



SCHOOL OF BASIC AND APPLIED SCIENCES
Department of Chemistry
(Syllabus and Scheme of Studies w. e. f. 2016-19 onwards)
B. Sc. III Year (V Semester)

Lectures	: 2 Hrs	
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 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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Lectures	: 2 Hrs	
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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Lectures	: 2 Hrs	
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 Mechanic s-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 Born-Oppenheimer 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

Lectures: 2 Hrs

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



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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)

1. To determine the strength of the given acid solution (mono and dibasic acid) conductometrically.
2. 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.



SCHOOL OF BASIC AND APPLIED SCIENCES

Department of Botany

(Syllabus and Scheme of Studies w. e. f. 2016-19 onwards)

B. Sc. III Year (V Semester)

Schedule per week Lectures: 3

Examination Time : 3 Hrs

Maximum Marks: 50(20+30)

Subject : Plant physiology

Paper Code: BOT-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 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

Plant-water relations: Imbibition, diffusion and osmosis; absorption and transport of water; transpiration; physiology of stomata. **Mineral nutrition and transport of organic material:** Essential macro and micro elements and their role; mineral uptake; deficiency symptoms. **Transport of organic substances:** Mechanism of phloem transport; source-sink relationship; factors affecting translocation.

UNIT -II

Photosynthesis: Historical aspects; photosynthetic pigments; action spectra and enhancement effects; concept of two photosystems; Z-scheme; photo-phosphorylation; Calvin cycle; C4 pathway; CAM plants; photorespiration. **Respiration:** ATP – the biological energy currency; aerobic and anaerobic respiration; Krebs cycle; electron transport mechanism (chemiosmotic theory); oxidative phosphorylation; PPP

UNIT-III

Growth and development: Definitions; phases of growth and development; seed dormancy; plant movements; the concept of photoperiodism; physiology of flowering; florigen concept; physiology of senescence; fruit ripening;

UNIT -IV

Plant hormones: auxins, gibberellins, cytokinins, abscissic acid and ethylene, history of discovery, mechanism of action; photo-morphogenesis; Phytochromes and their discovery, physiological role and mechanism of action.

SUGGSETED 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.



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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 **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-II

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

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.



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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	: Biochemistry	Paper Code : ZOO-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 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. Carbohydrates: structure, function and significance
2. Oxidation of glucose through glycolysis, Krebs' cycle and oxidative phosphorylation,
3. Elementary knowledge of inter conversion of glycogen and glucose in liver
4. Role of insulin and glucagon

UNIT 2

1. Lipids: structure, function and significance
2. Beta-oxidative pathway of fatty acids
3. Essential and non essential fatty acids
4. Brief account of biosynthesis of triglycerides,
5. Phospholipids and steroids

UNIT 3

1. Proteins: structure, function and significance
2. Essential and non essential amino acids
3. Transformation of amino acids; deamination, transamination, decarboxylation
4. Synthesis of protein and urea
5. Fate of ammonia (ornithine cycle)
6. Fate of carbon skeleton
7. Enzymes; types and mechanism of action

UNIT 4

1. Vitamins; sources and deficiency
2. Minerals; sources and deficiency
3. Nucleic acid; nucleotides, Catabolism and biosynthesis of nucleotides



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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
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
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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

Open Elective paper

Lectures	: 2 Hrs		
Examination Time	: 3 Hrs	Maximum Marks: 50(20+30)	
Paper Title	: Basic Electrical	Paper Code	: BE-301

Unit – I

Definition of Electromagnetic Induction, Faradays Laws, Fleming's right hand rule, Lenz's Law, Statically and dynamically induced emf. Self-inductance, mutual inductance and coefficient of coupling. Energy stored in magnetic field. Force on current carrying conductor placed in a magnetic field, Fleming's left hand rule.

Unit – II

Generation of sinusoidal voltage, frequency of generated voltage, definition and numerical values of average value, root mean square value, form factor and peak factor of sinusoidal varying quantities, phasor representation of alternating quantities. Analysis, with phasor diagrams, of R, L, C, R-L, R-C and R-L-C circuits and, parallel and series- parallel circuits.

Unit – III

Necessity of transformer, Principle of operation and construction of single phase transformers (core and shell types). Emf equation, losses, variation losses with respect to load, efficiency, Condition for maximum efficiency, Voltage regulation and its significance.

Unit – IV

Principle of operation, Concept and production of rotating magnetic field, Synchronous speed, rotor speed, Slip, Frequency of the rotor induced emf, Types and Constructional features. Slip and its significance. Applications of squirrel - cage and slip - ring motors.

Lectures : 2 Hrs
Examination Time : 3 Hrs
Paper Title : Introductory Law

Maximum Marks: 50(20+30)
Paper Code : IL-301

Unit 1

Introduction and Background of Law-

- a) definition and meaning,
- b) kinds of law,
- c) law and society (why do we need law),
- d) Law of torts- meaning, introduction to major kinds of torts and defences.

Unit 2

Intellectual property law 1

- a) meaning and need,
- b) Introduction to patents, trademark, copyright. (definitions, eligibility criteria and rights)

Unit 3

Intellectual property law 2

- a) Introduction to trade secrets, geographical indications and industrial designs (definitions, eligibility criteria and rights)

Unit 4

Business laws

- a) Law of contract- Meaning and definition, kinds of contract, essentials of contract.

Lectures : 2 Hrs
Examination Time : 3 Hrs
Paper Title : Human Value

Maximum Marks: 50(20+30)
Paper Code : HV-301

UNIT 1: Course Introduction - Need, Basic Guidelines, Content and Process for Value Education

1. Understanding the need, basic guidelines, content and process for Value Education 2. Self Exploration–what is it? - its content and process; ‘Natural Acceptance’ and Experiential Validation- as the mechanism for self exploration 3. Continuous Happiness and Prosperity- A look at basic Human Aspirations 4. Right understanding, Relationship and Physical Facilities- the basic requirements for fulfillment of aspirations of every human being with their correct priority 5. Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario 6. Method to fulfill the above human aspirations: understanding and living in harmony at various levels

UNIT 2: Understanding Harmony in the Human Being - Harmony in Myself! 7. Understanding human being as a co-existence of the sentient ‘I’ and the material ‘Body’ 8. Understanding the needs of Self (‘I’) and ‘Body’ - Sukh and Suvidha 9. Understanding the Body as an instrument of ‘I’ (I being the doer, seer and enjoyer) 10. Understanding the characteristics and activities of ‘I’ and harmony in ‘I’ 11. Understanding the harmony of I with the Body: Sanyam and Swasthya; correct appraisal of Physical needs, meaning of Prosperity in detail 12. Programs to ensure Sanyam and Swasthya - Practice Exercises and Case Studies will be taken up in Practice Sessions.

UNIT 3: Understanding Harmony in the Family and Society- Harmony in Human Human Relationship 13. Understanding Harmony in the family – the basic unit of human interaction 14. Understanding values in human-human relationship; meaning of Nyaya and program for its fulfillment to ensure Ubhay-tripti; Trust (Vishwas) and Respect (Samman) as the foundational values of relationship 15. Understanding the meaning of Vishwas; Difference between intention and competence 16. Understanding the meaning of Samman, Difference between respect and differentiation; the other salient values in relationship 17. Understanding the harmony in the society (society being an extension of family): Samadhan, Samridhi, Abhay, Sah-astitva as comprehensive Human Goals 18. Visualizing a universal harmonious order in society- Undivided Society (Akhand Samaj), Universal Order (Sarvabhaum Vyawastha)- from family to world family! - Practice Exercises and Case Studies will be taken up in Practice Sessions.

UNIT 4: Understanding Harmony in the Nature and Existence - Whole existence as Co-existence 19. Understanding the harmony in the Nature 20. Interconnectedness and mutual fulfillment among the four orders of nature recyclability and self-regulation in nature 21. Understanding Existence as Co-existence (Sah-astitva) of mutually interacting units in all-pervasive space 22. Holistic perception of harmony at all levels of existence - Practice Exercises and Case Studies will be taken up in Practice Sessions.



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

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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

Lectures : 2 Hrs
Examination Time : 3 Hrs
Subject : **Industrial Chemicals and Environment**
(Elective)

Maximum Marks: 50(20+30)
Paper Code : CH-302

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
Department of Chemistry
(Syllabus and Scheme of Studies w. e. f. 2016-19 onwards)
B. Sc. III Year (VI Semester)

Lectures : 2 Hrs

Examination Time : 3 Hrs

Subject : Organic Chemistry

Maximum Marks: 50(20+30)

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.



SCHOOL OF BASIC AND APPLIED SCIENCES
Department of Chemistry
(Syllabus and Scheme of Studies w. e. f. 2016-19 onwards)
B. Sc. III Year (VI Semester)

Lectures	: 2 Hrs	
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. 2016-19 onwards)
B. Sc. III Year (VI Semester)

Schedule per week Practical: 6

Examination Time : 4 Hrs

Maximum Marks: 50

(30+20)

Subject : Chemistry Lab-VI

Paper Code :

CH-308

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



SCHOOL OF BASIC AND APPLIED SCIENCES
Department of Botany
(Syllabus and Scheme of Studies w. e. f. 2016-19 onwards)
B. Sc. III Year (VI Semester)

Schedule per week Lectures: 3

Examination Time : 3 Hrs

Maximum Marks: 50 (20+30)

Paper Code : BOT-302

Subject : Biochemistry and Plant Biotechnology

***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 Enzymology: Discovery and nomenclature; characteristics of enzymes; concept of holoenzyme, apoenzyme, coenzyme and co-factors; regulation of enzyme activity; mechanism of action.

UNIT-II

Carbohydrate: Introduction, importance, nomenclature, classification, molecular structure & function of mono, di, and poly saccharides, their properties, glycosidic linkages and glycoprotein. **Protein:** Amino acids-structure, electrochemical properties, peptide bonds, chemical bonds and nomenclature, structure and classification of proteins, physical and chemical properties.

UNIT-III

Lipid metabolism: Structure and functions of lipids; fatty acid biosynthesis; β -oxidation; saturated and unsaturated fatty acids; storage and mobilization of fatty acids. **Nitrogen metabolism:** Biology of nitrogen fixation; importance of nitrate reductase and its regulation; ammonium assimilation.

UNIT-IV

Genetic engineering and Biotechnology: Tools and techniques of recombinant DNA technology; cloning vectors; genomic and cDNA library; transposable elements; aspects of plant tissue culture; cellular totipotency, differentiation and morphogenesis; biology of *Agrobacterium*; vectors for gene delivery and marker genes.

SUGGESTED READINGS:

1. Bhojwani, S.S. 1990: Plant Tissue Culture Applications and Limitations. Elsevier Science Publishers, New York, USA.
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



SCHOOL OF BASIC AND APPLIED SCIENCES
Department of Botany
(Syllabus and Scheme of Studies w. e. f. 2016-19 onwards)
B. Sc. III Year (VI Semester)

Schedule per week Lectures: 3

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

Subject : Economic Botany **Paper Code : BOT-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 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

Vavilov's centres of origin of crop plants, Origin, distribution, botanical description, brief idea of cultivation and economic uses of the following: **Food plants:** cereals (rice, wheat and maize), pulses (gram, arhar and pea), vegetables (potato, tomato and onion).

UNIT-II

Origin, distribution, botanical description, brief idea of cultivation and economic uses of the following: **Fibers:** cotton, jute and flax. **Oils:** Groundnut, mustard, sunflower and coconut.

UNIT-III

Morphological description, brief idea of cultivation and economic uses of the following: **Spices:** coriander, ferula, ginger, turmeric, cloves; **Medicinal plants:** *Cinchona, Rauwolfia, Atropa, Opium, Cannabis, Azadirachta, Withania.*

UNIT-IV

Botanical description, processing and uses of: **Beverages:** tea and coffee; **Rubber:** *Hevea*; **Sugar:** sugarcane; General account and sources of timber; energy plantations and bio-fuels.

SUGGESTED READINGS:

1. Kocchar, S.L. 1998: Economic Botany in Tropics, 2nd edition, MacMillan India Ltd., New Delhi.
2. Sambammurthy, A.V.S.S. And Subramanyam, N.S. 1989: A Textbook of Economic Botany, Wiley Eastern Ltd., New Delhi.
3. Sharma, O.P. 1996: Hills Economic Botany (Late Dr. A.F. Hill adapted by O.P. Sharma), Tata McGraw Hill Co. Ltd., New Delhi.
4. Simpson, B.B. and Conner-Ogorzaly, M. 1986: Economic Botany- Plants in Our World, McGraw Hill, New York.



SCHOOL OF BASIC AND APPLIED SCIENCES
Department of Botany
(Syllabus and Scheme of Studies w. e. f. 2016-19 onwards)
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

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.



SCHOOL OF BASIC AND APPLIED SCIENCES
Department of Zoology
(Syllabus and Scheme of Studies w. e. f. 2016-19 onwards)
B. Sc. III Year (VI Semester)

Schedule per week Lectures: 3

Examination Time : 3 Hrs

Maximum Marks: 50(20+30)

Subject : Environmental Biology & Ethology

Paper Code : ZOO-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 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

1. Environment and its concepts, global environment, hydrosphere, lithosphere and atmosphere
2. Natural resources; present status and future needs, conservation and management of natural resources; renewable (forest, wildlife, water) and non renewable (soil, minerals and energy)
3. 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

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. 2016-19 onwards)
B. Sc. III Year (VI Semester)

Schedule per week Lectures: 3

Examination Time : 3 Hrs

Maximum Marks: 50(20+30)

Subject : Applied Zoology & Biostatistics

Paper Code : ZOO-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 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



SCHOOL OF BASIC AND APPLIED SCIENCES
Department of Zoology
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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 : Zoology Lab-VI

Paper Code : ZOO-306

Environmental biology & Ethology

1. Chemical analysis of pond water for pH, alkalinity, acidity, dissolved oxygen,
2. Estimating water salinity in a given water sample/ TDS
3. Visiting nearby factory to study their control measures taken up for controlling various types of pollution
4. Qualitative estimation of zooplankton in given sample of water
5. A visit to zoo/museum of natural history and wildlife sanctuary (where present)
6. Behavioural study in mammals/birds
7. Construction of frequency table, histograms, polygons and pie charts
8. Exercises on mean, mode and median, standard deviation and correlation
9. Study of stored pests/agricultural pests
10. Project report:
 - a. Apiculture/Sericulture
 - b. Pollution control measures taken up by any industry
 - c. Hazardous waste treatment in your city

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, Meerut.
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.