

# B.Sc. Part-III

## SYLLABUS (CHEMISTRY, BOTANY & ZOOLOGY),

### RAJKAMAL SCIENCE & MANAGEMENT COLLEGE BAHADRABAD (HARIDWAR)

## CHEMISTRY SYLLABUS

For

UNDER GRADUATE COURSES (B.Sc. Part-III)  
(Annual System)

*(Applicable w.e.f. the Session 2019-2020)*



Department of Chemistry

Sridev Suman Uttarakhand University Badshahithaul Tehri-  
Garhwal - 249001

There shall be three written papers and a practical examination as follows:

Paper	Paper Code	Course	Max. Marks	Work Hrs
I	CH-301	Inorganic Chemistry	50	60
II	CH-302	Organic Chemistry	50	60
III	CH-303	Physical Chemistry	50	60
	CH-304	Laboratory Practical	50	60
		Grand Total	200	180

Candidate will be required to pass in Theory and Practical Separately.

## B.Sc. – III Inorganic Chemistry (Paper-I)

### Unit – I

#### 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.

#### II. Thermodynamic and Kinetic Aspects of Metal Complexes

A brief outline of thermodynamic stability of metal complexes and factors affecting the stability, stability constants of complexes and their determination, substitution reactions of square planar complexes.

### Unit – II

#### III. Magnetic Properties of Transition Metal Complexes

Types of magnetic behavior, methods of determining magnetic susceptibility, spin-only formula, L-S coupling, correlation of  $\mu_s$  and  $\mu_{\text{eff}}$  values, orbital contribution to magnetic moments, application of magnetic moment data for 3d-metal complexes.

#### IV. Electronic 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 ion.

### Unit – III

#### V. Organometallic Chemistry

Definition, nomenclature and classification of organometallic compounds, Preparation, properties, bonding and applications of alkyls and aryls of Li, Al, Hg,

Sn.

Metal carbonyls: 18 electron rule, preparation, structure and nature of bonding in the mononuclear carbonyls.

**VI.** Silicones and Phosphazenes

Silicones and phosphazenes as examples of inorganic polymers, nature of bonding in triphosphazenes.

**Unit – IV**

**VII.** Hard and Soft Acids and Bases (HSAB)

Classification of acids and bases as hard and soft, Pearson's HSAB concept, acid-base strength and hardness and softness, Symbiosis, theoretical basis of hardness and softness, electro negativity and hardness and softness, Drago wayland equation, donor acceptor number.

**Unit - V**

**VIII.** Bioinorganic Chemistry

Essential and trace elements in biological processes, metalloporphyrins with special reference to hemoglobin and myoglobin, cooperative effect, Biological role of alkali and alkaline earth metal ions with special reference to  $\text{Ca}^{2+}$ .

**Organic Chemistry Paper-II**

**Unit – I**

**I.** Spectroscopy

Nuclear magnetic resonance (NMR) spectroscopy, Proton magnetic resonance ( $^1\text{H}$  NMR) spectroscopy, nuclear shielding and deshielding, chemical shift and molecular structure, spin-spin splitting and coupling constants, areas of signals, interpretation of  $^1\text{H}$  NMR spectra of simple organic molecules such as ethyl bromide, ethanol, acetaldehyde, 1, 1, 2-tribromoethane, ethyl acetate, toluene and acetophenone, Problems pertaining to the structures elucidation of simple organic compounds using UV, IR and  $^1\text{H}$  NMR spectroscopic techniques.

**Unit – II**

**II.** Organometallic Compounds

Organomagnesium compounds: The Grignard reagents, formation, structure and

chemical reactions. Organozinc compounds: formation and chemical reactions. Organolithium compounds: formation and chemical reactions.

### III. Organosulphur Compounds

Nomenclature, structural formation, methods of formation and chemical reactions of thiols, thioethers, sulphonic acids, sulphonamides and Sulphaguanidine.

### IV. Heterocyclic Compounds

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 reaction in pyridine derivatives, Comparison of basicity of pyridine, piperidine and pyrrole.

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-Nepieralski synthesis, Mechanism of electrophilic substitution reactions of indole, quinoline and isoquinoline.

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## Unit – III

### V. Carbohydrates

Classification and nomenclature, Monosaccharides, mechanism of osazone formation, interconversion of glucose and fructose, chain lengthening and chain shortening of aldoses. Configuration of monosaccharides, Erythro and threo diastereomers, Conversion of glucose into mannose, Formation of glycosides, ethers and esters, Determination of ring size of monosaccharides, Cyclic structure of D (+)-glucose, Mechanism of mutarotation. Structures of ribose and deoxyribose,

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

### VI. Amino Acids, Peptides, Proteins and Nucleic Acids:

Classification, structure and stereochemistry of amino acids, Acid-base behavior isoelectric point and electrophoresis, Preparation and reactions of  $\alpha$ -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, Levels of protein structure, Protein denaturation/renaturation; Nucleic acids : Introduction, constituents of nucleic acids, Ribonucleosides and ribonucleotides, The double helical structure of DNA.

## Unit – IV

**VII. Fats, Oils and Detergents**

Natural fats, edible and industrial oils of vegetable origin, common fatty acids, glycerides, hydrogenation of unsaturated oils, Saponification value, iodine value, acid value, Soaps, synthetic detergents, alkyl and aryl sulphonates.

**VIII. 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, Elementary idea of organic conducting polymers.

**IX. Synthetic Dyes**

Colour and constitution (electronic Concept), Classification of dyes, Chemistry and synthesis of Methyl orange, Congo red, Malachite green, crystal violet, phenolphthalein, fluorescein, Alizarin and Indigo.

**Unit – V****X. Organic Synthesis via Enolates**

Acidity of O-hydrogens, alkylation of diethyl malonate and ethyl acetoacetate, Synthesis of ethyl acetoacetate: The Claisen condensation, Keto-enol tautomerism of ethylacetoacetate. Alkylation of 1, 3-dithianes, Alkylation and acylation of enamines.

**Physical Chemistry (Paper-III)****Unit – I****I. Introduction:**

Black-body radiation, Planck's radiation law, photoelectric effect, heat capacity of solids, Bohr's model of hydrogen atom (without derivation) their solution of overall solution and its defects, Compton effect, de-Broglie's hypothesis, the Heisenberg's uncertainty principle, Hamiltonian Operator.

**II. Elementary Quantum Mechanics:**

Schrödinger wave equation and its importance, physical interpretation of the wave function, postulates of quantum mechanics, particle in a one dimensional box. Schrödinger wave equation for H-atom, separation into three equations (without derivation), quantum numbers and their importance, hydrogen like wave functions, radial wave functions, angular wave functions.

Molecular orbital theory, basic ideas – criteria for forming M.O. from A.O.,

construction of M.O's by LCAO –  $H_2^+$  ion, calculation of energy levels from wavefunctions, physical picture of bonding and anti-bonding wave functions, concept of  $\sigma$ ,  $\sigma^*$ ,  $\pi$ ,  $\pi^*$  orbitals and their characteristics, Hybrid orbitals –  $sp$ ,  $sp^2$ ,  $sp^3$ , calculation of coefficients of A.O's used in  $sp$  and  $sp^2$  hybrid orbitals and interpretation of geometry.

Introduction to valence bond model of  $H_2$ , comparison of M.O. and V.B. models.

## Unit – II

### III. 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 properties-paramagnetism, diamagnetism and ferromagnetic, Magnetic susceptibility, its measurements and its importance.

## Unit – III

### IV. Spectroscopy:

*Introduction:* Electromagnetic radiation, regions of the spectrum, basic features of different spectrophotometers, statement of the born-oppenheimer approximation, degrees of freedom.

*Rotational Spectrum:* Diatomic Molecules: Energy levels of a rigid rotor (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.

*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, effect of a harmonic motion and isotope on the spectrum, 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.

*Electronic Spectrum:* Concept of potential energy curves for bonding and anti-bonding molecular orbitals, qualitative description of selection rules and Franck-Condon principle. Qualitative description of  $\sigma$ ,  $\pi$  and  $\pi$  M.O. their energy levels and the respective transition.

## Unit – IV:

### V. Photochemistry:

Interaction of radiation with matter, difference between thermal and photochemical processes, Laws of photochemistry: Grothus – Drapper law, Stark – Einstein law, 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), Kinetics of Photo chemical reaction.

## Unit – V

### **VI. 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, laws of osmotic pressure, its measurement and determination of molecular weight from osmotic pressure. Elevation of boiling point and depression of freezing, 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, Van't Hoff factor, Colligative properties of degree of dissociation and association of solutes.

### **B.Sc. – III Year (LABORATORY PRACTICAL) 180 hrs. (12 hrs./week)**

Atleast three practicals from each specialization should be carried out.

#### **Inorganic Chemistry:**

##### **I. Synthesis and Analysis:**

(a) Preparation of sodium trioxalato ferrate (III),  $\text{Na}_3[\text{Fe}(\text{C}_2\text{O}_4)_3]$  and determination of its composition by permagnometry.

(b) Preparation of Ni-DMG complex,  $[\text{Ni}(\text{DMG})_2]$

(c) Preparation of copper tetra ammine complex.  $[(\text{Cu}(\text{NH}_3)_4)\text{SO}_4]$ .

(d) Preparation of cis-and trans-*bis*-oxalatodiaqua chromate (III) ion.

##### **II. Instrumentation:**

Colorimetry- (a) Job's method (b) Mole-ratio method Adulteration – Food stuffs. Effluent analysis, water analysis

Solvent Extraction- Separation and estimation of Mg(II) and Fe(II) Ion

Exchange Method- Separation and estimation of Mg(II) and Zn(II)

#### **Organic Chemistry:**

### III. Laboratory Techniques- Steam Distillation

Naphthalene from its suspension in water  
Clove oil from cloves

Separation of o-and p-nitro phenols

### IV. Column Chromatography-

Separation of fluorescein and methylene blue

Separation of leaf pigments from spinach leaves

Resolution of racemic mixture of (+) mandelic acid

### V. Qualitative Analysis-

Analysis of an organic mixture containing two solid components using water,  $\text{NaHCO}_3$ ,  $\text{NaOH}$  for separation and preparation of suitable derivatives

### VI. Synthesis of Organic Compounds-

(a) Acetylation of salicylic acid, aniline, glucose and hydroquinone, Benzoylation of aniline and phenol

(b) Aliphatic electrophilic substitution

Preparation of iodoform from ethanol and acetone

(c) Aromatic electrophilic substitution

Nitration:

Preparation of m-dinitrobenzene

Preparation of p-nitroacetanilide

Halogenation

Preparation of p-bromoacetanilide

Preparation of 2, 4, 6-tribromophenol

(d) Diazotization/coupling

Preparation of methyl orange and methyl red

(e) Oxidation

Preparation of benzoic acid from toluene

(f) Reduction

Preparation of aniline from nitrobenzene

Preparation of m-nitroaniline from m-dinitrobenzene

### VII. Stereo chemical Study of Organic Compounds via Models R and S

configuration of optical isomers

E, Z configuration of geometrical isomers

Conformational analysis of cyclohexanes and substituted cyclohexanes

### Physical Chemistry:

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### VIII. Electrochemistry:

1. To determine the strength of the given acid conductometrically using standard alkali solution.

2. To determine the solubility and solubility of a sparingly soluble electrolyte



conducometrically.

3. To study the saponification of ethyl acetate conductometrically.
4. To determine the ionization constant of a weak acid conductometrically.
5. To titrate potentiometrically the given ferrous ammonium sulphate solution using  $\text{KMnO}_4/\text{K}_2\text{Cr}_2\text{O}_7$  as titrant and calculate the redox potential of  $\text{Fe}^{2+}/\text{Fe}^{3+}$  system on the hydrogen scale.

#### **IX. Refractometry, Polarimetry:**

1. To verify law of refraction of mixtures (e.g. of glycerol and water) using Abbe's refractometer.
2. To determine the specific rotation of a given optically active compound.
3. To determine stoichiometry and stability constant of complexes.

#### **X. Molecular Weight Determination:**

1. Determination of molecular weight of a non-volatile solute by Rast method/ Beckmann freezing point method.
2. Determination of the apparent degree of dissociation of an electrolyte (e.g.  $\text{NaCl}$ ) in aqueous solution at different concentrations by ebullioscopy.

#### **Colorimetry:**

1. To verify Beer – Lambert Law for  $\text{KMnO}_4/\text{K}_2\text{Cr}_2\text{O}_7$  and determining the concentration of the given solution of the substance from absorption measurement.

# RAJKAMAL SCIENCE & MANAGEMENT COLLEGE

BAHADRABAD (HARIDWAR)

## BOTANY SYLLABUS

For

UNDER GRADUATE COURSES (**B.Sc. Part-III**)

(Annual System)

*(Applicable w.e.f. the Session 2019-2020)*



Department of Botany

Sridev Suman Uttarakhand University Badshahithaul Tehri-  
Garhwal - 249001

**B.Sc.-THIRD YEAR (BOTANY)****Paper I (BBO– 301) CYTOGENETICS, MOLECULAR BIOLOGY AND BIOTECHNOLOGY****UNIT 1**

1. Structure and functions of Nucleus: Ultra structure, nuclear membrane, nucleolus, structure and functions of other cell organelles: Golgi body, endoplasmic reticulum, peroxysomes and vacuoles. The cell envelope: Plasma membrane, bilayer lipid structure and functions of cell wall.
2. Cell division: Comparison of mitosis and meiosis.
3. Chromosome organization: Morphology, centromere and telomere, chromosome alteration in chromosome numbers, aneuploidy, polyploidy and sex chromosomes.
4. Extra nuclear genome: Presence and functions of mitochondrial and plastid DNA, plasmids.

**UNIT II**

1. Genetic Inheritance: Mendelism: Law of segregation and independent assortment, incomplete dominance.
2. Interaction of genes: Linkage- complete and incomplete linkage and crossing over.
3. Sex linked inheritance: Determination of sex.
4. Genetic variation: Mutations, transposable genetic elements, DNA damage and repair.

**UNIT III**

1. DNA,-the genetic material: DNA structure, replication, DNA- protein interaction, the nucleosome model, satellite and repetitive DNA.
2. RNA: Structure and types.
3. Gene concept: Classical and modern concept of gene, operon concept.

**UNIT IV**

1. Protein Structure: 1D, 2D and 3D structure.
2. Genetic code and protein synthesis.
3. Regulation and gene expression in prokaryotes and eukaryotes.

**UNIT V**

1. Introduction to Biotechnology: Functional definition, role in modern life, history and ethical issues connected with biotechnology.

2. Genetic engineering: Tools and techniques of DNA technology, cloning vectors, genome, cDNA libraries, transposable elements and techniques of gene mapping.
3. Basic concept of tissue culture, cryopreservation, differentiation and morphogenesis, biology of *Agrobacterium*, vectors for gene delivery and marker genes.
4. A brief account of Industrial biotechnology (fermentation and alcohol production), Agricultural biotechnology (biofertilizers and biopesticides) and Nutritional biotechnology (Mycotoxins and health hazards, control of mycotoxin production, single cell protein).

### **Suggested Readings**

- Gupta P.K. 2000. Cytology, Genetics And Evolution. Rastogi Publication, Meerut
- Gupta P.K. 2012. Genetics. Rastogi Publication, Meerut
- Gupta P.K. 2001. Elements of Biotechnology. Rastogi Publication, Meerut
- Power, C.B. 1994. Cell Biology. Himalaya Publishing House, New Delhi

## **PAPER II (BBO– 302): PLANT PHYSIOLOGY AND ELEMENTARY BIOCHEMISTRY**

### **UNIT I**

1. Cell physiology, diffusion, permeability, plasmolysis, imbibition, water potential and osmotic potential.
2. Types of soil water, water holding capacity, water requirement, wilting coefficient.
3. Active and passive absorption, anatomical features of xylem in relation to path of water transport and ascent of sap.

### **UNIT II**

1. Loss of water from plants, transpiration, factors affecting transpiration, Guttation, anatomy of the leaf with special reference to the loss of water.
2. Structure of stomata, mechanism of stomatal
3. Movement and diffusion capacity of the stomata.
4. Mechanism of absorption of mineral salts.
5. Translocation of solutes, theories and mechanism of translocation. Anatomical features of the phloem tissue with reference to the translocation of solutes.

**UNIT III**

1. Elementary knowledge of macro and micro nutrients.
2. Symptoms on mineral deficiency, techniques of water and sand culture.
3. Nitrogen cycle and nitrogen fixation, importance of nitrate reductase and its regulation, ammonium assimilation.

**UNIT IV**

1. Photosynthesis: Historical background and importance of the process, role of primary pigments, concept of two photosystems, Z- scheme, photophosphorylation, Calvin cycle, factors affecting photosynthesis, chemosynthesis.
2. Respiration, glycolysis, Krebs's cycle, Electron transport mechanism (Chemiosmotic theory), ATP- the biological energy currency, redox potential, oxidative phosphorylation, pentose phosphate pathway, CAM plants, factors affecting respiration, fermentation.

**UNIT V**

1. Types and strength of solutions, acid base and salts, pH, buffer solutions and their importance.
2. Enzyme action, active sites, Michaelis-Menton constant, classification of enzymes, factors affecting the enzyme activity, coenzymes and co factors.
3. Carbohydrates: Classification, properties, structure and biological role.
4. Protein and amino acids: Classification, structure and chemical bonds in protein structure and properties.
5. Lipids: Structure and functions, fatty acid biosynthesis, beta- oxidation, saturated and unsaturated fatty acids, storage and mobilization of fatty acids.

**Suggested Readings**

- Jain, V.K. 2014. Fundamentals of Plant Physiology. S. Chand Publications, New Delhi
- Verma, S.K. and Verma M.2014. A text book of Plant Physiology and Biochemistry. S. Chand Publications, New Delhi
- Devlin, R.M. 1996, Plant Physiology. Indian Print New Delhi
- Pandey, S.N.2000. Plant Physiology.
- Srivastava, H.S. Biochemistry. Rastogi Publication, Meerut

# PAPER III: (BBO– 303) PLANT BREEDING AND BIOSTATISTICS

## UNIT 1

1. Plant breeding: Aims and objectives, basic techniques of plant breeding.
2. Methods of plant breeding in relation to self pollinated and cross pollinated plants.

## UNIT 2

1. Crop improvement methods: Plant introduction, selection, acclimatization and hybridization, vegetative propagation and grafting.
2. Heterosis: Genetic and physiological basis
3. Mutational breeding and breeding for disease resistance.

## UNIT 3

1. Improved seed production, multiplication and distribution.
2. Maintenance and seed testing.
3. National Seed Corporation (NSC), seed testing laboratories, International and National Centre for plant breeding.

## UNIT IV

1. Bio-statistics and its applications.
2. Methods of representation of statistical data diagrams.
3. Measurements of Central tendencies: Mean, Median and Mode

## UNIT V

1. Measures of dispersion: Range, mean deviation , standard deviation and standard error.
2. Coefficient of correlation.
3. Test of significance: Chi- square test.

## Suggested Readings

Singh, B.D. 2002. Plant Breeding: Principles and Methods. Kalyani Publishers, New Delhi

Chaudhary, H.C. Plant Breeding

Banerjee, P.K. 2007. Introduction to Biostatistics

Prasad, Satguru, 1992. Fundamentals of Biostatistics

## **LAB COURSE (BBO30P)**

### **CYTOGENETICS, MOLECULAR BIOLOGY AND BIOTECHNOLOGY**

1. To study Prokaryotic cells (Bacteria) and Eukaryotic cells with the help of light and electron micrographs.
2. To study cell structure from onion leaf peels, demonstration of staining and mounting methods.
3. Study of mitosis and meiosis (temporary mounts and permanent slides).
4. Exercises on genetical problems out of the following : Mendel's Law Of Inheritance, Incomplete Dominance, Sex Linked Inheritance, Sex Determination, Cytoplasmic Inheritance.
5. To study the working of following instruments: Incubator, Water Bath, Spectrophotometer, Oven and Centrifuge.
6. To study about life history of various scientists and their contribution in the field of molecular biology.
7. To study the working of the following instruments PCR, Laminar Airflow, Autoclave, etc
8. Culture media preparation.
9. Comment upon the given photograph, specimens, slides etc.

### **PLANT PHYSIOLOGY AND ELEMENTARY BIOCHEMISTRY**

1. To perform endosmosis and exosmosis using potato tuber and egg osmoscope. Demonstration of imbibition, plasmolysis and deplasmolysis.
2. To study the effects of temperature on the permeability of plasma membrane.
3. Structure of stomata, their opening and closing, stomatal frequency.
4. Comparison of the rate of transpiration using four leaf method, cobalt chloride paper or by different types of potometers under different climatic conditions.
5. Separation of photosynthetic pigments by circular paper and strip chromatography.
6. To study the effect of light and darkness on starch synthesis.
7. To study the effect of intensity and quality of light on the rate of photosynthesis by Wilmott's bubbler.
8. Study of R.Q by Ganong's respirometer in different seeds.
9. Comparasion of the rate of respiration of various plants.

**10.** Demonstration of colour tests and micro- chemical tests for carbohydrates, proteins and lipids.

### **PLANT BREEDING AND BIOSTATISTICS**

1. Study of the floral biology of some of the locally available crops such as Wheat, Pea, Bean, Mustard, Brinjal, Orka, Tomato etc.
2. Emasculation techniques in the field along with bagging and labelling.
3. Estimation of dockage percentage in seed samples.
4. Estimation of moisture content in seed samples.
5. National and International Institutes of crop research and improvement, their abbreviations.
6. Representation of data through graphs and diagrams.
7. Comment upon given graphs and diagrams.
8. Statistical problems of Central Tendencies, Standard Deviation, Correlation and Chi Square Test.



# RAJKAMAL SCIENCE & MANAGEMENT COLLEGE

BAHADRABAD (HARIDWAR)

## ZOOLOGY SYLLABUS

For

UNDER GRADUATE COURSES (**B.Sc. Part-III**)

(Annual System)

*(Applicable w.e.f. the session 2019-2020)*



Department of Zoology

**Sridev Suman Uttarakhand University**

**Badshahithaul Tehri-Garhwal – 249001**

**B.Sc. 3rd Year (Zoology)**

**Paper -I: Endocrinology and Applied Zoology**

**UNIT I**

Basic idea of endocrine, paracrine & autocrine secretion. Mechanism of action of hormones. Structure and function of Pituitary, Thyroid, Adrenal, Pancreas, Testes and ovary. Hormonal control of menstrual cycle

**Unit II**

Structure and function of Pituitary, Thyroid, Adrenal, Pancreas, Testes and ovary. Hormonal control of menstrual cycle.

**Unit III**

Sericulture: Types of silk worms (Mulberry & Nonmulberry), Rearing of Mulberry Silkworm

Lac culture: cultivation practices of host plants, extraction and uses of lac

**Unit IV**

Medicinal Pests: Identification, Characteristics of Mosquitoes, Housefly, Bedbug, Sand Medicinal Pests fly, Human lice, Tse Tse fly, Rat flea

**Unit V**

Aquaculture (Fish Culture): Monoculture and composite culture.

Hatchery management – development of fish hatcheries, types of hatcheries, production of spawn, fry and fingerlings, Pond management and fertilization - pre and post stocking management.

Induced breeding with special reference to Indian major carps.

**Suggested Readings**

Hadley, M.E.: Endocrinology. Pearson Education Pvt. Ltd. Singapore.

**Paper –II : Ecology, Conservation Biology and Animal Behaviour**

**Unit -I**

Ecology: Definition, scope and importance,

Introduction to laws of Limiting factors: Liebig's law of the minimum, Shelford's law of tolerance. Factor interaction

## Unit -II

Biogeochemical cycles: Concept and types of biogeochemical cycle (Water, Carbon, Nitrogen and Phosphorus cycle)

## Unit -III

Ecosystem concept: Component & types (Grassland, Forest, Pond, River); Abiotic, biotic & edaphic factors and their interdependence, Energy flow in ecosystem. Primary and secondary productivity. Food chains, food web and ecological pyramids

## Unit -IV

Conservation Biology: Definition & scope. Concept of biodiversity; Biodiversity as a resource; Biodiversity loss and its Causes.

Conservation & Management of Biodiversity. Concept of Protected Areas: *Ex-situ* & *In-situ* Conservation. Biodiversity hot spots.

India's wildlife: Habitats & Distribution; Protected areas: National Parks & Sanctuaries.

## Unit-III

The science of behaviour: History, scope and terminology. Biological rhythms. Biological Clock. Circadian rhythms and their synchronisation seasonal rhythms. Photoperiodism

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## Recommended Books:

1. Alcock : Animal behaviour Sinaur Associates, Inc. 1989.
2. Drickamer & Vessey: Animal Behaviour: Concepts, Processes and Methods (2nd ed.)1986
3. Goodenough et al.: Perspectives on animal behaviour. Wiley & Sons, New Youk. 1993.
4. Grier : Biology of animal behaviour, Mosby 1984.
5. M P Arora. Anilam behaviour. Himalayan Publishing house
6. Negi: An introduction to Wildlife Management, 1983.
7. Negi: Himalayan Wildlife: Habitat and Conservation. 1992. Indus Publ. Com., New Delhi.
8. Pullin: Conservation Biology, Cambridge, 2002.
9. Rawat & Agarwal : Biodiversity: Concept, threats and conservation.

10. Sharma, High Altitude Wildlife of India. Oxford 7 IBH Publ. Co. Pvt. Ltd. 1994.

## **Paper -III: Developmental Biology and Toxicology**

### **Unit - I**

Gametogenesis: Spermatogenesis in mammals, Morphology of mature mammalian spermatozoon: Oogenesis in mammals, Vitellogenesis in birds. Fertilization: external (amphibian), Internal (mammals), Block to polyspermy

### **Unit - II**

Early Development of Frog and Human: types of egg; patterns of cleavage; role of yolk during cleavage; Morphogenetic movements; Development up to formation of gastrula.

Neurulation in frog embryo, Extra embryonic membranes.

### **Unit - III**

Implantation of embryo in human; Types of placenta on the basis of histology; Formation of human placenta and its functions.

Elementary concept of primary organizer; Induction. Differentiation and organogenesis of vertebrate eye.

### **Unit - IV**

Definition, history, scope of toxicology.

Classification of toxic agents, natural toxins, food toxins, and chemical toxins

Environmental toxicology of heavy metal (lead)

### **Unit - V**

Air pollution-types of air pollutants, their effects and remedial measures.

Water pollution- types of water pollutants, their effects and remedial measures.

General introduction to pesticides;, herbicides, fungicides, and insecticides

### **Books Recommended:**

1. Jain P C . Development Biology.
2. Gilbert, Developmental Biology. 3rd ed. Sinauer, 1991.
3. Berril: Developmental Biology, McGraw-Hill. Indian ed. 1974.
4. Laycock, J.F. and Wise, P.H.: Essential Endocrinology. Oxford University Press.
5. Hadley, M.E.: Endocrinology. Pearson Education Pvt. Ltd. Singapore

**PRACTICAL SYLLABUS of B.Sc. 3rd Year (Zoology)**

**A. Endocrinology**

Study of slides; pituitary, adrenal gland, thymus, testes, ovary

**B. Ecology**

Models Based on different aspects of ecology.

Population study of available terrestrial and aquatic animals

Physico-chemical study of soil and water (pH, DO, Free CO<sub>2</sub>, Turbidity etc)

Study of an ecosystem, its biotic components and food chains

**C. Animal Behavior &**

Models Based on different aspects of animal behavior.

Study of Birds Nest showing Nesting Behaviour

Experiments related to learning behaviour/conditional learning.

Conservation Biology: Definition & scope. Concept of biodiversity; Biodiversity as a resource; Biodiversity loss and its Causes.

**D. Conservation Biology**

Study of Biodiversity hot spots with the help of maps..

Study of Protected areas: National Parks & Sanctuaries with the help of maps.

**D. Developmental Biology**

**Frog** - Study of developmental stages - whole mounts and sections through permanent slides – cleavage stages, blastula, gastrula, neurula, tail bud stage, tadpole-external and internal gill stages.

Study of the different types of placentae- histological sections through permanent slides or photomicrographs.

**E. Toxicology**

**Distribution of marks:** Duration 4 hrs.

Spotting (05) 15

(Ecological adaptation, Wildlife, Animal behaviour)

Exercise on Ecology/ Conservation Biology 10

Exercise on Animal Behaviour 05

Record and Collection 05

Viva Voice 05

Sessional Marks 10

**Total: 50**