Analysis

Complexometric titrations: Determination of Hardness of Water by EDTA

Paper Chromatography

Qualitative Analysis of the any one of the following Inorganic cations and anions by paper chromatography (Pb^{2+} , Cu^{2+} , Ca^{2+} , Ni^{2+} , Cl^- , Br^- , I^- and PO_4^{3-} and NO_3^-).

UNIT-II (Physical)

1. To determine the surface tension of a given liquid by drop number method.
2. To determine the viscosity of a given liquid.
3. To determine the specific refractivity of a given liquid

UNIT-III (Organic)

To study the process of sublimation of camphor and phthalic acid,

Distribution of marks

1. UNIT-I marks	10	(6+4)
2. UNIT-II marks	10	(6+4)
3. UNIT-III marks	10	(6+4)
4. Viva-voce marks	10	(6+4)
5. Lab Record marks	10	(6+4)

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B. Sc. II Year (III Semester)

Schedule per week Lectures: 2

Examination Time	: 3 Hrs	Maximum	Marks:
50(20+30)			
Subject	: Inorganic Chemistry	Paper Code	: CH-
201			

Note: Examiner will set nine questions and the students will be required to attempt five questions in all, Question number one is compulsory containing six short answer types questions covering

the entire syllabus and will be of 1 marks. Further examiner will be set two questions from each unit and the students will be required to attempt one question from each unit which will be of 6 marks each.

UNIT-I

Chemistry of Elements of I transition series: Definition of transition elements, position in the periodic table, General characteristics & properties of I transition elements, Structures & properties of some compounds of transition elements-TiO₂, VOCl₂, FeCl₃, CuCl₂ and Ni(CO)₄

UNIT-II

Chemistry of Elements of IInd & IIIrd transition series: General characteristics and properties of the IInd and IIIrd transition elements Comparison of properties of 3d elements with 4d & 5d elements with reference only to ionic radii, oxidation state, magnetic and Spectral properties and stereochemistry

UNIT-III

Coordination Compounds: Werner's coordination theory, effective atomic number concept, chelates, nomenclature of coordination compounds, isomerism in coordination compounds, valence bond theory of transition metal complexes

UNIT-IV

Non-aqueous Solvents: Physical properties of a solvent, types of solvents and their general characteristics, reactions in non-aqueous solvents with reference to liquid NH₃ and liquid SO₂

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B. Sc. II Year (III Semester)

Schedule per week Lectures: 2

Examination Time : 3 Hrs
50(20+30)

Maximum Marks:

Subject
203

: Organic Chemistry

Paper Code : CH-

Note: Examiner will set nine questions and the students will be required to attempt five questions in all, Question number one is compulsory containing six short answer types questions covering the entire syllabus and will be of 1 marks. Further examiner will be set two questions from each unit and the students will be required to attempt one question from each unit which will be of 6 marks each.

UNIT-I

Alcohols: Monohydric alcohols nomenclature, methods of formation by reduction of aldehydes, ketones, carboxylic acids and esters. Hydrogen bonding. Acidic nature. Reactions of alcohols. Dihydric alcohols — nomenclature, methods of formation, chemical reactions of vicinal glycols, oxidative cleavage [Pb(OAc)₄ and HIO₄] and pinacol-pinacolone rearrangement.

Epoxides: Synthesis of epoxides. Acid and base-catalyzed ring opening of epoxides, orientation of epoxide ring opening, reactions of Grignard and organolithium reagents with epoxides

UNIT-II

Phenols: Nomenclature, structure and bonding. Preparation of phenols, physical properties and acidic character. Comparative acidic strengths of alcohols and phenols, resonance stabilization of phenoxide ion. Reactions of phenols — electrophilic aromatic substitution, Mechanisms of Fries rearrangement, Claisen rearrangement, Reimer-Tiemann reaction, Kolbe's reaction and Schotten and Baumann reactions.

UNIT-III

Ultraviolet (UV) absorption spectroscopy: Absorption laws (Beer-Lambert law), molar absorptivity, presentation and analysis of UV spectra, types of electronic transitions, effect of conjugation. Concept of chromophore and auxochrome. Bathochromic, hypsochromic, hyperchromic and hypochromic shifts. UV spectra of conjugated enes and enones, Woodward-Fieser rules, calculation of λ_{max} of simple conjugated dienes and -unsaturated ketones. Applications of UV Spectroscopy in structure elucidation of simple organic compounds.

UNIT-IV

Carboxylic Acids & Acid Derivatives: Nomenclature of Carboxylic acids, structure and bonding, physical properties, acidity of carboxylic acids, effects of substituents on acid strength. Preparation of carboxylic acids. Reactions of carboxylic acids. Hell-Volhard Zelinsky reaction. Reduction of carboxylic acids. Mechanism of decarboxylation. Structure, nomenclature and preparation of acid chlorides, esters, amides and acid anhydrides. Relative stability of acyl derivatives. Physical properties, interconversion of acid derivatives by nucleophilic acyl substitution. Mechanisms of esterification and hydrolysis (acidic and basic)

OR

Schedule per week Lectures: 2

Examination Time	: 3 Hrs	Maximum	Marks:
50(20+30)			
Subject	: Polymer Chemistry(Elective)	Paper Code	: CH-
203			

UNIT-I

Introduction and history of polymeric materials: Different schemes of classification of polymers, Polymer nomenclature, Molecular forces and chemical bonding in polymers, Texture of Polymers.

Functionality and its importance: Criteria for synthetic polymer formation, classification of polymerization processes, Relationships between functionality, extent of reaction and degree of polymerization. Bifunctional systems, Poly-functional systems.

UNIT-II

Kinetics of Polymerization: Mechanism and kinetics of step growth, radical chain growth, ionic chain (both cationic and anionic) and coordination polymerizations, Mechanism and kinetics of copolymerization, polymerization techniques. **Crystallization and crystallinity:** Determination of crystalline melting point and degree of crystallinity, Morphology of crystalline polymers, Factors affecting crystalline melting point.

Nature and structure of polymers-Structure, Property relationships.

UNIT-III

Determination of molecular weight of polymers (M_n , M_w , etc) by end group analysis, viscometry, light scattering and osmotic pressure methods. Molecular weight distribution and its significance. Polydispersity index.

Glass transition temperature (T_g) and determination of T_g , Free volume theory, WLF equation, Factors affecting glass transition temperature (T_g).

UNIT-IV

Polymer Solution – Criteria for polymer solubility, Solubility parameter, Thermodynamics of polymer solutions, entropy, enthalpy, and free energy change of mixing of polymers solutions, Flory- Huggins theory, Lower and Upper critical solution temperatures.

Properties of Polymers (Physical, thermal, Flow & Mechanical Properties). Brief introduction to preparation, structure, properties and application of the following polymers: polyolefins, polystyrene and styrene copolymers, poly(vinyl chloride) and related polymers, poly(vinyl acetate) and related polymers, acrylic polymers, fluoro polymers, polyamides and related polymers. Phenol formaldehyde resins (Bakelite, Novalac), polyurethanes, silicone polymers, polydienes, Polycarbonates, Conducting Polymers, [polyacetylene, polyaniline, poly(p-phenylene sulphide polypyrrole, polythiophene)].

Reference Books:

1. Seymour's Polymer Chemistry, Marcel Dekker, Inc.
2. G. Odian: Principles of Polymerization, John Wiley.
3. F.W. Billmeyer: Text Book of Polymer Science, John Wiley.
4. P. Ghosh: Polymer Science & Technology, Tata Mcgraw-Hill.

5. R.W. Lenz: Organic Chemistry of Synthetic High Polymers.

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B. Sc. II Year (III Semester)

Schedule per week Lectures: 2

Examination Time : 3 Hrs Maximum Marks:
50(20+30)

Subject : Physical Chemistry Paper Code : CH-
205

***Note:** Examiner will set nine questions and the students will be required to attempt five questions in all, Question number one is compulsory containing six short answer types questions covering the entire syllabus and will be of 1 marks. Further examiner will be set two questions from each unit and the students will be required to attempt one question from each unit which will be of 6 marks each*

UNIT-I

Thermodynamics-I: Definition of thermodynamic terms: system, surrounding etc. Types of systems, intensive and extensive properties. State and path functions and their differentials. Thermodynamic process. Concept of heat and work. Zeroth Law of thermodynamics, First law of thermodynamics: statement, definition of internal energy and enthalpy. Heat capacity, heat capacities at constant volume and pressure and their relationship.

UNIT-II

Thermodynamics-II: Joule's law, Joule Thomson coefficient for ideal gas and real gas: and inversion temperature. Calculation of w q dU & dH for the expansion of ideal gases under isothermal and adiabatic conditions for reversible process, Temperature dependence of enthalpy, Kirchoffs equation. Bond energies and applications of bond energies.

UNIT-III

Chemical Equilibrium: Equilibrium constant and free energy, concept of chemical potential, Thermodynamic derivation of law of chemical equilibrium. Temperature dependence of equilibrium constant; Van't Hoff reaction isochore, Van't Hoff reaction isotherm. Le-Chatetier's principle and its applications Clapeyron equation and Clausius-Clapeyron equation its applications.

UNIT-IV

Distribution Law: Nernst distribution law – its thermodynamic derivation, Modification of distribution law when solute undergoes dissociation, association and chemical

combination. Applications of distribution law: (i) Determination of degree of hydrolysis and hydrolysis constant of aniline hydrochloride. (ii) Determination of equilibrium constant of potassium triiodide complex and process of extraction.

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B. Sc. II Year (III Semester)

Schedule per week Practical: 6

Examination Time : 4 Hrs

Maximum Marks: 50

(20+30)

Subject : Chemistry Lab-III

Paper Code : CH-

207

UNIT-I (Inorganic)

1. Gravimetric Analysis

Quantitative estimations of, Cu^{2+} as copper thiocyanate and Ni^{2+} as Ni – dimethylglyoxime.

2. Colorimetry:

To verify Beer - Lambert law for $\text{KMnO}_4/\text{K}_2\text{Cr}_2\text{O}_7$ and determine the concentration of the given $\text{KMnO}_4/\text{K}_2\text{Cr}_2\text{O}_7$ solution.

UNIT-II (Physical)

1. To determine the CST of phenol – water system.

2. To determine the solubility of benzoic acid at various temperatures and to determine the H of the dissolution process.

UNIT-III (Organic)

Laboratory Techniques

(a) Steam distillation (non evaluative) Naphthalene from its suspension in water

Separation of *o*- and *p*-nitrophenols

(b) Column chromatography (non evaluative) Separation of fluorescein and methylene blue

Separation of leaf pigments from spinach leaves

Distribution of marks

1. UNIT-I
marks

10 (6+4)

2. UNIT-II marks	10	(6+4)
3. UNIT-III marks	10	(6+4)
4. Viva-voce marks	10	(6+4)
5. Lab Record marks	10	(6+4)

SCHOOL OF BASIC AND APPLIED SCIENCES
Department of Chemistry
(Syllabus and Scheme of Studies w. e. f. 2016-17 onwards)
B. Sc. II Year (IV Semester)

Schedule per week Lectures: 2

Examination Time	: 3 Hrs	Maximum	Marks:
50(20+30)			
Subject	: Inorganic Chemistry	Paper Code	: CH-
202			

Note: Examiner will set nine questions and the students will be required to attempt five questions in all, Question number one is compulsory containing six short answer types questions covering the entire syllabus and will be of 1 marks. Further examiner will be set two questions from each unit and the students will be required to attempt one question from each unit which will be of 6 marks each.

UNIT-I

Chemistry of f -block elements:

Lanthanides: Electronic structure, oxidation states and ionic radii and lanthanide contraction, complex formation, occurrence and isolation, lanthanide compounds.

UNIT-II

Chemistry of f -block elements

Actinides: General features and chemistry of actinides, chemistry of separation of Np, Pu and Am from U, Comparison of properties of Lanthanides and Actinides and with transition elements.

UNIT-III

Theory of Qualitative and Quantitative Inorganic Analysis-I:

Chemistry of analysis of various acidic radicals, Chemistry of identification of acid radicals in typical combinations, Chemistry of interference of acid radicals including their removal in the analysis of basic radicals.

UNIT-IV

Theory of Qualitative and Quantitative Inorganic Analysis-II:

Chemistry of analysis of various groups of basic radicals, Theory of precipitation, co-precipitation, Post- precipitation, purification of precipitates.

OR

Schedule per week Lectures: 2

Examination Time	: 3 Hrs	Maximum	Marks:
50(20+30)			
Subject	: Coordination Chemistry (Elective)	Paper Code	: CH-
202			

UNIT-I

Werner's theory, valence bond theory (inner and outer orbital complexes), electroneutrality principle and back bonding. Crystal field theory, measurement of $10 Dq$ (Δ_o), CFSE in weak and strong fields, pairing energies, factors affecting the magnitude of $10 Dq$ (Δ_o , Δ_t). Octahedral vs. tetrahedral coordination, tetragonal distortions from octahedral geometry Jahn-Teller theorem, square planar geometry. Qualitative aspect of Ligand field and MO Theory.

IUPAC nomenclature of coordination compounds, isomerism in coordination compounds. Stereochemistry of complexes with 4 and 6 coordination numbers. Chelate effect, polynuclear complexes, Labile and inert complexes.

UNIT-II

Transition Elements: General group trends with special reference to electronic configuration, colour, variable valency, magnetic and catalytic properties, ability to form complexes. Stability of various oxidation states and e.m.f. (Latimer diagrams) Different between the first, second and third transition series. Chemistry of Cr, Mn, Fe and Co in various oxidation states with special reference to the following compounds: peroxo compounds of chromium, potassium dichromate,

potassium permanganate, potassium ferrocyanide, potassium ferricyanide, sodium nitroprusside and sodium cobaltinitrite.

UNIT-III

Lanthanoids and Actinoids: Electronic configuration, oxidation states, colour, spectral and magnetic properties, lanthanide contraction, separation of lanthanides (ion-exchange method only).

UNIT-IV

Inorganic Reaction Mechanism :Introduction to inorganic reaction mechanisms. Substitution reactions in square planar complexes, Trans- effect, theories of trans effect. Thermodynamic and Kinetic stability.

Reference Books:

1. Purcell, K.F. & Kotz, J.C., Inorganic Chemistry W.B. Saunders Co, 1977.
2. Huheey, J.E., Inorganic Chemistry, Prentice Hall, 1993.
3. Cotton, F.A. & Wilkinson, G., Advanced Inorganic Chemistry Wiley-VCH, 1999
4. Basolo, F, and Pearson, R.C., Mechanisms of Inorganic Chemistry, John Wiley & Sons, NY, 1967.
5. Greenwood, N.N. & Earnshaw A., Chemistry of the Elements, ButterworthHeinemann,1997.
6. Miessler, G. L. & Tarr, Donald A. Inorganic Chemistry 3 rd Ed.(adapted), Pearson, 2009

OR

Schedule per week Lectures: 2

Examination Time : 3 Hrs
50(20+30)

Maximum Marks:

Subject : Novel Inorganic Solids (Elective)
202

Paper Code : CH-

UNIT-I

Synthesis and modification of inorganic solids: Conventional heat and beat methods, Co-precipitation method, Sol-gel methods, Hydrothermal method, Ion-exchange and Intercalation methods.

Inorganic solids of technological importance: Solid electrolytes – Cationic, anionic, mixed Inorganic pigments – coloured solids, white and black pigments.

One-dimensional metals, molecular magnets, inorganic liquid crystals.

UNIT-II

Nanomaterials: Overview of nanostructures and nanomaterials: classification. Preparation of gold and silver metallic nanoparticles, self-assembled nanostructures-control of nanoarchitecture onedimensional control. Carbon nanotubes and inorganic nanowires.

Bioinorganic nanomaterials, DNA and nanomaterials, natural and antisical nanomaterials, bionano composites. Introduction to engineering materials for mechanical construction: Composition, mechanical and fabricating characteristics and applications of various types of cast irons, plain carbon and alloy steels, copper, aluminum and their alloys like duralumin, brasses and bronzes cutting tool materials, super alloys thermoplastics, thermosets and composite materials.

UNIT-III

Composite materials:

Introduction, limitations of conventional engineering materials, role of matrix in composites, classification, matrix materials, reinforcements, metal-matrix composites, polymer-matrix composites, fibre-reinforced composites, environmental effects on composites, applications of composites.

UNIT-IV

Speciality polymers: Conducting polymers - Introduction, conduction mechanism, polyacetylene, polyparaphenylene and polypyrrole, applications of conducting polymers, Ion-exchange resins and their applications. Ceramic & Refractory: Introduction, classification, properties, raw materials, manufacturing and applications.

Reference Books:

1. Atkins, Peter, Overton, Tina, Rourke, Jonathan, Weller, Mark and Armstrong, Fraser • Shriver & Atkins' Inorganic Chemistry, 5 th Edition, Oxford University Press 2011- 2012
2. Adam, D.M. Inorganic Solids: An introduction to concepts in solid-state structural • chemistry, John Wiley and Sons, London, New York, Sydney, Toronto, 1974
3. Poole Jr., Charles P., Owens, Frank J., Introduction to Nanotechnology John Wiley and • Sons, 2003.

SCHOOL OF BASIC AND APPLIED SCIENCES

Department of Chemistry

(Syllabus and Scheme of Studies w. e. f. 2016-17 onwards)

B. Sc. II Year (IV Semester)

Schedule per week Lectures: 2

Examination Time : 3 Hrs

Maximum Marks:

50(20+30)

Subject : Organic Chemistry

Paper Code : CH-

204

Note: Examiner will set nine questions and the students will be required to attempt five questions in all, Question number one is compulsory containing six short answer types questions covering the entire syllabus and will be of 1 marks. Further examiner will be set two questions from each unit and the students will be required to attempt one question from each unit which will be of 6 marks each.

UNIT-I

Infrared (IR) absorption spectroscopy: Molecular vibrations, Hooke's law, selection rules, intensity and position of IR bands, measurement of IR spectrum, fingerprint region, characteristic absorptions of various functional groups and interpretation of IR spectra of simple organic compounds. Applications of IR spectroscopy in structure elucidation of simple organic compounds.

UNIT-II

Amines: Structure and nomenclature of amines, physical properties. Separation of a mixture of primary, secondary and tertiary amines. Structural features affecting basicity of amines. Preparation of alkyl and aryl amines (reduction of nitro compounds, nitriles, reductive amination of aldehydic and ketonic compounds. Gabrielphthalimide reaction, Hofmann bromamide reaction. electrophilic aromatic substitution in aryl amines, reactions of amines with nitrous acid.

UNIT-III

Diazonium Salts: Mechanism of diazotisation, structure of benzene diazonium chloride, Replacement of diazo group by H, OH, F, Cl, Br, I, NO₂ and CN groups, reduction of diazonium salts to hydrazines, coupling reaction and its synthetic application.

Nitro Compounds: Preparation of nitro alkanes and nitro arenes and their chemical reactions. Mechanism of electrophilic substitution reactions in nitro arenes and their reductions in acidic, neutral and alkaline medium.

UNIT-IV

Aldehydes and Ketones: Nomenclature and structure of the carbonyl group. Synthesis of aldehydes and ketones with particular reference to the synthesis of aldehydes from acid chlorides, advantage of oxidation of alcohols with chromium trioxide (Sarett reagent) pyridinium chlorochromate (PCC) and pyridinium dichromate., Physical properties. Comparison of reactivities of aldehydes and ketones. Mechanism of nucleophilic additions to carbonyl group with particular emphasis on benzoin, aldol, Perkin and Knoevenagel condensations. Condensation with ammonia and its derivatives. Wittig reaction. Mannich reaction. Oxidation of aldehydes, Baeyer–Villiger oxidation of ketones, Cannizzaro reaction. MPV, Clemmensen, Wolff-Kishner, LiAlH₄ and NaBH₄ reductions.

SCHOOL OF BASIC AND APPLIED SCIENCES

Department of Chemistry

(Syllabus and Scheme of Studies w. e. f. 2016-17 onwards)

B. Sc. II Year (IV Semester)

Schedule per week Lectures: 2

Examination Time	: 3 Hrs	Maximum	Marks:
50(20+30)			
Subject	: Physical Chemistry	Paper Code	: CH-
206			

Note: Examiner will set nine questions and the students will be required to attempt five questions in all, Question number one is compulsory containing six short answer types questions covering the entire syllabus and will be of 1 marks. Further examiner will be set two questions from each

unit and the students will be required to attempt one question from each unit which will be of 6 marks each

UNIT-I

Thermodynamics-III: Second law of thermodynamics, need for the law, different statements of the law, Carnot's cycles and its efficiency, Carnot's theorem, Thermodynamics scale of temperature. Concept of entropy– entropy as a state function, entropy as a function of V & T, entropy as a function of P & T, entropy change in physical change, entropy as a criteria of spontaneity and equilibrium. Entropy change in ideal gases and mixing of gases.

UNIT-II

Thermodynamics-IV: Third law of thermodynamics: Nernst heat theorem, statement of concept of residual entropy, evaluation of absolute entropy from heat capacity data. Gibbs and Helmholtz functions; Gibbs function(G) and Helmholtz function (A) as thermodynamic quantities, A & G as criteria for thermodynamic equilibrium and spontaneity, their advantage over entropy change. Variation of G and A with P, V and T.

UNIT-III

Electrochemistry-III: Electrolytic and Galvanic cells, reversible & Irreversible cells, conventional representation of electrochemical cells, EMF of cell and its measurement, Weston standard cell, activity and activity coefficients, Calculation of thermodynamic quantities of cell reaction (G, H & K). Types of reversible electrodes metal-metal ion gas electrode, metal-insoluble salt anion and redox electrodes. Electrode reactions, Nernst equations, derivation of cell EMF and single electrode potential. Standard Hydrogen electrode, reference electrodes, standard electrodes potential, sign conventions, electrochemical series and its applications.

UNIT-IV

Electrochemistry-IV: Concentration cells with and without transference, liquid junction potential, application of EMF measurement i.e. valency of ions, solubility product activity coefficient, potentiometric titration (acid- base and redox). Determination of pH using Hydrogen electrode, Quinhydrone electrode and glass electrode by potentiometric methods.

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B. Sc. II Year (IV Semester)

Schedule per week Practical: 6

Examination Time : 4 Hrs

Maximum

Marks:

50(20+30)

Subject
208

: Chemistry Lab-IV

Paper Code : CH-

UNIT-I (Inorganic)

Preparations: Preparation of Cuprous chloride, prussian blue from iron fillings, tetraammine cupric sulphate, chrome alum, potassium trioxalatochromate (III).

UNIT-II (Physical)

1. To determine the enthalpy of neutralisation of a weak acid/weak base vs. strong base/strong acid and determine the enthalpy of ionisation of the weak acid/weak base.
2. To determine the enthalpy of solution of solid calcium chloride
3. To study the distribution of iodine between water and CCl₄.

UNIT-III (Organic)

Systematic identification (detection of extra elements, functional groups, determination of melting point or boiling point and preparation of at least one pure solid derivative) of the following simple mono and bifunctional organic compounds: Naphthalene, anthracene, acenaphthene, benzyl chloride, *p*-dichlorobenzene, *m*-dinitrobenzene, *p*-nitrotoluene, resorcinol, hydroquinone, α -naphthol, β -naphthol, benzophenone, ethyl methyl ketone, benzaldehyde, vanillin, oxalic acid, succinic acid, benzoic acid, salicylic acid, aspirin, phthalic acid, cinnamic acid, benzamide, urea, acetanilide, benzanilide, aniline hydrochloride, *p*-toluidine, phenyl salicylate (salol), glucose, fructose, sucrose, *o*-, *m*-, *p* nitroanilines, thiourea.

Distribution of marks

1. UNIT-I marks	10	(6+4)
2. UNIT-II marks	10	(6+4)
3. UNIT-III marks	10	(6+4)
4. Viva-voce marks	10	(6+4)
5. Lab Record marks	10	(6+4)

SCHOOL OF BASIC AND APPLIED SCIENCES
Department of Chemistry
(Syllabus and Scheme of Studies w. e. f. 2016-17 onwards)
B. Sc. III Year (V Semester)

Schedule per week Lectures: 2

Examination Time	: 3 Hrs	Maximum	Marks:
50(20+30)			
Subject	: Inorganic Chemistry	Paper Code	: CH-
301			

Note: Examiner will set nine questions and the students will be required to attempt five questions in all, Question number one is compulsory containing six short answer types questions covering the entire syllabus and will be of 1 marks. Further examiner will be set two questions from each unit and the students will be required to attempt one question from each unit which will be of 6 marks each.

UNIT-I

Metal-ligand bonding in Transition Metal Complexes: Limitations of valence bond theory, an elementary idea of crystal-field theory, crystal field splitting in octahedral, tetrahedral and square planar complexes, factors affecting the crystal-field parameters.

UNIT-II

Thermodynamic and Kinetic Aspects of Metal Complexes: A brief outline of thermodynamic stability of metal complexes and factors affecting the stability, substitution reactions of square planar complexes of Pt (II).

UNIT-III

Magnetic Properties of Transition Metal Complexes: Types of magnetic behavior, methods of determining magnetic susceptibility, spin-only formula. L-S coupling, correlation of s and e_{eff} values, orbital contribution to magnetic moments, application of magnetic moment data for 3d metal complexes.

UNIT-IV

Electron Spectra of Transition Metal Complexes: Types of electronic transitions, selection rules for d-d transitions, spectroscopic ground states, spectrochemical series. Orgel-energy level diagram for d^1 and d^9 states, discussion of the electronic spectrum of $[\text{Ti}(\text{H}_2\text{O})_6]^{3+}$ complex.

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B. Sc. III Year (V Semester)

Schedule per week Lectures: 2

Examination Time	: 3 Hrs	Maximum	Marks:
50(20+30)			
Subject	: Organic Chemistry	Paper Code	: CH-
303			

Note: Examiner will set nine questions and the students will be required to attempt five questions in all, Question number one is compulsory containing six short answer types questions covering the entire syllabus and will be of 1 marks. Further examiner will be set two questions from each unit and the students will be required to attempt one question from each unit which will be of 6 marks each.

UNIT-I

NMR Spectroscopy-I: Principle of nuclear magnetic resonance, the PMR spectrum, number of signals, peak areas, equivalent and nonequivalent protons positions of signals and chemical shift, shielding and de-shielding of protons, proton counting, splitting of signals and coupling constants, magnetic equivalence of protons.

UNIT-II

NMR Spectroscopy-II: Discuss ion of PMR spectra of the molecules: ethyl bromide, n-propyl bromide, isopropyl bromide, 1,1-dibromoethane, 1,1,2-tribromoethane, ethanol, acetaldehyde, ethyl acetate, toluene, benzaldehyde and acetophenone. Simple problems on PMR spectroscopy for structure determination of organic compounds.

UNIT-III

Carbohydrates-I: Classification and nomenclature. Monosaccharides, mechanism of osazone formation, inter-conversion of glucose and fructose, chain lengthening and chain shortening of aldoses. Configuration of monosaccharides. Erythro and threo diastereomers. Conversion of glucose in to mannose. Formation of glycosides, ethers and esters. Determination of ring size of glucose and fructose. Open chain and cyclic structure of D (+)-glucose & D (-) fructose. Mechanism of mutarotation. Structures of ribose and deoxyribose.

UNIT-IV

Carbohydrates-II: An introduction to disaccharides (maltose, sucrose and lactose) and polysaccharides (starch and cellulose) without involving structure determination.

Organometallic Compounds:

Organomagnesium compounds: the Grignard reagents-formation, structure and chemical reactions. Organozinc compounds: formation and chemical reactions. Organolithium compounds: formation and chemical reactions

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B. Sc. III Year (V Semester)

Schedule per week Lectures: 2

Examination Time	: 3 Hrs	Maximum	Marks:
50(20+30)			
Subject	: Physical Chemistry	Paper Code	: CH-
305			

Note: Examiner will set nine questions and the students will be required to attempt five questions in all, Question number one is compulsory containing six short answer types questions covering the entire syllabus and will be of 1 marks. Further examiner will be set two questions from each unit and the students will be required to attempt one question from each unit which will be of 6 marks each.

UNIT-I

Quantum Mechanics-I: Black-body radiation, Plank's radiation law, photoelectric effect, heat capacity of solids, Compton effect, wave function and its significance of Postulates of quantum mechanics, quantum mechanical operator, commutation relations, Hamiltonian operator, Hermitian operator, average value of square of Hermitian as a positive quantity, Role of operators in quantum mechanics, To show quantum mechanically that position and momentum cannot be predicated simultaneously, Determination of wave function & energy of a particle in one dimensional box, Pictorial representation and its significance,

UNIT-II

Physical Properties and Molecular Structure: Optical activity, polarization-(Clausius-Mossotti equation). Orientation of dipoles in an electric field, dipole moment, induced dipole moment, measurement of dipole moment-temperature method and refractivity method, dipole moment and structure of molecules, Magnetic permeability, magnetic susceptibility and its determination. Application of magnetic susceptibility, magnetic properties-paramagnetism, diamagnetism and ferromagnetics.

UNIT-III

Spectroscopy-I: Electromagnetic radiation, regions of spectrum, basic features of spectroscopy, statement of Bornoppenheimer approximation, Degrees of freedom.

Rotational Spectrum: Diatomic molecules. Energy levels of rigid rotator (semi-classical principles), selection rules, spectral intensity distribution using population distribution (Maxwell-Boltzmann distribution), determination of bond length, qualitative description of non-rigid rotor, isotope effect.

UNIT-IV

Spectroscopy-II, Vibrational spectrum: Infrared spectrum: Energy levels of simple harmonic oscillator, selection rules, pure vibrational spectrum, intensity, determination of force constant and qualitative relation of force constant and bond energies, effects of anharmonic motion and isotopic effect on the spectra., idea of vibrational frequencies of different functional groups.

Raman Spectrum: Concept of polarizability, pure rotational and pure vibrational Raman spectra of diatomic molecules, selection rules, Quantum theory of Raman spectra

OR

Schedule per week Lectures: 2

Examination Time	: 3 Hrs	Maximum	Marks:
50(20+30)			
Subject	: Green Chemistry (Elective)	Paper Code	: CH-
305			

UNIT-I

Introduction to Green Chemistry

What is Green Chemistry? Need for Green Chemistry. Goals of Green Chemistry. Limitations/ Obstacles in the pursuit of the goals of Green Chemistry

Principles of Green Chemistry and Designing a Chemical synthesis

Twelve principles of Green Chemistry with their explanations and special emphasis on the following with examples:

1. Designing a Green Synthesis using these principles; Prevention of Waste/ byproducts; maximum incorporation of the materials used in the process into the final products , Atom Economy, calculation of atom economy of the rearrangement, addition, substitution and elimination reactions.
2. Prevention/ minimization of hazardous/ toxic products reducing toxicity risk = (function) hazard x exposure ; waste or pollution prevention hierarchy
3. Green solvents– super critical fluids, water as a solvent for organic reactions, ionic liquids, fluoruous biphasic solvent, PEG, solventless processes, immobilized solvents and how to compare greenness of solvents

UNIT-II

4. Energy requirements for reactions – alternative sources of energy: use of microwaves and ultrasonic energy
5. Selection of starting materials; avoidance of unnecessary derivatization – careful use of blocking/protecting groups;

6. use of catalytic reagents (wherever possible) in preference to stoichiometric reagents; catalysis and green chemistry, comparison of heterogeneous and homogeneous catalysis, bio catalysis, asymmetric catalysis and photo catalysis.
7. Prevention of chemical accidents designing greener processes, inherent safer design, principle of ISD —What you don't have cannot harm you||, greener alternative to Bhopal Gas Tragedy (safer route to carbaryl) and Flixiborough accident (safer route to cyclohexanol) subdivision of ISD, minimization, simplification, substitution, moderation and limitation.
8. Strengthening/ development of analytical techniques to prevent and minimize the generation of hazardous substances in chemical processes.

UNIT-III

Examples of Green Synthesis/ Reactions and some real world cases

1. Green Synthesis of the following compounds: adipic acid, catechol, disodium iminodiacetate (alternative to Strecker synthesis)
2. Microwave assisted reactions in water: Hofmann Elimination, methyl benzoate to benzoic acid, oxidation of toluene and alcohols; microwave assisted reactions in organic solvents Diels-Alder reaction and Decarboxylation reaction
3. Ultrasound assisted reactions: sonochemical Simmons-Smith Reaction (Ultrasonic alternative to Iodine)
4. Surfactants for Carbon Dioxide – replacing smog producing and ozone depleting solvents with CO₂ for precision cleaning and dry cleaning of garments.
5. Designing of Environmentally safe marine antifoulant.
6. Rightfit pigment: synthetic azopigments to replace toxic organic and inorganic pigments.
7. An efficient, green synthesis of a compostable and widely applicable plastic (poly lactic acid) made from corn.
8. Healthier Fats and oil by Green Chemistry: Enzymatic Inter esterification for production of no Trans-Fats and Oils
9. Development of Fully Recyclable Carpet: Cradle to Cradle Carpeting

UNIT-IV

Future Trends in Green Chemistry

Oxidation reagents and catalysts; Biomimetic, multifunctional reagents; Combinatorial green chemistry; Proliferation of solvent less reactions; co crystal controlled solid state synthesis (C² S³); Green chemistry in sustainable development.

Reference Books:

1. Ahluwalia, V.K. and Kidwai, M.R. New Trends in Green Chemistry, Anamalaya Publishers, 2005

- Anastas, P.T. and Warner, J.K. Oxford Green Chemistry -Theory and Practical, University Press, 1998
- Matlack, A.S. Introduction to Green Chemistry, Marcel Dekker, 2001
- Cann, M.C. and Connely, M.E. Real-World Cases in Green Chemistry, American Chemical Society, Washington, 2000
- Ryan, M.A. and Tinnesand, M., Introduction to Green Chemistry, American Chemical Society Washington, 2002
- Lancaster, Mike, Green Chemistry an Introductory Text 2nd Ed., RSC Publishing,. ISBN: 978- 1-84755-873-2

SCHOOL OF BASIC AND APPLIED SCIENCES

Department of Chemistry

(Syllabus and Scheme of Studies w. e. f. 2016-17 onwards)

B.Sc. III Year (V Semester)

Schedule per week Practical: 6

Examination Time	: 4 Hrs	Maximum	Marks:
50(20+30)			
Subject	: Chemistry Lab-V	Paper Code	: CH-
307			

UNIT-I (Inorganic)

Semimicro qualitative analysis of mixture containing not more than four radicals (including interfering, Combinations and excluding insolubles):

Pb²⁺, Hg²⁺, Hg₂²⁺, Ag⁺, Bi³⁺, Cu²⁺, Cd²⁺, As³⁺, Sb³⁺, Sn²⁺, Fe³⁺, Cr³⁺, Al³⁺, Co²⁺, Ni²⁺, Mn²⁺, Zn²⁺, Ba²⁺, Sr²⁺, Ca²⁺, Mg²⁺,

UNIT-II (Physical)

- To determine the strength of the given acid solution (mono and dibasic acid) conductometrically.
- To determine the solubility and solubility product of a sparingly soluble electrolyte conductometrically

UNIT-III (Organic)

Chromatography Method

Determination of R_f values and identification of organic compounds

- (a) Separation of green leaf pigments (spinach leaves may be used) by paper chromatographic method
(b) Separation of a mixture of colored organic compounds using common organic solvents by TLC.

Distribution of marks

1. UNIT-I marks	10	(6+4)
2. UNIT-II marks	10	(6+4)
3. UNIT-III marks	10	(6+4)
4. Viva-voce marks	10	(6+4)
5. Lab Record marks	10	(6+4)

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(Syllabus and Scheme of Studies w. e. f. 2016-17 onwards)
B. Sc. III Year (VI Semester)

Schedule per week Lectures: 2

Examination Time	: 3 Hrs	Maximum	Marks:
50(20+30)			
Subject	: Inorganic Chemistry	Paper Code	: CH-
302			

Note: Examiner will set nine questions and the students will be required to attempt five questions in all, Question number one is compulsory containing six short answer types questions covering the entire syllabus and will be of 1 marks. Further examiner will be set two questions from each unit and the students will be required to attempt one question from each unit which will be of 6 marks each.

UNIT-I

Organometallic Chemistry: Definition, nomenclature and classification of organometallic compounds. Preparation, properties, and bonding of alkyls of Li, Al, Hg, and Sn a brief account of metal-ethylenic complexes, mononuclear carbonyls and the nature of bonding in metal carbonyls.

UNIT-II

Acids and Bases, HSAB Concept: Arrhenius, Bronsted-Lowry, the Lux-Flood, Solvent system and Lewis concepts of acids & bases, relative strength of acids & bases, Concept of Hard and Soft Acids & Bases. Symbiosis, electronegativity and hardness and softness

UNIT-III

Bioinorganic Chemistry: Essential and trace elements in biological processes, metalloporphyrins with special reference to haemoglobin and myoglobin. Biological role of alkali and alkaline earth metal ions with special reference to Ca^{2+} . Nitrogen fixation.

UNIT-IV

Silicones and Phosphazenes: Silicones and phosphazenes, their preparation, properties, structure and uses

OR

Schedule per week Lectures: 2

Examination Time : 3 Hrs

Maximum Marks:

50(20+30)

Subject : Industrial Chemicals and Environment paper Code : CH-

302

(Elective)

UNIT-I

Industrial Gases and Inorganic Chemicals

Industrial Gases: Large scale production, uses, storage and hazards in handling of the following gases: oxygen, nitrogen, argon, neon, helium, hydrogen, acetylene, carbon monoxide, chlorine, fluorine, sulphur dioxide and phosgene.

Inorganic Chemicals: Manufacture, application, analysis and hazards in handling the following chemicals: hydrochloric acid, nitric acid, sulphuric acid, caustic soda, common

salt, borax, bleaching powder, sodium thiosulphate, hydrogen peroxide, potash alum, chrome alum, potassium dichromate and potassium permanganate.

UNIT-II

Industrial Metallurgy: Preparation of metals (ferrous and nonferrous) and ultrapure metals for semiconductor technology.

Environment and its segments : Ecosystems. Biogeochemical cycles of carbon, nitrogen and sulphur. Air Pollution: Major regions of atmosphere. Chemical and photochemical reactions in atmosphere. Air pollutants: types, sources, particle size and chemical nature; Photochemical smog: its constituents and photochemistry. Environmental effects of ozone, Major sources of air pollution. Pollution by SO₂, CO₂, CO, NO_x, H₂S and other foul smelling gases. Methods of estimation of CO, NO_x, SO_x and control procedures. Effects of air pollution on living organisms and vegetation. Greenhouse effect and Global warming, Ozone depletion by oxides of nitrogen, chlorofluorocarbons and Halogens, removal of sulphur from coal. Control of particulates.

UNIT-III

Water Pollution: Hydrological cycle, water resources, aquatic ecosystems, Sources and nature of water pollutants, Techniques for measuring water pollution, Impacts of water pollution on hydrological and ecosystems. Water purification methods. Effluent treatment plants (primary, secondary and tertiary treatment). Industrial effluents from the following industries and their treatment: electroplating, textile, tannery, dairy, petroleum and petrochemicals, agro, fertilizer, etc.

Sludge disposal. Industrial waste management, incineration of waste. Water treatment and purification (reverse osmosis, electro dialysis, ion exchange). Water quality parameters for waste water, industrial water and domestic water.

UNIT-IV

Energy & Environment Sources of energy: Coal, petrol and natural gas. Nuclear Fusion / Fission, Solar energy, Hydrogen, geothermal, Tidal and Hydel, etc. Nuclear Pollution: Disposal of nuclear waste, nuclear disaster and its management.

Biocatalysis Introduction to biocatalysis:

Importance in —Green Chemistry|| and Chemical Industry.

Reference Books:

1. E. Stocchi: Industrial Chemistry, Vol-I, Ellis Horwood Ltd. UK.
2. R.M. Felder, R.W. Rousseau: Elementary Principles of Chemical Processes, Wiley Publishers, New Delhi.
3. J. A. Kent: Riegel's Handbook of Industrial Chemistry, CBS Publishers, New Delhi.
4. S. S. Dara: A Textbook of Engineering Chemistry, S. Chand & Company Ltd. New Delhi.

5. K. De, Environmental Chemistry: New Age International Pvt., Ltd, New Delhi.
6. S. M. Khopkar, Environmental Pollution Analysis: Wiley Eastern Ltd, New Delhi.
7. S.E. Manahan, Environmental Chemistry, CRC Press (2005).
8. G.T. Miller, Environmental Science 11th edition. Brooks/ Cole (2006).
9. A. Mishra, Environmental Studies. Selective and Scientific Books, New Delhi (2005).

SCHOOL OF BASIC AND APPLIED SCIENCES
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(Syllabus and Scheme of Studies w. e. f. 2016-17 onwards)
B. Sc. III Year (VI Semester)

Schedule per week Lectures: 2

Examination Time	: 3 Hrs	Maximum	Marks:
50(20+30)			
Subject	: Organic Chemistry	Paper Code	: CH-
304			

Note: Examiner will set nine questions and the students will be required to attempt five questions in all, Question number one is compulsory containing six short answer types questions covering the entire syllabus and will be of 1 marks. Further examiner will be set two questions from each

unit and the students will be required to attempt one question from each unit which will be of 6marks each.

UNIT-I

Heterocyclic Compounds-I: Introduction: Molecular orbital picture and aromatic characteristics of pyrrole, furan, thiophene and pyridine. Methods of synthesis and chemical reactions with particular emphasis on the mechanism of electrophilic substitution. Mechanism of nucleophilic substitution reactions in pyridine derivatives. Comparison of basicity of pyridine, piperidine and pyrrole

UNIT-II

Heterocyclic Compounds-II: Introduction to condensed five and six- membered heterocycles. Preparation and reactions of indole, quinoline and isoquinoline with special reference to Fisher indole synthesis, Skraup synthesis and Bischler-Napieralski synthesis. Mechanism of electrophilic substitution reactions of, quinoline and isoquinoline

Organosulphur Compounds: Nomenclature, structural features, Methods of formation and chemical reactions of thiols, thioethers, sulphonic acids, sulphonamides and sulphaguanidine. Synthetic detergents alkyl and aryl sulphonates.

UNIT-III

Organic Synthesis via Enolates: Acidity of hydrogens, alkylation of diethyl malonate and ethyl acetoacetate. Synthesis of ethyl acetoacetate: the Claisen condensation. Keto-enol tautomerism of ethyl acetoacetate.

Synthetic Polymers: Addition or chain-growth polymerization. Free radical vinyl polymerization, ionic vinyl polymerization, Ziegler-Natta polymerization and vinyl polymers. Condensation or step growth polymerization. Polyesters, polyamides, phenol formaldehyde resins, urea formaldehyde resins, epoxy resins and polyurethanes. Natural and synthetic rubbers.

UNIT-IV

Amino Acids, Peptides & Proteins: Classification, of amino acids. Acid-base behavior, isoelectric point and electrophoresis. Preparation of α -amino acids. Structure and nomenclature of peptides and proteins. Classification of proteins. Peptide structure determination, end group analysis, selective hydrolysis of peptides. Classical peptide synthesis, solid-phase peptide synthesis. Structures of peptides and proteins: Primary & Secondary structure.

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Department of Chemistry

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B. Sc. III Year (VI Semester)

Schedule per week Lectures: 2

Examination Time : 3 Hrs

Maximum Marks: 50

(20+30)

Subject : Physical Chemistry

Paper Code : CH-

306

Note: Examiner will set nine questions and the students will be required to attempt five questions in all, Question number one is compulsory containing six short answer types questions covering the entire syllabus and will be of 1 marks. Further examiner will be set two questions from each unit and the students will be required to attempt one question from each unit which will be of 6 marks each

UNIT-I

Spectroscopy-III: - Electronic Spectrum: Concept of potential energy curves for bonding and antibonding molecular orbitals, qualitative description of selection rules and Franck-Condon principle.

Qualitative description of sigma and pi and n molecular orbital (MO) their energy level and respective transitions.

UNIT-II

Photochemistry: Interaction of radiation with matter, difference between thermal and photochemical processes. Laws of photochemistry: Grotthuss-Draper law, Stark-Einstein law (law of photochemical equivalence) Jablonski diagram depicting various processes occurring in the excited state, qualitative description of fluorescence, phosphorescence, non-radiative processes (internal conversion, intersystem crossing), quantum yield, photosensitized reactions-energy transfer processes (simple examples).

UNIT-III

Solutions:- Dilute Solutions and Colligative Properties: Ideal and non-ideal solutions, methods of expressing concentrations of solutions, activity and activity coefficient. Dilute solution, Colligative properties, Raoult's law, relative lowering of vapour pressure, molecular weight determination, Osmosis law of osmotic pressure and its measurement, determination of molecular weight from osmotic pressure. Elevation of boiling point and depression of freezing point, Thermodynamic derivation of relation between molecular weight and elevation in boiling point and depression in freezing point. Experimental methods for determining various colligative properties. Abnormal molar mass, degree of dissociation and association of solutes.

UNIT-IV

Phase Equilibrium: Statement and meaning of the terms – phase component and degree of freedom, thermodynamic derivation of Gibbs phase rule, phase equilibria of one component System, water and Sulphur systems. Phase equilibria of two component systems, solid-liquid equilibria, simple eutectic, Pb-Ag system, desilverisation of lead

SCHOOL OF BASIC AND APPLIED SCIENCES

Department of Chemistry

(Syllabus and Scheme of Studies w. e. f. 2016-17 onwards)

B. Sc. III Year (VI Semester)

Schedule per week Practical: 6

Examination Time : 4 Hrs
(30+20)

Maximum Marks: 50

Subject : Chemistry Lab-VI
CH-308

Paper Code :

UNIT-I (Inorganic)

Semimicro qualitative analysis of mixture containing not more than four radicals (including interfering, Combinations and excluding insoluble's):

NH_4^+ , CO_3^{2-} , S^{2-} , SO_3^{2-} , $\text{S}_2\text{O}_3^{2-}$, NO_2^- , CH_3COO^- , Cl^- , Br^- , I^- , NO_3^- , SO_4^{2-} , $\text{C}_2\text{O}_4^{2-}$, PO_4^{3-} , BO_3^{3-}

UNIT-II (Physical)

1. To determine the strength of given acid solution (mono and dibasic acid)/ KMnO_4 – Mohr salt potentiometrically.
2. To determine the molecular weight of a non-volatile solute by Rast method.
3. To standardize the given acid solution (mono and dibasic acid) pH metrically.

UNIT-III (Organic)

Synthesis of the following organic compounds:

- (a) To prepare o-chlorobenzoic acid from anthranilic acid.
- (b) To prepare p-bromoaniline from p-bromoacetanilide.
- (c) To prepare m-nitroaniline from m-dinitrobenzene.
- (d) To prepare S-Benzyl-iso-thiouonium chloride from thiourea

Distribution of marks

1. UNIT-I marks	10	(6+4)
2. UNIT-II marks	10	(6+4)
3. UNIT-III marks	10	(6+4)
4. Viva-voce marks	10	(6+4)
5. Lab Record marks	10	(6+4)

(Syllabus and Scheme of Studies w. e. f. 2016-17 onwards)

B. Sc. Botany



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Department of Botany
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Department of Botany
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SCHOOL OF BASIC AND APPLIED SCIENCES
Department of Botany
(Syllabus and Scheme of Studies w. e. f. 2016-17 onwards)
B. Sc. I Year (I Semester)

Schedule per week Lectures: 3

Examination Time : 3 Hrs Maximum Marks: 50(20+30)

**Subject : Diversity of microbes
and plant pathology Paper Code : BOT-101**

Note: Examiner will set nine questions and the students will be required to attempt five questions in all, Question number one is compulsory containing six short answer types' questions covering the entire syllabus and will be of 1 mark. Further examiner will be set two questions from each unit and the students will be required to attempt one question from each unit which will be of 6 marks each.

UNIT-I

Bacteria: Structure, nutrition, reproduction and economic importance

Cyanobacteria: General characters; life-history of *Nostoc* & *Oscillatoria*

Mycoplasma: Occurrence, Morphology, Reproduction and Importance

Viruses: General account of Viruses including structure of TMV and Bacteriophages

UNIT-II

Algae: General characters, classification (upto classes) and economic importance; General account of algal blooms

Important features and life-history (excluding development) of *Volvox*, *Oedogonium* (Chlorophyceae), *Vaucheria* (Xanthophyceae), *Ectocarpus* (Phaeophyceae) and *Polysiphonia* (Rhodophyceae)

UNIT-III

Fungi: General characters, classification (upto classes) and economic importance; Important features and life-history of *Phytophthora* (Mastigomycotina), *Mucor* (Zygomycotina), *Penicillium* (Ascomycotina), *Puccinia*, *Agaricus* (Basidiomycotina), *Colletotrichum* (Deuteromycotina)

UNIT-IV

Lichens: General characters, Habitat, Structure, Reproduction, Economic and Ecological importance of Lichens.

Plants diseases: Brief account, structure, importance and life history and/or disease cycle and control of the following:

Albugo and White rust, *Sclerospora* and Downy mildew/Green ear disease of Bajra; *Aspergillus*; *Claviceps* and Ergot; *Peziza*.

SUGGESTED READINGS:

1. Clifton, A. 1958. Introduction to the Bacteria: McGraw Hill & Co., New York.
2. Dube, H.C. 1990. An Introduction to Fungi, Vikas Publishing House Pvt.Ltd., Delhi.
3. Kumar, H.D. : Introductory phycology, affiliated East-West Press, Ltd. New York, 1998
4. Lodish, H., Berk, A., Zipursky, S.L., Matsudaria, P., Baltimore, D. and Darnell, J. 2000. Molecular, Cell Biology, W.H. Freeman and Co., New York., USA
5. Smith, G.M. 1971. Cryptogamic Botany. Vol.I. Algae & Fungi. Tata McGraw Hill Publishing Co., New Delhi.
6. Sharma, P.D. 1991. The Fungi. Rastogi & Co., Meerut.

SCHOOL OF BASIC AND APPLIED SCIENCES
Department of Botany
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B. Sc. I Year (I Semester)

Schedule per week Lectures: 3

Examination Time : 3 Hrs **Maximum Marks: 50(20+30)**
Subject : Cell biology **Paper Code : BOT-103**

Note: Examiner will set nine questions and the students will be required to attempt five questions in all, Question number one is compulsory containing six short answer types' questions covering the entire syllabus and will be of 1 mark. Further examiner will be set two questions from each unit and the students will be required to attempt one question from each unit which will be of 6 marks each.

UNIT-I

The Cell Envelopes: Structure and functions of Cell Wall, Plasma Membrane, Golgi Apparatus, Endoplasmic Reticulum, Lysosomes, Peroxisomes and Vacuoles

UNIT II

Ultra-structure and function: Chloroplast, Mitochondria, Nucleus and Nucleolus
Chromosome: Morphology, ultra-structure - kinetochore, centromere and telomere

UNIT-III

Cell Cycle: General account

Cell Division: Mitosis and Meiosis - Stages and Significance

UNIT - IV

Chromosomal aberrations: Structural and Numerical - deletions, duplications, translocations, inversions, aneuploidy, polyploidy
Sex chromosomes and Sex determination in Plants

SUGGESTED READINGS:

1. Alberts, B. Bray, D. Lewis, J., Raff, M., Roberts, K. and Watson. I.D. 1999. Molecular Biology of Cell. Garland Publishing Co., Inc., New York, USA.
2. Gupta, P.K. 1999. A text book of Cell and Molecular Biology. Rastogi Publications, Meerut, India.
3. Kleinsmith, L. J and Kish, V.M. 1995. Principles of Cell and Molecular Biology (2nd edition) Harper Collins College Publishers, New York, USA.
4. Lodish, H., Berk, A., Zipursky, S.L., Matsudaria, P., Baltimore, D. and Darnell, J.



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Japanese Zone, National Highway-8, Neemrana-307105

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2000. Molecular, Cell Biology, W.H. Freeman and Co., New York., USA.
5. Smith, G.M. 1971. Cryptogamic Botany. Vol.I. Algae & Fungi. Tata McGraw Hill Publishing Co., New Delhi.

SUGGESTED READINGS:

1. Atherly, A.g. Girton, J.R. and McDonald, J.F. 1999. The Science of Genetics, Saunders College Publishing, Fort Worth, USA.
2. Gupta, P.K. 1999. A text book of Cell and Molecular Biology. Rastogi Publications, Meerut, India
3. Kleinsmith, L.J. and Kish, V.M. 1995. Principles of Cell and Molecular Biology (2nd edition). Harper Collins College Publishers, New York, USA.
4. Lodish, H., Berk, A., Zipursky, S.L., Matudaria, P., Baltimore, D. and Darnell, J. 2000. Molecular, Cell Biology, W.H. Freeman and Co., New York, USA.
5. Russel, P.J. 1998. Genetics, The Benjamin/Cummings Publishing Co. Inc., USA.
6. Snustad, D.P. and Simmons, M.J. 2000. Principles of Genetics. John Wiley and Sons, Inc. USA.
7. Smith, G.M. 1971. Cryptogamic Botany, Vol.II, Bryophytes & Pteridophytes. Tata McGraw Hill Publishing Co., New Delhi.
8. Sharma, O.P. 1992. Text Book of Thallophytes, McGraw Hill Publishing Co.
9. Sharma, O.P. 1990. Text Book of Pteridophyta, Mc Millan India Ltd.
10. Puri, P., 1980, Bryophyta, Atma Ram & Sons, Delhi.
11. Russel, P.J. 1998. Genetics, The Benjamin/Cummings Publishing Co. Inc., USA.

SCHOOL OF BASIC AND APPLIED SCIENCES
Department of Botany
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B. Sc. I Year (II Semester)

Schedule per week Lectures: 3

Examination Time : 3 Hrs **Maximum Marks: 50(20+30)**
Subject : **Diversity of Archegoniate** **Paper Code** : **BOT-102**

***Note:** Examiner will set nine questions and the students will be required to attempt five questions in all, Question number one is compulsory containing six short answer types' questions covering the entire syllabus and will be of 1 mark. Further examiner will be set two questions from each unit and the students will be required to attempt one question from each unit which will be of 6 marks each.*

UNIT-I

Bryophyta: General characters, Origin and evolution of Bryophytes classification (upto classes), alternation of generations, evolution of sprophytes and economic importance

UNIT -II

Bryophyta: Structure and reproduction (excluding development) of *Riccia* and *Marchantia* (Hepaticopsida), *Anthoceros* (Anthocerotopsida) and *Funaria* (Bryopsida)

UNIT-III

Pteridophyta: General characters, classification (upto classes), alternation of generations, heterospory, apospory, apogamy and economic importance; General account of stelar evolution

UNIT IV

Pteridophyta: Structure and reproduction (excluding development) of *Rhynia* (Psilopsida), *Selaginella* (Lycopsida), *Equisetum* (Sphenopsida) and *Pteris* (Pteropsida)

SUGGESTED READINGS:

1. Gilford. L.M. and Foster. A.S. 1998. Morphology and evaluation of vascular plants. W.H. Preeman and Compony. New York.
2. Sharma. O.P. Pteridophytes. 2000. Total and tomorrow Publicatios.
7. Surbhai.R.C. and Saxena. R.C. 1990. A text book of Botany. Rastogi & Co., Meerut.
3. Sporne. K. R. 2002. The Morphology of Gymnosperms.B.I. pub. Pvt. Ltd., Mumbai, Kolkata,
4. Whilson, N.S. and rothewall. G.W. 1993 Paleobotany and evaluation of plants. (II Ed.). Cambridge university press.U.K.
8. Singh, V.P. Pandey, P.C. & Jain, D.K. 2013. A text book of botany (IV Ed). Rastogi.

SUGGESTED READINGS:

1. Choudhary, H.K. (1989). Elementary Principles of Plant breeding. Oxford and IBM Publishing Co., New Delhi.
2. Gupta, P.K. (2009). Cytology, Genetics, Evolution and Plant Breeding, Rastogi Publications, Meerut.
3. Miglani, G.S. (2000). Advanced Genetics, Narosa Publishing House, New Delhi.
4. Russel, P.L. (1998). Genetics. The Benejamins/Cumming Publishing House, Co., Inc.U.S.A.
5. Shukla, R.S. and Chandel, P.S. (2000). Cytogenetics, Evolution and plant Breeding, S. Chan & Co. Ltd., New Delhi.
6. Sing, R.B. (1999). Text Book of Plant Breeding, Kalyani Publishers, Ludhiana.
7. Dnyansagar, V.R. (1986). Cytology and Genetics, Tata McGraw-Hill Pub. Co. Ltd. New Delhi.



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Delhi.

4. Shukla, R.S. and Chandel, P.S. (2000). Cytogenetics, Evolution and plant Breeding, S. Chan & Co. Ltd., New Delhi.
5. Dnyansagar, V.R. (1986). Cytology and Genetics, Tata McGraw-Hill Pub. Co. Ltd. New Delhi.

Suggested Readings

1. Gilford. L.M. and Foster. A.S. 1998. Morphology and evolution of vascular plants. W.H. Preeman and Compony. New York.
1. Bhatnagar, S. and Moitra, A. 1996. Gymnosperms. New Age International Limited, New Delhi.
2. Davis, P.H. and Heywood, V.H. 1963. Principles of Angiosperms Taxonomy, Oliver and Boyd. London.
3. Gifford, E.M. and Foster, A.S. 1988. Morphology and Evolution of Vascular Plants, W.H. Freeman & Company, New York.
4. Heywood, V.H. and Moore, D.M. (eds) 1984. Current concepts in Plant Taxonomy. Academic Press, London.
5. Jeffrey, C. 1982. An introduction to Plant Taxonomy. Cambridge University Press, Cambridge, London.
6. Jones, S.B. , Jr. Luchsinger, A.E. 1986. Plants Systematics 2nd edition). McGraw Hill Book Co. New York.
7. Maheshwari, J.K. 1963. Flora of Delhi, CSIR, New Delhi.
8. Radford, A.E. 1986. Fundamentals of Plant Systamtics. Harper and Row, New York.
9. Singh, G. 1999. Plant Systematics: Theory and Practical. Oxford and IBH Pvt. Ltd., New Delhi.
10. Sporn, K.R. 1965. The Morphology of Gymnsperms. Hutchinson & Co. Ltd., London.
11. Stace, C.A. 1989. Plant Taxonomy and Biosystematics (2nd edition). Edward Arnold, London.
12. Steward, W.M. Paleobotany and the Evolution of Plants. Cambridge University Press, Cambridge.

SCHOOL OF BASIC AND APPLIED SCIENCES
Department of Botany
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B. Sc. II Year (III Semester)

Schedule per week Lectures: 3

Examination Time	: 3 Hrs	Maximum Marks: 50(20+30)
Subject	: Botany Lab-III	Paper Code : BOT-205

Time allotted: 4Hours

- 1 Cut the section of given material from gymnosperms and prepare a double-stained permanent mount. Identify giving reasons and show it to the examiner. (4)
- 2 Cut the section of given material from angiosperms and prepare a double-stained permanent mount. Identify giving reasons and show it to the examiner. (4)
- 3 Identify, classify and write morphological notes on the given material/specimens A & B from Gymnosperms. (3)
- 4 Identify, giving the important characters of identification of the spots/specimen 1 and 2 from Gymnosperms and 3 and 4 from angiosperms. (3)
- 5 Describe/compare the given flowers C and D in semi-technical language giving V.S. of flowers, T.S. of ovaries, floral diagrams and Floral Formulae. Identify and assign them to their respective families giving reasons. (3)
- 6 Identify, giving the important characters of identification of the spots 1, 2 and 3 from embryology. (3)
- 7 Any experiment designed by the examiner as per syllabus (2)
- 8 Practical records (3)
- 9 Viva-voce (5)

IA. Lab exercise, Practical records, Field collection, Seminars, Assignments and projects

List of experiments

T.S. of stem *Cycus*
T.S. of Leaf *Cycus*
T.S. of Root *Cycus*
T.S. of stem *Pinus*

Leaf *Pinus*

Root *Pinus*

Suggested Readings

1. Bhojwani, S.S. and Bhatnagar, S.P. 2000. The Embryology of Angiosperms. 4th revised and enlarge edition. Vikas Publishing House, Delhi.
2. Cutter, E.G. 1969. Plant Anatomy Part-I, Cells and Tissues, Edward Arnold, London.
3. Cutter, E.G. 1971. Plant Anatomy: Experiment and Interpretation. Part-II Organs, Edward Arnold London.
4. Esau, K. 1977. Anatomy of Seed Plants, 2nd edition. John Wiley & Sons, New York.
5. Fageri, K and Van der Pijl 1979. The Principles of Pollination Ecology. Pergamon Press, Oxford.
6. Fahn, A. 1974. Plant Anatomy, 2nd Edition. Pergamon Press, Oxford.
7. Hartmann, H.T. and Kestler, D.E. 1976. Plant Propagation; Principles and Practices. 3rd edition. Prentice Hall of India Pvt. Ltd. New Delhi
8. King. J. 1997. Reaching for the Sun: How Plants Works. Cambridge University Press, Cambridge, U.K.
9. Mauseth, J.D. 1988. Plant Anatomy. The Benjamin/Cummings Publishing Company Inc. Menlo Park, California, USA.
10. Proctor, M and Yeo, P. 1973. The Pollination of Flowers. William Collins Sons, London.
11. Raven, P.H. Evert, R.F. and Eichhorn, S.E. 1999. Biology of Plants. 5th edition. W.R. Freeman and Co., Worth Publishers, New York.
12. Thomas, P. 2000. Trees: Their Natural History. Cambridge University Press, Cambridge.

SCHOOL OF BASIC AND APPLIED SCIENCES
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B. Sc. II Year (IV Semester)

Schedule per week Lectures: 3

Examination Time	: 3 Hrs	Maximum Marks: 50(20+30)
Subject	: Botany Lab-IV	Paper Code : BOT-206

Time allotted: 4Hours

- 1 Cut the section of given material from gymnosperms and prepare a double-stained permanent mount. Identify giving reasons and show it to the examiner. (4)
 - 2 Cut the section of given material from angiosperms and prepare a double-stained permanent mount. Identify giving reasons and show it to the examiner. (4)
 - 3 Identify, classify and write morphological notes on the given material/specimens A & B from Gymnosperms. (4)
 - 5 Dissect out the globular/heart-shaped embryo from the given material.(4)
 - 6 Identify, giving the important characters of identification of the spots 1, 2 and 3 from embryology. (4)
 - 7 Any experiment designed by the examiner as per syllabus (2)
 6. Practical records (3)
 - 9 Viva-voce (5)
- IA. Lab exercise, Practical records, Field collection, Seminars, Assignments and projects

List of experiments

Plants According to season and area
T. S. Of Flowers Parts
T.S. of Ovary
T. S. of embryo
Pisum
Brasica
Hibiscus
Rosa

Suggested Readings

13. Bhojwani, S.S. and Bhatnagar, S.P. 2000. The Embryology of Angiosperms. 4th

- revised and enlarge edition. Vikas Publishing House, Delhi.
14. Cutter, E.G. 1969. Plant Anatomy Part-I, Cells and Tissues, Edward Arnold, London.
 15. Cutter, E.G. 1971. Plant Anatomy: Experiment and Interpretation. Part-II Organs, Edward Arnold London.
 16. Esau, K. 1977. Anatomy of Seed Plants, 2nd edition. John Wiley & Sons, New York.
 17. Fageri, K and Van der Pijl 1979. The Principles of Pollination Ecology. Pergamon Press, Oxford.
 18. Fahn, A. 1974. Plant Anatomy, 2nd Edition. Pergamon Press, Oxford.
 19. Hartmann, H.T. and Kestler, D.E. 1976. Plant Propagation; Principles and Practices. 3rd edition. Prentice Hall of India Pvt. Ltd. New Delhi
 20. King. J. 1997. Reaching for the Sun: How Plants Works. Cambridge University Press, Cambridge, U.K.
 21. Mauseth, J.D. 1988. Plant Anatomy. The Benjamin/Cummings Publishing Company Inc. Menlo Park, California, USA.
 22. Proctor, M and Yeo, P. 1973. The Pollination of Flowers. William Collins Sons, London.
 23. Raven, P.H. Evert, R.F. and Eichhorn, S.E. 1999. Biology of Plants. 5th edition. W.R. Freeman and Co.

Suggested Readings:

1. Dennis, D.T., Turpin, D.H., Lefebvre, D.D. and Layzell (eds.). 1997: Plant Metabolism (2nd Edition), Longman, Essex, England.
2. Galston, A.W. 1989: Life Processes in Plants, Scientific American Library, Springer-Verlag, New York, USA.
3. Hopkins, W.G., 1995: Introduction to Plant Physiology, John Wiley & Sons, Inc., New York, USA.
4. Mohr, H. and Schopfer, P. 1995: Plant Physiology. Springer-Verlag, Berlin Germany.

SCHOOL OF BASIC AND APPLIED SCIENCES
Department of Botany
(Syllabus and Scheme of Studies w. e. f. 2016-17 onwards)
B. Sc. III Year (V Semester)

Schedule per week Lectures: 3

Examination Time : 3 Hrs **Maximum Marks: 50(20+30)**

Subject : Ecology **Paper Code : BOT-303**

Note: Examiner will set nine questions and the students will be required to attempt five questions in all, Question number one is compulsory containing six short answer types' questions covering the entire syllabus and will be of 1 mark. Further examiner will be set two questions from each unit and the students will be required to attempt one question from each unit which will be of 6 marks each.

UNIT-I

Introduction to Ecology: Definition; scope and importance; levels of organization .

Environment: Introduction; environmental factors- climatic (water, humidity, wind, light, temperature), edaphic (soil profile, physico-chemical properties), topographic and biotic factors (species interaction).

UNIT-II

Adaptations of plants to water stress and salinity (morphological and anatomical features of hydrophytes, xerophytes and halophytes).

Population ecology: Basic concept; characteristics; biotic potential, growth curves; ecotypes and ecads.

UNIT-III

Community ecology: Concepts; characteristics (qualitative and quantitative-analytical and synthetic); methods of analysis; ecological succession. **Ecosystem:** Structure (components) and functions (trophic levels, food chains, food webs, ecological pyramids and energy flow) **Biogeochemical cycles:** Carbon, nitrogen, phosphorus and hydrological cycle.

UNIT-IV

Phyto-geography: Phyto- geographical regions of India; vegetation types of India (forests). Environmental pollution: Sources, types and control of air and water pollution. **Global change:** Greenhouse effect and greenhouse gases; impacts of global warming; carbon trading; Ozone layer depletion; Biomagnification

Suggested Readings:

1. Odum, E.P. 1983: Basic Ecology, Saunders, Philadelphia.
2. Kormondy, E.J. 1996: Concepts of Ecology, Prantice-Hall of India Pvt. Ltd., New Delhi.
3. Mackenzie, A. et al. 1999: Instant Notes in Ecology, Viva Books Pvt. Ltd., New Delhi.

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B. Sc. III Year (V Semester)

Schedule per week Lectures: 3

Examination Time	: 3 Hrs	Maximum Marks: 50(20+30)
Subject	: Botany Lab-V	Paper Code : BOT-305

Max. Marks: 50

Time allotted: 4Hours

1. Devise an experiment to demonstrate the physiological process
(As per list). Perform it and show it to the examiner. (5)
2. Comment on physiological experiment
(Specimen set up/ model/chart). (2)
3. Ecological experiment/ecological specimen. (5)
(As per list)
4. Any experiment designed by the examiner as per syllabus. (5)
Collection and field report of xerophytes, hydrophytes, halophytes. (5)
5. Practical records (3)
6. Viva-voce (5)
- IA. Lab exercise, Practical records, Field collection, Seminars, Assignments and projects

LIST OF PRACTICALS

A. Plant Physiology

1. Demonstration of Imbibition by Plaster of Paris method.
2. Demonstration of osmosis by potato osmoscope method.
3. Demonstration of plasmolysis and deplasmolysis.
4. Determination of osmotic pressure of plant cells by plasmolytic method.
5. Comparison of stomatal and cuticular transpiration by four leaf/ cobalt chloride method.
6. Demonstration of transpiration by Ganongs'/ Farmer's photometer.
7. Separation of photosynthetic pigments by thin layer/ paper chromatography.
8. Demonstration of Ascent of sap / Transpiration pull.
9. Demonstration of phloem being the channel of translocation of organic solutes.

10. Rate of photosynthesis under varying CO₂ concentration.
11. Effect of kind of light intensity on oxygen evolution during photosynthesis using Wilmott's bubbler.
12. To demonstrate that coleoptiles tip produce growth hormone.
13. Experiments on phototropism, geotropism and hydrotropism.

B. Ecology

1. Determination of pH of soil and water samples.
2. Study of physical properties of soil- soil density, water holding capacity etc.
3. Study of community structure by quadrat / line transect method.
4. Determination of density, abundance and frequency of species by quadrat method.
5. Morphological and anatomical features of hydrophytes, xerophytes, halophytes and parasites in relation to their habitats.
6. To prepare a report on local visit to an industry to identify the source and types of Pollutants.
7. Demonstration of anther culture, protoplast isolation and culture using suitable models / charts / photographs etc.
8. Callus formation experiment.

2. Lea, P.J. and Leegood, R.C. 1999: Plant Biochemistry and Molecular Biology, John Wiley & Sons, Chichester, England.
3. Old, R.W. and Primrose, S.B. 1989: Principles of Gene Manipulation, Blackwell Scientific Publications, Oxford, UK.
4. Raghavan, V. 1986: Embryogenesis in Angiosperms: A Developmental and Experimental Study, Cambridge University Press, New York, USA



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SCHOOL OF BASIC AND APPLIED SCIENCES

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B. Sc. III Year (VI Semester)

Schedule per week Lectures: 3

Examination Time	: 3 Hrs	Maximum Marks: 50(20+30)
Subject	: Botany Lab-VI	Paper Code : BOT-306

Max. Marks: 50

Time allotted: 4Hours

1. Design an experiment from Biochemistry (As per list). Perform it and show it to the examiner. (4)
 2. Devise an experiment to demonstrate the physiological process (As per list). Perform it and show it to the examiner. (4)
 3. Perform /Comment on Biotechnological experiment. (6)
(As per list).
 4. Identify and classify spots 1,2,3 & 4 from the point of view of economic importance and morphology of the plant part used. (4)
 5. Any experiment designed by the examiner as per syllabus. (4)
 6. Practical records.(3)
 7. Viva-voce. (5)
- IA. Lab exercise, Practical records, Field collection, Seminars, Assignments and projects

LIST OF PRACTICALS

A. Biochemistry

1. Demonstration of aerobic respiration.
2. Demonstration of anaerobic respiration.
3. Evolution of heat during respiration
4. Demonstration of Manometric determination of R.Q.
5. Determination of peroxidase activity.
6. Simple tests for the detection of Carbohydrates (Monosaccharides, Disaccharides and Starch); Proteins and Fats.

B. Utilization of plants & Applied Botany

1. Study of plant parts/products from the point of view of economic importance (as per theory syllabus).
2. To prepare any one of the tissue culture medium.
3. Preparation of petriplates and slants for culture.
4. Study of techniques of sterilization, culturing and sub-culturing of cell, tissues and organs.
5. Demonstration of anther culture, protoplast isolation and culture using suitable models / charts / photographs etc.
6. Callus formation experiment.

MARKS DISTRIBUTION OF PRACTICAL EXAMINATION

Practical Total Internal Assessment Marks	= 20
a) Experimental work/Exercises	= 10 Marks
b) Internal Viva	= 5 Marks
c) Regularity/discipline	= 5 Marks
 End Term Practical Examination Marks	 = 30
a) Experimental work/Exercises	= 20 Marks
b) External Viva	= 5 Marks
d) Practical Record file	= 5 Marks
Total Practical Marks	(20 + 30) = 50



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B. Sc. Zoology



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RAFFLES UNIVERSITY, NEEMRANA, ALWAR (RAJASTHAN)
Japanese Zone, National Highway-8, Neemrana-307105
Tel.: +91-9214205555 www.rafflesuniversity.edu.in
SCHOOL OF BASIC AND APPLIED SCIENCES

Department of Zoology
(Syllabus and Scheme of Studies w. e. f. 2016-17 onwards)

B. Sc. I Year (I Semester)

Schedule per week Lectures: 3

Examination Time : 3 Hrs

Maximum Marks: 50(20+30)

Paper Code : ZOO-101

Subject : Life and Diversity from Protozoa to Helminthes

Note: Examiner will set nine questions and the students will be required to attempt five questions in all, Question number one is compulsory containing six short answer types' questions covering the entire syllabus and will be of 1 mark each (Answer to each question should not exceed 20 words). Answer to each part should not exceed 20 words. Further examiner will set two questions from each unit and the students will be required to attempt one question from each unit which will be of 6 marks each.

UNIT 1 - Phylum- Protozoa

- (1) General characters and classification upto order level
- (2) Biodiversity and economic importance of Protozoa
- (3) Parasitic Protozoans: Life history, mode of infection and pathogenicity of *Entamoeba*, *Plasmodium*, *Trypanosoma*, *Leishmania* and *Giardia*

UNIT 2 - Phylum- Porifera

- (1) General characters and classification up to order level
- (2) Biodiversity and economic importance of Porifera
- (3) Type study - *Sycon*
- (4) Canal system in sponges
- (5) Spicules in sponges

UNIT 3 - Phylum - Coelenterata

- (1) General characters and classification up to order level
- (2) Biodiversity, economic importance
- (3) Type Study - *Obelia*
- (4) Corals and coral reefs
- (5) Polymorphism in Siphonophores

UNIT 4 - Helminths

- (1) General characters and classification of Platyhelminthes
- (2) General characters and classification of Aschelminthes
- (3) Type study - *Fasciola hepatica* and *Ascaris*
- (4) Helminths parasites: Brief account of life history, mode of infection and pathogenicity of *Schistosoma*, *Taenia*, *Ancylostoma*, *Trichinella*, *Wuchereria* and *Oxyuris*
- (5) Parasitic adaptations

Schedule per week Lectures: 3

Examination Time	: 3 Hrs	Maximum Marks: 50(20+30)
Subject	: Cell biology & Genetics	Paper Code : ZOO-103

Note: Examiner will set nine questions and the students will be required to attempt five questions in all, Question number one is compulsory containing six short answer types' questions covering the entire syllabus and will be of 1 mark each (Answer to each question should not exceed 20 words). Answer to each part should not exceed 20 words. Further examiner will set two questions from each unit and the students will be required to attempt one question from each unit which will be of 6 marks each.

UNIT 1

1. Ultrastructure of different cell organelles of animal cell
2. Plasma Membrane: Fluid mosaic model, various modes of transport across the membrane, mechanism of active and passive transport, endocytosis and exocytosis.
3. Endoplasmic reticulum (ER): types, role of ER in protein synthesis and transportation in animal cell
4. Goigi complex: Structure, Associated enzymes and role of golgi-complex in animal cell
5. Lysosomes: Structure, enzyme and their role; polymorphism

UNIT 2

1. Ribosomes: Types, biogenesis and role in protein synthesis
2. Mitochondria: Mitochondrial DNA; as semiautonomous body, biogenesis, mitochondrial enzymes (only names), role of mitochondria
3. Cytoskeleton: Microtubules, microfilaments, centriole and basal body. Cilia and Flagella
4. Nucleus: Nuclear membrane, nuclear lamina, nucleolus, fine structure of chromosomes, nucleosome concept and role of histones, euchromatin and heterochromatin, lampbrush and polytene chromosomes
5. Mitosis and Meiosis (Cell reproduction)

UNIT 3

1. Basic principles of Heredity, basic idea on extensions and modifications of basic principles
2. Linkage and recombination : coupling and repulsion hypothesis, crossing over and chiasma formation
3. Sex linked Inheritance: Chromosomal system of sex determination, Haemophilia and Colour blindness in man, Eye colour in *Drosophila*, Non-disjunction of sex chromosomes in *Drosophila*
4. Variation; types, sources of variation

UNIT 4

1. Mutation; chromosome and gene mutations, implications of mutation
2. Human genetics: Human Karyotype, genetic counselling and testing, Chromosomal abnormalities involving autosomes and sex chromosomes, monozygotic and dizygotic twins, Inborn errors of metabolism (Alcaptonuria, Phenylketonuria, Albinism, Sickle-cell anaemia), DNA fingerprinting, genetic compatibility
3. Applied genetics; genetic engineering, implications, transgenic animals, eugenics, euthenics and euphenics

Schedule per week Lectures: 3

Examination Time : 4 Hrs

Maximum Marks: 50 (20+30)

Subject : Zoology Lab-I

Paper Code : ZOO-105

(A) Classification up to orders with ecological note and economic importance of the following animal:

Protozoa : Lamination of cultures of *Amoeba*, *Euglena* and *Paramecium*;

Permanent prepared slides: *Amoeba*, *Euglena*, *Trypanosoma*, *Noctiluca*, *Eimeria*, *Paramecium* (binary fission and conjugation), *Opalina*, *Verticella*, *Balantidium*, *Nyctotherus*, radiolarian and foraminiferan ooze.

Parazoa (Porifera): Specimens: *Sycon*, *Grantia*, *Euplectella*, *Hyalonema*, *Spongilla*, *Euspongia*

Coelenterata : Specimens: *Porpita*, *Valella*, *Physalia*, *Aurelia*, *Rhyzostoma*, *Metridium*, *Millipora*, *Alcyonium*, *Tubipora*, *Zoanthus*, *Madrepora*, *Favia*, *Fungia*, and *Astrea*, Permanent prepared slides: *Hydra* (W.M.), *Hydra* with buds, *Obelia* (colony and medusa), *Sertularia*, *Plumularia*, *Tubularia*, and *Bougainvillea*, *Aurelia* (sense organs and stages of life history)

Platyhelminthes : Specimens: *Dugesia*, *Fasciola*, *Taenia*, *Echinococcus*, Permanent prepared slides: *Miracidium*, *sporocyst*, *redia*, *cercaria*, *scolex* and *proglottids*; *Taenia* (mature and gravid)

Aschelminthes : Specimens: *Ascaris* (male & female), *Trichinella*, *Ancylostoma*, *Meloidogyne*.

(B) Study of the following permanent stained preparations:

L.S. and TS. *Sycon*; gemmules, spicules and sponging fibres of *Sycon*, canal system of sponges, TS. *Hydra* (testis and ovary region). T.S. *Fasciola* (different regions). T.S. *Ascaris* (male and female).

Temporary preparation of *Volvox*, *Paramecium*, Gemmules and spicules of *Sycon*, Preparation of permanent stained whole mounts of *Hydra*, *Obelia*, *Sertularia*, *Plumularia* and *Bougainvillea*, Pathogenic protozoans: Plasmodium, Giardia or as available, Pathogenic Helminthes: Ancylostoma; Wuchereria or as available

(C) Cell biology and Genetics:

Cell division: Prepared slides of stages of mitosis and meiosis, Temporary squash preparations of onion root tip / grasshopper testis for the study of mitosis using acetocarmine stain, Salivary gland and polytene chromosomes of *Drosophila/Chironomus*, Exercise based on Mendel's law

(E) Project:

1. Parasitic adaptations (Protozoa to helminthes)
2. DNA: types, structure and its model preparation
3. Survey: Diversity of particular family/taxa in your surrounding area
4. Microscopy: principles and its significance
5. Staining techniques and their significance

MARKS DISTRIBUTION OF PRACTICAL EXAMINATION

Practical Total Internal Assessment Marks	= 20
a) Experimental work/Exercises	= 10 Marks
b) Internal Viva	= 5 Marks
c) Regularity/discipline	= 5 Marks
End Term Practical Examination Marks	= 30
a) Experimental work/Exercises	= 20 Marks
b) External Viva	= 5 Marks
d) Practical Record file	= 5 Marks
Total Practical Marks	(20 + 30) = 50

Suggested readings

1. Barnes, RD. Invertebrate zoology. WG Saunders, Philadelphia.
2. P S Verma, E L Jordan. Invertebrate Zoology 25th Edition, 2001. S. Chand Publications, New Delhi.
3. Stephen A. Miller, John B. Harley, Zoology, 6th Edition 2005 [The McGraw-Hill Companies](#).
4. D. T. Anderson .Invertebrate Zoology. Second Edition, 1999 Oxford University Press
5. [E. D. De Robertis](#), 1987. Cell and Molecular Biology 8th Edition. Lippincott Williams & Wilkins
6. [Benjamin A. Pierce](#). Genetics: A Conceptual Approach, 2014. W.H.Freeman & Co Ltd;
7. [Janet Moore](#). An Introduction to the Invertebrates.2006. Cambridge University Press
8. Ahluwalia KB. Genetics. Wiley Eastern Ltd., New Delhi.
9. Jonathan, Slack. Genes. Oxford University Press, New Delhi.



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Department of Zoology

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B. Sc. I Year (II Semester)

Schedule per week Lectures: 3

Examination Time : 3 Hrs

Maximum Marks: 50(20+30)

Paper Code : ZOO-102

Subject : Life and Diversity of Annelida to Hemichordata

Note: Examiner will set nine questions and the students will be required to attempt five questions in all, Question number one is compulsory containing six short answer types' questions covering the entire syllabus and will be of 1 mark each (Answer to each question should not exceed 20 words). Answer to each part should not exceed 20 words. Further examiner will set two questions from each unit and the students will be required to attempt one question from each unit which will be of 6 marks each.

UNIT 1- Phylum – Annelida

1. General characters and classification up to order level
2. Biodiversity and economic importance of Annelida
3. Type study - *Pheretima* (Earthworm)
4. Metamerism in Annelida
5. Trochophore larva: Affinities, evolutionary significance

UNIT 2 - Phylum - Arthropoda

1. General characters and classification up to order level
2. Biodiversity and economic importance of insects
3. Type study – *Periplaneta*

UNIT 3- Phylum – Mollusca

1. General characters and classification up to order level
2. Biodiversity and economic importance
3. Type study - *Pila*
4. Torsion and detorsion in gastropoda
5. Respiration and foot

UNIT 4- Phylum - Echinodermata

1. General characters and classification up to order level
2. Biodiversity and economic importance
3. Type Study -*Asteries* (Sea Star)
4. Echinoderm larvae
5. Aristotle's Lantern

Phylum – Hemichordata

1. General characters and classification, Type study: *Balanoglossus*

Schedule per week Lectures: 3

Examination Time : 3 Hrs Maximum Marks: 50(20+30)

Subject : Developmental Biology Paper Code : ZOO-104

Note: Examiner will set nine questions and the students will be required to attempt five questions in all, Question number one is compulsory containing six short answer types' questions covering the entire syllabus and will be of 1 mark. Further examiner will be set two questions from each unit and the students will be required to attempt one question from each unit which will be of 6 marks each.

UNIT 1

1. History and basic concepts : Epigenesis, preformation, mosaic and regulative development
2. Discovery of induction, cell-cell interaction, differentiation and growth
3. Differential gene expression, cytoplasmic determinants and asymmetric cell division
4. Reliability of development: Redundancy and negative feed back

UNIT 2

1. Early Embryonic development: gametogenesis, oogenesis, types of eggs, egg membranes, fertilization, changes in gametes, monospermy and polyspermy, planes and patterns of cleavage, early development of frog and chick up to gastrulation, fate maps, embryonic induction and organizers
2. Late Embryonic development: fate of germ layers, extra-embryonic membranes in birds, implantation of embryo in humans, placenta structure, types and functions of placenta

UNIT 3

Post embryonic development

1. Metamorphosis; changes, hormonal regulations in amphibians,
2. Regeneration; modes of regeneration, epimorphosis, morphallaxis and compensatory regeneration (with one example each),
3. Ageing; concepts and models

UNIT 4

Implications of developmental biology

1. Cloning of animals; nuclear transfer technique, embryo transfer technique, Teratogenesis; teratogenic agents and their effects on embryonic development
2. In- vitro fertilization
3. Stem cells; types, applications, stem cell culture

Schedule per week Lectures: 3

Examination Time : 3 Hrs Maximum Marks: 50(20+30)

Subject : Zoology Lab-II Paper Code : ZOO-106

(A) Classification up to orders with ecological note and economic importance of the following group of animals:

1. Annelida Specimens: Pheretima, Heteronereis, Aphrodite, Chaetopterus, Arenicola, Tubifex and Pontobdella.
2. Arthropoda Specimens: Peripatus, Palaemon (Prawn), Lobster, Cancer (crab), Sacculina, Eupagurus (hermit crab), Lepas, Balanus, Cyclops, Daphnia, Lepisma, Periplaneta (cockroach), Schistocerca (locust), Poecilocus (ak-hopper), Gryllus (cricket), Mantis (praying mantis), Cicada, Forficula (earwig), Dragon fly, termite queen, bug, moth, beetle, Polistes (wasp), Apis (honeybee), Bombyx (silk moth), Cimex (bedbug), Pediculus (body louse). Millipedes, Scolopendra (centipedes), Palamnaeus (scorpion), Aranea (spider), Limulus (king crab).
3. Mollusca Specimens: Mytilus, Ostrea, Cardium, Pholas, Solen (razor fish), Pecten, Haliotis, Patella, Aplysia, Doris, Limax, Loligo, Sepia, Octopus, Nautilus (complete and T.S.), Chiton and Dentalium.
4. Echinodermata Specimens: Asterias, Echinus, Cucumara, Ophiothrix, Antedon and Asterophyton.
5. Hemichordata: Balanoglossus

(B) Study of the following permanent stained preparations:

1. T.S. Pheretima (pharyngeal and typhlosolar regions), Setae, septal nephridia and spermathecae of Pheretima.
2. Trachea and mouthparts of cockroach.
3. Statocyst of Palaemon.
4. Glochidium larva of Anodonta; radula and osphradium of Pila.
5. T.S. Star fish (arm)
6. T.S. Balanoglossus (through various regions)

(C) Demonstration by C. D.:

1. Mouth parts and trachea of Periplaneta (cockroach), radula of Pila; pedicellariae of Asterias.
2. Setae of earthworm, and mouth parts of Honey bee, House fly and



cockroach.

(D) Preparation of models of the different systems of the following animals:

1. Earthworm: Digestive, reproductive and nervous systems.
2. Grasshopper/ cockroach: Digestive, reproductive and nervous systems.
3. Pila: Pallial complex, digestive and nervous systems

(E) Embryology:

1. Histological slides of frog: cleavage, blastula, gastrula, neurula and tailbud stage
2. Chick developmental study (slides): 18 hrs, 21 hrs, 33 hrs, 72 hrs and 96 hrs of incubation, primitive streak stage in embryo and study of various foetal membranes in a 10-12 day old chick embryo.

MARKS DISTRIBUTION OF PRACTICAL EXAMINATION

Practical Total Internal Assessment Marks	= 20
a) Experimental work/Exercises	= 10 Marks
b) Internal Viva	= 5 Marks
c) Regularity/discipline	= 5 Marks
End Term Practical Examination Marks	= 30
a) Experimental work/Exercises	= 20 Marks
b) External Viva	= 5 Marks
d) Practical Record file	= 5 Marks
Total Practical Marks	(20 + 30) = 50

Suggested readings:

1. Barrington, EJW. Invertebrate structure and function. East West Press Pvt. Ltd. New Delhi.
2. Parker and Haswell. Text book of zoology: invertebrates. Vol. 1. Lowpriced textbook. The Macmillan press Ltd.
3. [R. L. Kotpal](#) Modern Text Book of Zoology: Invertebrates, 2009. Rastogi Publications
4. P S Verma, E L Jordan . Chordate Zoology, 2009. S. Chand Publications, New Delhi.
5. [Scott F. Gilbert](#), [Susan R. Singer](#). Developmental Biology, 2010. Sinauer Associates.
6. Balinsky, BI. An introduction to Embryology. Saunders, Philadelphia.
7. Lewis, Wolpert. Development Biology. Oxford University Press, Delhi.



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B. Sc. II Year (III Semester)

Schedule per week Lectures: 3

Examination Time : 3 Hrs

Maximum Marks: 50(20+30)

Paper Code : ZOO-201

Subject : Life and Diversity of Chordates-I

Note: Examiner will set nine questions and the students will be required to attempt five questions in all, Question number one is compulsory containing six short answer types' questions covering the entire syllabus and will be of 1 mark each (Answer to each question should not exceed 20 words). Answer to each part should not exceed 20 words. Further examiner will set two questions from each unit and the students will be required to attempt one question from each unit which will be of 6 marks each.

UNIT-1

Chordates: General characteristics and classification, affinities and origin, Protochordates, Retrogressive metamorphosis, Agnatha: General features of living Agnatha and classification upto classes. Type study of Pteromyzon: Structure and life history

UNIT-2

Pisces: General features & Classification, Osmoregulation, migration and Parental care, Type study: Scoliodon

Amphibia: General features & Classification upto orders, Origin and evolution of terrestrial ectotherms/tetrapods, Parental care & pedomorphosis. Type study: Rana.

UNIT-3

Reptiles: General features & Classification upto orders, Origin of reptiles skull types, Poisonous and non- poisonous snakes in India, Biting mechanism in snakes

Aves: General features & Classification upto orders. Origin of birds, Flight adaptations, Migration.

UNIT-4

Mammals: General features & Classification upto orders. Origin of mammals, dentition, Type study: Rat.



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B. Sc. II Year (III Semester)

Schedule per week Lectures: 3

Examination Time : 3 Hrs Maximum Marks: 50(20+30)

Subject : Mammalian Physiology-I Paper Code : ZOO-203

***Note:** Examiner will set nine questions and the students will be required to attempt five questions in all, Question number one is compulsory containing six short answer types' questions covering the entire syllabus and will be of 1 mark each (Answer to each question should not exceed 20 words). Answer to each part should not exceed 20 words. Further examiner will set two questions from each unit and the students will be required to attempt one question from each unit which will be of 6 marks each.*

UNIT 1

Digestion - Brief introduction to digestive system, Buccal digestion; salivary secretion and digestion, Gastric digestion; gastric secretion and digestion, Intestinal digestion; pancreatic secretion, bile juices and digestion and small intestine and digestion and absorption in large intestine

UNIT 2

Osmoregulation and excretion - Osmoregulation , Mammalian excretory system; excretory organs and major associated blood vessels, kidney structure, nephron structure, Urine formation; ultra filtration, selective re-absorption and tubular secretion, Counter current multiplier system

UNIT 3

Respiration - Respiratory organs, Breathing mechanism, Respiratory pigments; properties and functions, External and internal respiration, Transport of gases.

Circulation - Working of mammalian heart, Blood composition and function, Mechanism of blood clotting

UNIT 4

Immunology - Innate and Acquired immunity, Humoral and cell-mediated immunity, Active and passive immunization, Blood groups and transfusions, tissue and organ transplants, Allergies, autoimmune diseases, immunodeficiency diseases

Schedule per week Lectures: 3

Examination Time : 3 Hrs

Maximum Marks: 50(20+30)

Subject : Zoology Lab-III

Paper Code : ZOO-205

1. Classification upto orders, habit, habitats, external characters and economic importance (if any) of the following animals:-

Protochordata; *Molqula*, *Hetryllus*, *Pyrosoma*, *Doliolum*, *Olikopleura*, and *Amphioxus*.

Cyclostomata; *Myxine*, *Petromyzon* and *Ammocoetus larva*.

Chondrichthyes; *Zygaena*, *Pristis*, *Narcine* (electric ray), *Trygon*, *Rhinobatus*, *Raja* and *Chimaera*.

Osteichthyes; *Acipenser*, *Lepidosteus*, *Muraena*, *Mystus*, *Catla*, *Hippocampus*, *Syngnathus*, *Exocoetus*, *Anabas*, *Diodon*, *Ostraczion*, *Tetradon*, *Echinus*, *Lophius*, *Solea* and *Polypterus*. Any of the Lung Fish

2. Preparation of models of the different systems of the following animals:
Herdmania: General anatomy
Labeo (locally available fish): Digestive and reproductive systems: cranial nerves
3. Study of the skeleton of : *Scoliodon*, *Labeo*
4. Study of the prepared slides: Tornaria larva, T.S. *Amphioxus* (through different regions). *Oikopleura*, different types of scales
5. Make permanent stained preparations of the following: *Salpa*, Spicules, and Cycloid scales
6. Physiology practical; Estimation of abnormal constituents of urine (Albumin, sugar, ketone bodies), Use of respirometer, Haematein crystal preparation, Estimation of Hb, DLC of Man, RBC count, WBC count.
7. Project Report: Migration in fishes, faunal survey
8. Disaster Management Project Work: (Field Work, Case Studies. for details see the UGC Website

MARKS DISTRIBUTION OF PRACTICAL EXAMINATION

Practical Total Internal Assessment Marks	= 20
a) Experimental work/Exercises	= 10 Marks
b) Internal Viva	= 5 Marks
c) Regularity/discipline	= 5 Marks
End Term Practical Examination Marks	= 30
a) Experimental work/Exercises	= 20 Marks
b) External Viva	= 5 Marks
d) Practical Record file	= 5 Marks
Total Practical Marks	(20 + 30) = 50



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B. Sc. II Year (IV Semester)

Schedule per week Lectures: 3

Examination Time : 3 Hrs

Maximum Marks: 50(20+30)

Paper Code : ZOO-202

Subject : Life and Diversity of Chordates-II

Note: Examiner will set nine questions and the students will be required to attempt five questions in all, Question number one is compulsory containing six short answer types' questions covering the entire syllabus and will be of 1 mark each (Answer to each question should not exceed 20 words). Answer to each part should not exceed 20 words. Further examiner will set two questions from each unit and the students will be required to attempt one question from each unit which will be of 6 marks each.

Unit 1

Comparative Anatomy of Chordates:

Integument; Structure and derivatives of integument

Bone; Structure and types, Ossification, bone growth.

Unit 2

Digestive System; Alimentary canal and associated glands

Respiratory system; Skin, Gills, Lungs, Air sacs and voice apparatus, Air bladder and accessory breathing organs in fishes.

Unit 3

Circulatory System; Evolution of heart and aortic arches, Venous system and lymphatic system

Skeleton System: Axial and appendicular skeleton, Jaw suspensorium and Visceral arches.

Unit 4

Nervous System; Central & Autonomic Nervous System, Cranial nerves

Sense Organs; Classification of receptors, structure and working of Mammalian eye and ear

Urinogenital System; Succession of kidney, Evolution of Urinogenital ducts

Schedule per week Lectures: 3

Examination Time : 3 Hrs

Maximum Marks: 50(20+30)

Subject : Mammalian Physiology-II

Paper Code : ZOO-204

***Note:** Examiner will set nine questions and the students will be required to attempt five questions in all, Question number one is compulsory containing six short answer types' questions covering the entire syllabus and will be of 1 mark each (Answer to each question should not exceed 20 words). Answer to each part should not exceed 20 words. Further examiner will set two questions from each unit and the students will be required to attempt one question from each unit which will be of 6 marks each.*

UNIT 1- Muscle physiology

1. Ultra structure of smooth, striated and cardiac muscles
2. Muscle contraction
3. Simple twitch and fatigue

UNIT 2- Nerve physiology

1. Structure of neuron
2. Conduction of nerve impulse through axon
3. Neurotransmitters
4. Synapses; ultrastructure and function

UNIT 3 - Endocrinology

1. Endocrine system; definition of endocrine, paracrine and autocrine system, significance of endocrine and neuro-endocrine system
2. Pituitary gland; structure, hormones and their functions
3. Thyroid gland; structure, hormones and their functions
4. Adrenal gland; structure, hormones and their functions
5. Pancreas; islets of langerhans, structure, hormones and their functions

UNIT 4 -Physiology of reproduction

1. Hormonal control of male and female reproduction
2. Implantation
3. Parturition and lactation in mammals
4. Reproductive cycle; oestrous and menstrual cycles
5. Menopause in human

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B. Sc. II Year (IV Semester)

Schedule per week Lectures: 3

Examination Time : 4 Hrs Maximum Marks: 50(20+30)
Subject : Zoology Lab-IV Paper Code : ZOO-206

1. Classification up to orders, habit, habitats, external characters and economic importance (if any) of the following animals:-
Amphibia: *Necturus, Proteus, Amphiuma, Salamandra, Amblystoma, Axolotle larva, Alytes, Bufo, Rana*
Reptilia: *Hemidactylus, Calotes, Draco, Varanus, Phrynosoma, Chamaeleon, Typhops, Python, Eryx, Ptyas, Bungarus, Naja, Hydrus, Viper, Crocodilus, Gavialis, Chelone* (Turtle) and *Testudo* (Tortoise)
Aves: *Casuaris, Arden, Anas, Milvus, Pavo, Eudynamis, Tyto* and *Alcedo, Halcyon*
Mammalia: *Ornithorphynchus, Echidna, Didelphis, Macropus, Loris, Macaque, Hystrix, Funambulus, Telix, Panthera, Canis, Herpestes, Capra, Pteropus*
2. Preparation of models of the different systems of the following animals:
Hemidactylus; Digestive, arterial, venous and urinogenital systems
Rat : Digestive, arterial, venous and urinogenital systems
3. Study of the skeleton of *Rana* (Frog), *Varanus*, Pigeon or Gallus and *Orcyctolagus*/rat
4. Study of the following prepared slides: Histology of rat (compound tissues)
5. Study and collection of different types of feathers; Quill, Contour, Filoplume and Down feathers
6. Physiology practical; study of estrus cycle, ultrasound image of foetus, study of histological structure of major endocrine glands of mammals
7. Project Report: Survey of diversity, Parental care , Dentition in mammals, Migration in birds

MARKS DISTRIBUTION OF PRACTICAL EXAMINATION

Practical Total Internal Assessment Marks	= 20
a) Experimental work/Exercises	= 10 Marks
b) Internal Viva	= 5 Marks
c) Regularity/discipline	= 5 Marks
End Term Practical Examination Marks	= 30
a) Experimental work/Exercises	= 20 Marks
b) External Viva	= 5 Marks

Prof. (Dr.) T. L. Rajawat, Dean, SCHOOL OF BASIC AND APPLIED SCIENCES, Raffles university, Neemrana, Alwar (Rajasthan) 301705

Email Id: prof.tlrajawat@rafflesuniversity.edu.in

www.rafflesuniversity.edu.in

d) Practical Record file

= 5 Marks

Total Practical Marks

(20 + 30) = 50

Suggested readings

1. Bell JN and Davidson GH, Textbook of physiology and Biochemistry, ELBS.
2. Sastry, KV. Animal physiology & biochemistry. Rastogi publications, Meerut.
3. Taylor, DJ, Green, NPO, and Stout, GW. Biological Science. Cambridge low price edition. Cambridge University Press.
4. Schmidt-Nielsen. Animal physiology. Cambridge University Press.
8. David S. Goodsell The Machinery of Life, 2009. [Springer-Verlag New York Inc.](http://www.springer-verlag.com)
9. Young JZ. The life of vertebrates, Osford University Press, London
5. Peter Holland. The Animal Kinggom. Oxford University Press, New Delhi.

Department of Zoology
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B. Sc. III Year (V Semester)

Schedule per week Lectures: 3

Examination Time : 3 Hrs

Maximum Marks: 50(20+30)

Subject : Ecology and Evolution

Paper Code : ZOO-303

***Note:** Examiner will set nine questions and the students will be required to attempt five questions in all, Question number one is compulsory containing six short answer types' questions covering the entire syllabus and will be of 1 mark each (Answer to each question should not exceed 20 words). Answer to each part should not exceed 20 words. Further examiner will set two questions from each unit and the students will be required to attempt one question from each unit which will be of 6 marks each.*

UNIT 1 - Introduction to Ecology

1. Relevance of studying ecology, its history, autecology, synecology
2. Species; Sympatric, parapatric and Allopatric
3. Abiotic Factors; Laws of limiting factors; Liebig's law of minimum and Shelford's law of tolerance, brief account of light and temperature as limiting factors, soil types and soil erosion

UNIT 2 - Population ecology

1. Unitary and modular populations
2. Population density, dispersion and demography
3. Exponential and logistic growth model
4. Population Growth regulation: Intrinsic mechanism and extrinsic mechanism
5. Age structure pyramids for the human population

UNIT 3 - Community and Ecosystem

1. Community structure, diversity index, ecotone/edge effect, island equilibrium model
2. Succession, stages of primary succession, climax community
3. Community's interactions; types with examples, Niche concept, Gause's principle of competitive exclusion with laboratory and field examples, Lotka Volterra Equation for prey predator interaction
4. Energy flow and chemical cycling through an ecosystem

UNIT 4 - Evolution

1. History of evolutionary thoughts
2. Natural selection, speciation

Prof. (Dr.) T. L. Rajawat, Dean, SCHOOL OF BASIC AND APPLIED SCIENCES, Raffles university, Neemrana, Alwar (Rajasthan) 301705

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3. Variations, isolation and adaptations
4. Palaeontology; fossils, geological divisions of the earth's crust, imperfection of the geological record
5. Study of extinct forms; Dinosaur, Archaeopteryx

SCHOOL OF BASIC AND APPLIED SCIENCES
Department of Zoology
(Syllabus and Scheme of Studies w. e. f. 2016-17 onwards)
B. Sc. III Year (V Semester)

Schedule per week Lectures: 6

Examination Time	: 4 Hrs	Maximum Marks: 50(20+30)
Subject	: Zoology Lab-V	Paper Code : ZOO-305

1. Study of an ecosystem; pond/lake/reservoir
2. Calculating Shannon index of biodiversity for fauna/flora of the campus
3. Evolutionary evidences and/or its demonstration through models/video/CD etc
4. Adaptive modifications in feet and beaks of birds
5. Evolutionary evidences of man and horse
6. Visit to a fossil park/Birbal Sahani Paleontological Institute in Lucknow
7. Qualitative tests for identification of simple sugars, disaccharides and polysaccharides.
8. Detection of proteins, carbohydrates and lipids in animal tissue food sample.
9. Demonstration of the principle of paper chromatography
10. Study of human salivary amylase activity: Effect of temperature, pH, Concentration
11. Project report : radio carbon dating, fossil collection, population study of any fauna in the university campus and elsewhere

MARKS DISTRIBUTION OF PRACTICAL EXAMINATION

Practical Total Internal Assessment Marks	= 20
a) Experimental work/Exercises	= 10 Marks
b) Internal Viva	= 5 Marks
c) Regularity/discipline	= 5 Marks
End Term Practical Examination Marks	= 30
a) Experimental work/Exercises	= 20 Marks
b) External Viva	= 5 Marks
d) Practical Record file	= 5 Marks
Total Practical Marks	(20 + 30) = 50

SCHOOL OF BASIC AND APPLIED SCIENCES
Department of Zoology
(Syllabus and Scheme of Studies w. e. f. 2016-17 onwards)
B. Sc. III Year (VI Semester)

Schedule per week Lectures: 3

Examination Time : 3 Hrs

Maximum Marks: 50(20+30)

Paper Code : ZOO-302

Subject : Environmental Biology & Ethology

***Note:** Examiner will set nine questions and the students will be required to attempt five questions in all, Question number one is compulsory containing six short answer types' questions covering the entire syllabus and will be of 1 mark each (Answer to each question should not exceed 20 words). Further examiner will be set two questions from each unit and the students will be required to attempt one question from each unit which will be of 6 marks each.*

UNIT 1

5. Environment and its concepts, global environment, hydrosphere, lithosphere and atmosphere
6. Natural resources; present status and future needs, conservation and management of natural resources; renewable (forest, wildlife, water) and non renewable (soil, minerals and energy)
7. Wildlife conservation; vanishing and threatened animals and plants in Rajasthan, wildlife management efforts by Government and Non government organizations (including wildlife Acts)

UNIT 2

1. Environmental pollution; general outline and various types of pollution (water, air, and soil), Sources and remedies for noise, radiation, industrial chemicals, agrochemicals, insecticides, pesticides and household pollutants
2. Green house effect, ozone layer depletion, El-Nino and La-Nino effects, fallout effects of radiation, nuclear accidents
3. Basic concepts of bioaccumulation, biomagnification, biodegradation of pollutants

UNIT 3

1. Impact of urbanization; development and distribution of urban centres, factors, problems and solutions of urbanization, brief idea of human population of India and Rajasthan
2. Space ecology; space ecosystem, space problems and their solutions, colonization

UNIT 4

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Email Id: prof.tlrajawat@rafflesuniversity.edu.in

www.rafflesuniversity.edu.in

1. Introduction and history of Ethology
2. Concepts of Ethology; fixed action pattern, sign stimulus, innate learning mechanism, motivation, imprinting and learning
3. Pheromones and their role in alarm spreading
4. Societies; characteristics and advantage with special reference to honey bee, and monkey
5. Biological rhythms and biological clocks
6. Methods of studying animal behaviour

SCHOOL OF BASIC AND APPLIED SCIENCES

Department of Zoology

(Syllabus and Scheme of Studies w. e. f. 2016-17 onwards)

B. Sc. III Year (VI Semester)

Schedule per week Lectures: 3

Examination Time : 3 Hrs

Maximum Marks: 50(20+30)

Paper Code : ZOO-304

Subject : Applied Zoology & Biostatistics

***Note:** Examiner will set nine questions and the students will be required to attempt five questions in all, Question number one is compulsory containing six short answer types' questions covering the entire syllabus and will be of 1 mark each (Answer to each question should not exceed 20 words). Further examiner will set two questions from each unit and the students will be required to attempt one question from each unit which will be of 6 marks each.*

UNIT 1

Principles and practices of Vermiculture, Sericulture (including Ericulture), Lac culture, Apiculture, Prawn culture, Pisciculture, Pearlculture and Poultry keeping

UNIT 2

Pest; definition, types of pests, control (insecticides and plant protection appliances (like hand compression spray, hand rotating duster, bucket pump etc. and natural control), Study of major crop pest; Jowar (stem borer, midge flies), cotton (red cotton bug, pink ballworm) etc.

UNIT 3

Introduction, scope and application of biostatistics
Scientific method, writing up an experiment, Hypothesis (null and alternative)
Basic concepts of statistics; presenting data (tabulations, graphical representation, frequency distributions, samples and populations

UNIT 4

Elementary statistical methods in biology; measures of central tendency (mean, mode, median), measures of dispersion (standard deviation, standard error, variance), correlation and regression

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Suggested readings

1. Townsend C, Harper J and Michael Begon. Essentials of Ecology, Blackwell Science.
2. David, L, Nelson and Michael M Cox. Lehninger's principles of Biochemistry.
3. Bell JN and Davidson GH, Textbook of physiology and Biochemistry, ELBS.
4. Sastry, KV. Animal physiology & biochemistry. Rastogi publications, Meerut.
5. Taylor, DJ, Green, NPO, and Stout, GW. Biological Science. Cambridge low price edition. Cambridge University Press.
6. Gupta, PK. Environmental biology. Rastogi publications, Meertu.
7. Miller TG, Jr. environmental Science. Wordsworth publishing company.
8. Odum, EP. Fundamentals of ecology, WB Sanunders.
9. Chapman and Reiss. Ecology. Cambridge University Press.
10. Manning and Dawkins. An introduction to animal behavior. Cambridge University Press.
11. Mathur, R. Animal behavior. Rastogi publications, Meerut.
12. Frank and Althoen. Statistics. Cambridge University Press.
13. Wilson and Walker. Principles and techniques of practical biochemistry. Cambridge University Press.
14. Harrison and de Mora. Introductory chemistry for the environmental science. Cambridge University Press.
15. Bailey. Statistical methods in biology. Cambridge University Press.
16. Brian & Deborah Charlesworth. Evolution. Oxford University Press.

SCHOOL OF SCIENCE

Department of Computer Science

(Syllabus and Scheme of Studies w.e.f. 2015-16 onwards)

B. Sc. I Year (I Semester)

Schedule per week Lectures: 2

Examination Time : 3 Hrs

Maximum Marks: 50(20+30)

Subject : Computer Fundamentals

Paper Code : COM-201

Note: Examiner will set nine questions and the students will be required to attempt five questions in all, Question number one is compulsory containing Six short answer types' questions covering the entire syllabus and will be of 1 marks. Further examiner will be set two questions from each unit and the students will be required to attempt one question from each unit which will be of 6 marks each.

UNIT-I

Computer Fundamentals: Definition, Block Diagram along with its components, characteristics & classification of computers. Evolution of Computers - Generations, Types of computers, Computer system characteristics, Basic components of a Digital Computer - Control unit, ALU, Input/output functions and memory

UNIT-II

Computer Software and Hardware, relationship between hardware and software, Software and Types of Software, Programming Languages- Machine Language, Assembly Language, High Level Language, Object Oriented Language. Techniques of Problem Solving: Flowcharting, algorithms, pseudo code, decision table, Structured programming concepts, Programming methodologies viz. top-down and bottom-up programming.

UNIT-III

Number Systems & Arithmetic Number System: Positional, Non-positional, binary, octal, decimal, hexadecimal and their representation; Methods of conversion from one base to another; Unsigned, Signed, 1's Complement, 2's Complement, Binary Arithmetic: Fixed & Floating point numbers, representation, errors, overflow, underflow.

UNIT-IV

Memory - RAM, ROM, EPROM, PROM and other types of memory, Storage fundamentals - Primary Vs Secondary Data Storage, Various Storage Devices - Magnetic Tape, Magnetic Disks, Cartridge Tape, Hard Disk Drives, Floppy Disks (Winchester Disk), Optical Disks, CD, VCD, CD-R, CD-RW, Zip Drive, flash drives Video Disk, Blue Ray Disc, SD/MMC Memory cards, DVD, DVD-RW, USB Pen drive.

Reference Books:

1. S.K. Basandra, "Computers Today ", Galgotia Publications.
2. Computer Fundamentals – P. K. Sinha – BPB Publication
3. PC Software – Shree Sai Prakashan, Meerut
4. Computer Fundamentals – B. Ram – New Age International Publishers.

SCHOOL OF SCIENCE
Department of Computer Science
(Syllabus and Scheme of Studies w. e. f. 2015-16 onwards)
B. Sc. I Year (I Semester)

Schedule per week Lectures: 2

Examination Time : 2 Hrs

Maximum Marks: 50

Subject : Computer Fundamentals

Paper Code : COM-202

List of Practical's

1. MS-Windows: Basics of Windows, Basic components of windows, icons, types of icons, taskbar, activating windows, using desktop, title bar, running applications, exploring computer, managing files and folders, copying and moving files and folders.
2. Control panel – display properties, adding and removing software and hardware, setting date and time, screen saver and appearance. Using windows accessories.
3. Documentation Using MS-Word - Creating & Editing Document, Formatting Document, Auto-text, Autocorrect, Spelling and Grammar Tool, Document Dictionary,
4. Page Formatting, Bookmark, Advance Features of MS-Word-Mail Merge, Macros, Tables, File Management, Printing, Styles, linking and embedding object, Template.
5. Electronic Spread Sheet using MS-Excel - Creating & Editing Worksheet, Formatting and Essential Operations, Formulas and Functions, Charts,
6. Advance features of MS-Excel-Pivot table & Pivot Chart, Linking and Consolidation.
7. Presentation using MS-PowerPoint: Presentations, Creating, Manipulating & Enhancing Slides, Organizational Charts, Excel Charts, Word Art,
8. Layering art Objects, Animations and Sounds, Inserting Animated Pictures or Accessing through Object, Inserting Recorded Sound Effect or In-Built Sound Effect.

Department of English and Humanities

(Syllabus and Scheme of Studies w.e.f. 2016-17 onwards)

B. Sc. I Year (I Semester)

Schedule per week Lectures: 2Hrs

Examination Time : 3 Hrs

Maximum Marks: 50(20+30)

Subject : English Communication Technique

Paper Code : ECT-101

UNIT I

Grammar:

1. Tenses
2. Passive Voice
3. Indirect Speech
5. Modal Verbs

4. Conditional Sentences

UNIT II

Composition:

1. Dialogue Writing
2. Paragraph and Précis Writing
3. Report, its importance and Report Writing

UNIT III

Short Stories

1. The Luncheon: W.S. Maugham
2. How Much Land Does a Man Need? Leo Tolstoy
3. The Last Leaf: O. Henry

Poems:

1. The Unknown Citizen: W. H. Auden
2. The Character of A Happy Life: Sir Henry Wotton
3. No Men are Foreign: James Kirkup
4. If : Rudyard Kipling

UNIT IV

Essays:

1. On the Rule of the Road: A. G. Gardiner
2. The Gandhian Outlook: S. Radhakrishnan
3. Our Own Civilisation: C.E.M. Joad

Suggested Readings :

1. Communication Skills for Engineers and Scientists, Sangeeta Sharma & Binod Mishra, PHI Learning Pvt. Ltd.
2. English for Engineers: Made Easy, Aeda Abidi & Ritu Chaudhary, Cengage Learning, (New Delhi)
3. A Practical Course for Developing Writing Skills in English, J.K. Gangal, PHI Learning Pvt. Ltd., New Delhi.
4. The Written Word, Vandana R. Singh, Oxford University Press (New Delhi)
5. The Great Short Stories edited by D.C. Datta, Ram Narain Lal Publishers (Allahabad)
6. "Current English Grammar and Usage with Composition" by R.P. Sinha, Oxford University Press

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www.rafflesuniversity.edu.in



**RAFFLES
UNIVERSITY**

(New Delhi).

RAFFLES UNIVERSITY, NEEMRANA, ALWAR (RAJASTHAN)

Japanese Zone, National Highway-8, Neemrana-307105

Tel.: +91-9214205555 www.rafflesuniversity.edu.in

7. "Grammar of the Modern English Language", by Sukhdev Singh & Balbir Singh, Foundation Books (New Delhi).

Prof. (Dr.) T. L. Rajawat, Dean, SCHOOL OF BASIC AND APPLIED SCIENCES, Raffles university, Neemrana, Alwar (Rajasthan) 301705

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Environmental science

(Syllabus and Scheme of Studies w. e. f. 2016-17 onwards)

B. Sc. I Year (I Semester)

Schedule per week Lectures: 2

Examination Time : 3 Hrs

Maximum Marks: 50(20+30)

Subject : Environmental science

Paper Code : EVS-102

Note: Examiner will set nine questions and the students will be required to attempt five questions in all, Question number one is compulsory containing six short answer types' questions covering the entire syllabus and will be of 1 mark. Further examiner will be set two questions from each unit and the students will be required to attempt one question from each unit which will be of 6 marks each.

UNIT-I

Basics of Environment: Definition, Scope and basic principles of ecology and environment. Biological levels of organization, Functional concepts of Ecology, Basics of species, Ecosystem, Hydrological and chemical cycles, Energy flow in ecosystems. Biodiversity, population dynamics. Environmental Acts and Regulations, Environmental Impact Assessment (EIA), Necessity and methodology of EIA. Renewable sources of energy, Potential & present status of renewable sources of energy in India. Environmental education—women and value education

UNIT-II

Air Pollution, Noise Pollution: Environmental Pollution, Air Pollution, Harmful effects of Air Pollution, Control of Air Pollution. Global warming, Acid rain, Ozone depletion. Noise Pollution, Harmful effects of noise pollution, control of noise pollution.

UNIT-III

Water Pollution: Water pollution, Harmful effects of water pollution, control of water pollution. Waste water management, Treatment & disposal of wastewater. Reuse and saving in use of water, rain water harvesting.

UNIT- IV

Solid Waste and Disaster Management: Solid Waste Management, Classification of solid waste, Collection, transportation, treatment, and disposal of solid waste. Economic recovery of solid waste. Sanitary landfill, on site sanitation.

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Type of Disasters: Natural and Manmade (Earthquake, Tsunami, Cyclone, Flood, Drought, Landslides, Fire and Environmental Hazards). Disaster Management Cycle and its components. Do's and Don'ts for safety during these disasters. Earthquake.

SUGGESTING READING:

1. Robert Ricklefs (2001). The Ecology of Nature. Fifth Edition. W.H. Freeman and Company.
2. Singh K.P. and J.S. Singh (1992). Tropical Ecosystems: Ecology and Management. Wiley Eastern Limited, Lucknow, India.
3. Singh, J.S. (ed.) 1993. Restoration of Degraded Land: Concepts and Strategies. Rastogi Publications, Meerut.
4. Smith, R.L. (1996). Ecology and Field Biology, Harper Collins, New York.
5. Botkin, D.B. and Keller, E.A. 2000. Environment Science: Earth as a living planet. Third Edition. John Wiley and Sons Inc.

Recommended Textbook:

1. Environmental Studies, J Krishnawamy , R J Ranjit Daniels, Wiley India.
3. Environmental Science, 8th Ed ISV, Botkin and Keller, 9788126534142, Wiley India.
4. Environmental Studies, R Rajagopalan, 978-0195673937, Oxford University Press
5. Textbook of Environmental Science and Technology, M.Anjireddy, BS Publications
6. Environmental Studies, Soli. J Arceivala, Shyam, R Asolekar, 9781259006050, Mc Graw Hill India, 2012.
7. Environmental Studies, D.L. Manjunath, 9788131709122 Pearson Education India, 2007
8. Textbook of Environment Ecology , Singh, Acme Learning
9. Perspective in Environmental Studies, Kaushik, New Age International
10. Environmental Studies, B. Joseph, 2nd Ed, 978-0070648134, Tata McGraw Hill