

B.Sc. Part-I
SYLLABUS (CHEMISTRY, BOTANY & ZOOLOGY),

RAJKAMAL SCIENCE & MANAGEMENT COLLEGE
BAHADRABAD (HARIDWAR)

CHEMISTRY SYLLABUS

For

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

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



Department of Chemistry
Sridev Suman Uttarakhand University Badshahithaul
Tehri-Garhwal - 249001

Chemistry Course for B.Sc. (Annual System) Part-I **B. Sc. Chemistry Syllabus (Part-I)**

To teach the fundamental concepts of chemistry and their applications, the syllabus pertaining to B.Sc. (3-year degree course) in the subject of chemistry has been prepared as per provision of UGC module and demand of the academic environment. The syllabus concepts are duly arranged unit wise and contents are included in such a manner so that due importance is given to requisite intellectual and laboratory skills. This B.Sc. course of chemistry consists of three-year course (annual system). Total marks: 600(200 per year).

B.Sc. First Year

Paper code	Paper	Course	Max. Marks	Work Hrs
I	CH-101	Inorganic Chemistry	50	60
II	CH-102	Organic Chemistry	50	60
III	CH-103	Physical Chemistry	50	60
	CH-104	Laboratory Practical	50	60
Grand Total			200	180

Note: Examiner should follow the below given pattern covering all the units for each section compulsorily:

- a)** Twelve compulsory objective type questions of one mark each, $12 \times 1 = 12$ Marks
- b)** Examinees to solve six short answer questions out of ten questions (3 marks each) $3 \times 6 = 18$ Marks.
- c)** Examinees to solve four long answer questions out of seven (5 mark each) $4 \times 5 = 20$ Marks

Distribution of marks for Practical exam will be as follows:

B.Sc. (FIRST YEAR)

(i) Inorganic Mixture analysis (six radicals)	15
(ii) Organic Experiment	12
(iii) Physical Chemistry Experiment	10
(iv) Viva-voce**	05
(v) Annual record	08
Total	50

***Full credit of marks shall be given upto 0.5% error after which for each 0.1% error, two marks shall be deducted in Quantitative analysis experiments.**

****Viva-voce for ex-student shall carry 13 marks.**

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

Paper-I

Inorganic Chemistry (Paper Code: CH-101)

Unit – I

I. Atomic Structure:

Idea of de-Broglie matter waves (dual nature), Heisenberg uncertainty principle, atomic orbitals, Schrödinger wave equation, significance of ψ and ψ^2 , quantum numbers, radial and angular wave functions and probability distribution curves, shapes of s, p, d, orbitals, Aufbau and Pauli exclusion principles, Hund's multiplicity rule, Electronic configurations of the elements, effective nuclear charge.

Unit – II

II. Periodic Properties:

Atomic and ionic radii, ionization energy, electron affinity and electronegativity definitions, methods of determination or evaluation, trends in periodic table and applications in predicting and explaining the chemical behaviour.

Unit – III

III. Chemical Bonding:

(A) 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, valence shell electron pair repulsion (VSEPR) theory to NH_3 , H_3O^+ , SF_4 , ClF_3 , ICl_2^- and H_2O , MO theory, homonuclear and heteronuclear (CO , NO , CN^+ , CO , CN^+ , CO^+ , CN^-) diatomic molecules, multicenter bonding in electron deficient molecules, bond strength and bond energy, percentage ionic character from dipole moment and electro-negativity difference.

(B) Ionic Solids – Ionic structures, radius ratio effect and coordination number, limitation of radius ratio rule, lattice defects, semiconductors, lattice energy and Born-Haber cycle, solvation energy and solubility of ionic solids, polarizing power and polarisability of ions, Fajan's rule, Metallic bond-free electron, valence bond and band theories.

(C) Weak Interactions – Hydrogen bonding, Vander Waals forces.

Unit – IV

IV. **s-Block Elements:**

Comparative study, diagonal relationship, salient features of hydrides, solvation and complexation tendencies including their function in biosystems, an introduction to alkyls and aryls.

V. **Chemistry of Noble Gases:**

Chemical properties of the noble gases, chemistry of xenon, structure and bonding in xenon compounds.

Unit – V

VI. **p-Block Elements:**

Comparative study (including diagonal relationship) of groups 13-17 elements, compounds like hydrides, oxides, oxyacids and halides of group 13-16, hydrides of boron-diborane and higher boranes, borazine, borohydrides, fullerenes, carbides, fluorocarbons, silicates (structural principle), tetrasulphur tetra nitride, basic properties of halogens, interhalogens and polyhalides.

Paper-II

Organic Chemistry (Paper Code: CH-102)

Unit – I

I. **Structure and Bonding:**

Hybridization, bond lengths and bond angles, bond energy, localized and delocalized chemical bonding, Van der Waals interactions, inclusion compounds, clathrates, charge transfer complexes, resonances, hyperconjugation, aromaticity, inductive and field effects, hydrogen bonding.

II. **Mechanism of Organic Reactions:**

Homolytic and heterolytic bond fission, Types of reagents –electrophiles and nucleophiles, Types of organic reactions, Energy considerations.

Reactive intermediates – Carbocations, carbanions, free radicals, carbenes, arynes and nitrenes (with examples). Assigning formal charges on intermediates and other ionic species. Methods of determination of reaction mechanism (product analysis, intermediates, isotope effects, kinetic and stereochemical studies).

III. **Alkanes and Cycloalkanes:**

IUPAC nomenclature of branched and unbranched alkanes, the alkyl group, classification of carbon atom in alkanes, Isomerism in alkanes, sources methods of formation (with special reference to Wurtz reaction, Kolbe's reaction, Corey-House reaction and decarboxylation of carboxylic acids),

physical properties and chemical reactions of alkanes, Mechanism of free radical halogenation of alkanes: orientation, reactivity and selectivity.

Cycloalkanes – Nomenclature, methods of formation, chemical reactions, Baeyer's strain theory and its limitations. Ring strain in small rings (cyclopropane and cyclobutane), theory of strain less rings. The case of cyclopropane ring, banana bonds.

Unit – II

IV. Stereochemistry of Organic Compounds:

Concept of isomerism, Types of isomerism, Optical isomerism – elements of symmetry, molecular chirality, enantiomers, stereogenic center, optical activity, properties of enantiomers, chiral and achiral molecules with two stereogenic centers, diastereomers, threo and erythro diastereomers, meso compounds, resolution of enantiomers, inversion, retention and racemization. Relative and absolute configuration, sequence rules, D & L and R & S systems of nomenclature.

Geometric isomerism – determination of configuration of geometric isomers, E & Z system of nomenclature, geometric isomerism in oximes and alicyclic compounds.

Conformational isomerism – conformational analysis of ethane and *n*-butane, conformations of cyclohexane, axial and equatorial bonds, conformation of monosubstituted cyclohexane derivatives, Newman projection and Sawhorse formulae, Fischer and flying wedge formulae, Difference between configuration and conformation.

Unit – III

V. Alkenes, Cycloalkenes, Dienes and Alkynes:

Nomenclature of alkenes, methods of formation, mechanisms of dehydration of alcohols and dehydrohalogenation of alkyl halides, regioselectivity in alcohol dehydration, The Saytzeff rule, Hofmann elimination, physical properties and relative stabilities of alkenes.

Chemical reactions of alkenes – mechanism involved in hydrogenation, electrophilic and free radical additions, Markownikoff's rule, hydroboration-oxidation, oxymercuration-reduction. Epoxidation, ozonolysis, hydration, hydroxylation and oxidation with KMnO_4 , Polymerization of alkenes, Substitution at the allylic and vinylic positions of alkenes, Industrial applications of ethylene and propene.

Methods of formation, conformation and chemical reactions of cycloalkenes, Nomenclature and classification of dienes: isolated, conjugated and cumulated dienes, Structure of allenes and butadiene, methods of formation,

polymerization, chemical reaction – 1, 2 and 1, 4 additions, 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, metal-ammonia reductions, oxidation and polymerization.

Unit – IV

VI. Arenes and Aromaticity:

Nomenclature of benzene derivatives, the aryl group, Aromatic nucleus and side chain, Structure of benzene, molecular formula and Kekulé structure, stability and carbon-carbon bond lengths of benzene, resonance structure, MO picture, Aromaticity: The Hückle rule, aromatic ions. Aromatic electrophilic substitution – general pattern of the mechanism, role of π and π complexes, Mechanism of nitration, halogenation, sulphonation, mercuration and Friedel-Crafts reaction. Energy profile diagrams. Activating and deactivating substituents, orientation and ortho/para ratio, Side chain reactions of benzene derivatives, Birch reduction; Methods of formation and chemical reactions of alkylbenzenes, alkynylbenzenes and biphenyl, naphthalene and Anthracene.

Unit-V

VII. Alkyl and Aryl Halides:

Nomenclature and classes of alkyl halides, methods of formation, chemical reactions, Mechanisms of nucleophilic substitution reactions of alkyl halides, S_N^2 and S_N^1 reactions with energy profile diagrams;

Polyhalogen compounds: Chloroform, carbon tetrachloride; Methods of formation of aryl halides, nuclear and side chain reactions, The addition-elimination and the elimination- addition mechanisms of nucleophilic aromatic substitution reactions, Relative reactivities of alkyl halides vs allyl, vinyl and aryl halides, Synthesis and uses of DDT and BHC.

Paper-III Physical Chemistry (Paper Code: CH-103)

Unit – I

I. Gaseous States:

Postulates of kinetic theory of gases, deviation from ideal behavior, Van der Waals equation of state, Critical Phenomena: PV isotherms of real gases, continuity of states, the isotherms of Van der Waals equation, relationship between critical constants and Van der Waals constants, the law of corresponding states, reduced equation of state.

Molecular velocities: Root mean square, average and most probable

velocities, Qualitative discussion of the Maxwell's distribution of molecular velocities, collision number, mean free path and collision diameter, Liquifaction of gases (based on Joule –Thomson effect).

Unit – II

II. Liquid State:

Intermolecular forces, structure of liquids (a qualitative description), Structural differences between solids, liquids and gases, Liquid crystals: Difference between liquid crystal, solid and liquid, Classification, structure of nematic and cholestric phases, Thermography and seven segment cells.

Unit – III

III. Solid States:

Definition of space lattice, unit cell, Laws of crystallography – (i) Law of constancy of interfacial angles, (ii) Law of rationality of indices (iii) Law of symmetry, Symmetry elements in crystals. X-ray diffraction by crystals, Derivation of Bragg equation, Determination of crystal structure of NaCl, KCl and CsCl (Laue's method and powder method).

IV. Colloidal States:

Definition of colloids, classification of colloids, Solids in liquids (sols): properties – kinetic, optical and electrical; stability of colloids, protective action, Hardy-Schulze law, gold number. Liquids in liquids (emulsions): types of emulsions, preparation, Emulsifier, Liquids in solids (gels): classification, preparation and properties, inhibition, general application of colloids, colloidal electrolytes.

Unit – IV

V. Chemical Kinetics and Catalysis:

Chemical kinetics and its scope, rate of a reaction, factors influencing the rate of a reaction – concentration, temperature, pressure, solvent, light catalyst, concentration dependence of rates, mathematical characteristics of simple chemical reactions – zero order, first order, second order, pseudo order, half-life and mean life, Determination of the order of reaction – differential method, method of integration, method of half-life period and isolation method. Radioactive decay as a first order phenomenon, Experimental methods of chemical kinetics: conductometric, potentiometric, optical methods, polarimetry and spectrophotometer. Theories of chemical kinetics: effect of temperature on rate of reaction, Arrhenius equation, concept of activation energy. Simple collision theory based on hard sphere model, transition state theory (equilibrium hypothesis), Expression for the rate constant based on equilibrium constant and thermodynamic aspects.

Catalysis, characteristics of catalyzed reactions, classification of catalysis homogeneous and heterogeneous catalysis, enzyme catalysis, miscellaneous examples.

B.Sc. – I (PRACTICAL) 180 hrs (6 Hrs/week)

Atleast three practicals from each specialization should be carried out.

Inorganic Chemistry:

- I** Semi micro Analysis – Mixture analysis for six radicals (3 cations & 3 anions), including interfering radicals.

Organic Chemistry:

Laboratory techniques:

- II** Calibration of Thermometer- 80-82^o(Naphthalene), 113.5-114^o(Acetanilide) 132.5- 133^o(Urea), 100^o(Distilled Water)
- III** Determination of melting point:
Naphthalene 80-82^o, Benzoic acid 121.5-122^o, Urea 132.5-133^o, Succinic acid 184.5-185^o, Cinnamic acid 132.5-133^o, Salicylic acid 157.5-158^o, Acetanilide 113.5-114^o, m-Dinitrobenzene 90^o, p-Dichlorobenzene 52^o, Aspirin 135^o
- IV** Determination of boiling point:
Ethanol 78^o, Cyclohexane 81.4^o, Toluene 110.6^o, Benzene 80^o Mixed melting point determination:
Urea-Cinnamic acid mixture of various compositions (1:4, 1:1, 4:1)
- V** Distillation:
Simple distillation of ethanol-water mixture using water condenser,
Distillation of nitrobenzene and aniline using air condenser
- VI** Crystallization:
Concept of induction of crystallization, Phthalic acid from hot water (using fluted filter paper and steamless funnel) Acetanilide from boiling water, Naphthalene from ethanol, Benzoic acid from water
Decolorisation and crystallization using charcoal:
Decolorisation of brown sugar (sucrose) with animal charcoal using gravity filtration. Crystallization and decolorisation of impure naphthalene (100g of naphthalene mixes with 0.3 g of Congo Red using 1g decolorizing carbon) from ethanol.
- VII** Sublimation (Simple and Vacuum): Camphor, Naphthalene, Phthalic acid and succinic acid. Qualitative Analysis:

VIII. Detection of extra elements (N, S and halogens) and functional groups (phenolic, carboxylic, carbonyl, esters, carbohydrates, amines, amides, nitro and anilide) in simple organic compounds.

Physical Chemistry:

IX. Chemical Kinetics:

1. To determine the specific reaction rate of the hydrolysis of methyl acetate/ethyl acetate catalyzed by hydrogen ions at room temperature.
2. To study the effect of acid strength on the hydrolysis of an ester.
3. To compare the strengths of HCl and H₂SO₄ by studying the kinetics of hydrolysis of ethyl acetate.
4. To study kinetically the reaction rate of decomposition of iodide by H₂SO₄. Distribution Law:

1. To study the distribution of iodine between water and CCl₄.
2. To study the distribution of benzoic acid between benzene and water.

X. Viscosity, Surface Tension:

1. To determine the percentage composition of a given mixture (non interacting systems) by viscosity method.
2. To determine the viscosity of amyl alcohol in water at different concentration and calculate the excess viscosity of these solutions.
3. To determine the percentage composition of a given binary mixture by surface tension method (acetone & ethyl methyl ketone).

RAJKAMAL SCIENCE & MANAGEMENT COLLEGE
BAHADRABAD (HARIDWAR)

BOTANY SYLLABUS

For

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

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



Department of Botany

Sridev Suman Uttarakhand University Badshahithaul

Tehri-Garhwal - 249001

UNDER ANNUAL SYSTEM

To teach the fundamental concept of Botany and their applications the syllabus pertaining to B.Sc. (3-year degree course) in the subject of Botany has been prepared as per provision of UGC module and demand of academic environment. The syllabus concepts are duly arranged unit wise and contents are included in a such manner so that due importance is given to requisite intellectual and laboratory skills. This B.Sc. course of Botany consists of 3-year course (Annual System). Total marks 600(200per year).

B.Sc Ist Year (Botany)

S.NO.	TITLE	PAPER CODE	MAX. MARKS
I	Fungi, Elementary Microbiology and Plant Pathology	BBO-101	50
II	Algae and Bryophytes	BBO-102	50
III	Pteridophytes, Gymnosperm and Elementary Palaeobotany	BBO-103	50
	Lab Course	BBO-10P	50

Note: Examiner should follow the below given pattern covering all the unit for each section compulsory:

- a) Twelve Compulsory subject objective type questions of one mark each, $12*1=12$.
- b) Examinees to solve 6 short answer questions out of 10 questions (3 marks each) $3*6=18$ marks.
- c) Examinees to solve 4 long answer questions out of seven (5 marks each) $4*5=20$ Marks.

BOTANY PAPER I: (BBO-101)

FUNGI, ELEMENTARY MICROBIOLOGY AND PLANT PATHOLOGY

UNIT I

1. Brief history and salient features of Fungi.
2. A broad outline of classification of Fungi (Ainsworth) and salient features of the important groups.
3. Structure, methods of reproduction and life history of following Genera:
Synchytrium, Saprolegnia, Albugo, Rhizopus, Penicillium, Saccharomyces, Phyllactinia, Erysiphe, Puccinia, Ustilago, Agaricus and

Alternaria.

4. Heterothallism, Parasexuality and Economic importance of Fungi.

UNIT II

1. Lichens: Habitats, characteristics, general structure and classification.
2. Physiology (Symbiotic relationship) and reproduction in Lichens.
3. Economic importance of Lichens.

UNIT III

1. General account of diversity of microorganisms.
2. Elementary principles of isolation and purification of microorganisms.
3. Role of microorganisms in carbon and nitrogen cycles in nature.

UNIT IV

1. Bacteria: Structure, classification, nutrition, reproduction, gram positive and gram negative bacteria; Economic importance of bacteria.
2. Viruses: Structure, transmission and multiplication. Economic importance of viruses. Brief idea of Bacteriophages.
3. General account of Mycoplasma.

UNIT V

1. General symptoms of plant diseases and principles of infection and resistance.
2. General methods of chemical and biological control of the plant diseases.
3. The symptoms, morphology of the causal organism, disease cycle and control measures of the following diseases: Wart disease of Potato, White rust of Crucifers, Powdery mildew of Shisham, Black rust of Wheat, Red rot of Sugarcane.

Suggested Readings

Vashistha, B.R., Sinha, A.K. 2014. Botany for degree students: Fungi. S. Chand Publication, New Delhi

Singh, V., Pandey, P.C. and Jain, D.K. 1998. A text book of Botany. Rastogi Publication Meerut
Gangulee, H.C. and Kar, A.K. 1992. College Botany. Vol 2, Kolkatta

Dubey, R.C. and Maheshwari, D.K.2014. A text book of Microbiology. S. Chand Publication, New Delhi.
Matthews, R.E. 2013. Fundamentals of Plant Virology, Elsevier India

BOTANY PAPER II (BBO-102):

ALGAE AND BRYOPHYTE

UNIT I

1. General characteristics of the group (Algae) and its position in Plant Kingdom.
2. Classification of algae, basic outlines of Fritsch's and Smith's classification.
3. Elementary knowledge of organisation of thallus in algae.

UNIT II

1. Structure, reproduction and life cycles of the following Genera:
Chlamydomonas, Volvox, Oedogonium, Vaucheria, Chara, Sargassum, Ectocarpus, Batrachospermum and Polysiphonia.
2. General account of Bacillariophyceae.
3. Cyanobacteria: General account of *Nostoc*.

UNIT III

1. Types of life cycles – Haplontic, Diplontic, Diplohaplontic, Haplodiplontic and Diplobiontic; Alternation of generation in Algae.
2. Ecology of Algae: Brief idea of freshwater and marine, terrestrial, epiphytic, parasitic, symbiotic algae and phytoplanktons.
3. Economic importance of algae as food, fodder, in agriculture, industry and public health.

UNIT IV

1. Outlines and basic principles of classification of the Bryophytes in accordance with the International Code of Botanical Nomenclature.
2. Comparative account of the gross morphology, anatomy, vegetative and sexual reproduction, development and structure of the sporophyte and mechanism of spore dispersal based on *Riccia and Marchantia*.
3. Habitat, distribution and economic importance of Bryophytes.

UNIT V

1. Comparative account of the gross morphology and anatomy of the gametophytes, vegetative and sexual reproduction, development and structure of the sporophyte and mechanism of spore dispersal in *Anthoceros* and Mosses (*Funaria*).
2. General account of Jungermanniales (*Porella*).
3. A brief account of the alternation of generation in Bryophytes.

Suggested readings

Kumar, H.D. 1999. Introductory Phycology, Affiliated East West Press, New Delhi

Vashistha, B.R., Sinha, A.K. and Singh, V.P. 2014. Botany for degree students: Algae. S. Chand Publication, New Delhi

Vashistha, B.R., Sinha, A.K and Kumar, Adarsh 2014. Botany for degree students: Bryophyta.

S. Chand Publication, New Delhi

Parihar, N.S. 1991. An Introduction to Bryophyta. Vol 1&2. Central Book

Depot, Allahabad Puri, P.1980. Bryophytes. Atma Ram and Sons, New Delhi

BOTANY PAPER III: (BBO-103)

PTERIDOPHYTES, GYMNOSPERMS AND ELEMENTARY PALAEOBOTANY

UNIT I

1. General characters of the Pteridophytes and classification as proposed by Pichi-Sermolli.
2. A comparative study of *Rhynia*, *Selaginella*, *Lycopodium*, *Equisetum*, *Adiantum*, and *Marsilea* on the basis of following features:
3. Morphology and anatomy of the vegetative plant body and spore production organs (strobilus, sporocarp, sporophyll, sporangium and spores), sexual reproduction, male and female gametophytes, fertilization.

UNIT II

1. A brief account of Telome theory, Stellar system and its evolution.
2. Heterospory and seed habit in Pteridophytes.
3. Apogamy, agamospory and apospory in ferns.

UNIT III

1. Outlines of classification as proposed by D D Pant and distinguishing features of Gymnosperms.
2. Comparative account of the structure, life history and evolutionary trends based on the following Genera:
Cycas, *Pinus* and *Ephedra*
3. General anatomy- Types of wood thickening, tracheids, medullary rays, pitting and resin canals, mesarch and pseudomesarch, foliar bundles and types of stomata.

UNIT IV

1. Distribution of Gymnosperms in India.
2. Economic importance of the Gymnosperms.

UNIT V

1. Fossils: Types of fossils and process of fossilization.
2. A general idea about Geological era.

3. Living fossils.

Suggested Readings

Parihar, N.S.1996. Biology and Morphology of Pteridophytes. Central Book Depot, Allahabad

Vashistha, P.C., Sinha, A.K and Kumar, Anil 2012. Botany for degree students: Pteridophyta. S. Chand Publication, New Delhi

Bhatnagar, S.P. and Moitra, A.1996, Gynnosperms, New Age International Pvt. Ltd, New Delhi

Vashistha, P.C., Sinha, A.K and Kumar, Anil 2012. Botany for degree students: Gynnosperms. S. Chand Publication, New Delhi

Botany Lab Course (BBO-10P)

Prepared slides and specimens should be shown to the students for demonstration of the general features. The students are required to make temporary slide preparation of the important plant material themselves. They are also required to submit a collection of plant species studied by them either on herbarium sheets or as specimen or live planted material as directed by the department.

FUNGI, ELEMENTARY MICROBIOLOGY & PLANT PATHOLOGY

1. To study identify and comment upon the following fungal materials by preparing the temporary slides/ specimens: *Saprolegnia*, *Albugo*, *Rhizopus*, *Saccharomyces*, *Phyllactinia*, *Morchella*, *Agaricus*, *Puccinia*, *Ustilago*, and *Alternaria*.
2. Study of morphology and structure of different types of lichens: Foliose, Fruticose, and Crustose.
3. Symptoms, morphology of pathogen and host parasite relationship of plant diseases: White rust of crucifers, Wart disease of potato, Loose smut of wheat, Black rust of wheat, Red rot of sugar cane and Powdery mildew of shisham
4. Different methods of isolation of microbes.
5. Staining of bacteria with gram stain.
6. Morphological features of viral infected plants; study of bacterial infections in plants.

ALGAE AND BRYOPHYTES

1. To study, identify and comment upon the following algal materials by preparing temporary slides/specimens: *Nostoc*, *Chlamydomonas*, *Volvox*, *Oedogonium*, *Vaucheria*, *Chara*, *Sargassum*, *Batrachospermum* And

Polysiphonia.

2. To study the morphological and anatomical features of the following material and identify them by preparing temporary slides: *Riccia*, *Marchantia*, *Anthoceros*, *Jungermanniales* and *Funaria*.

PTERIDOPHYTES, GYMNOSPERMS AND ELEMENTARY PALAEOBOTANY

1. Study of the external features, internal structures, rhizome, leaves, roots, sporangia and strobili of *Selaginella* and *Equisetum*, sporocarp of *Marsellia* and prothallus of *Selaginella*, *Equisetum*, *Adiantum* and *Marselia*.
2. Study of the morphological features and anatomical structures of vegetative and reproductive parts of *Cycas*, *Pinus* and *Ephedra*.
3. Study the fossil specimen: Impression, Casts and Petrification.

RAJKAMAL SCIENCE & MANAGEMENT COLLEGE
BAHADRABAD (HARIDWAR)

ZOOLOGY SYLLABUS

For

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

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



Department of Zoology
Sridev Suman Uttarakhand University Badshahithaul
Tehri-Garhwal - 249001

Zoology Paper I: Animal Diversity (Non-Chordata)

classification up to classes; locomotion and nutrition in Protozoa.
Porifera: General characters and classification up to classes; Canal system in sponges

UNIT-II

Coelenterata: General characters and classification up to classes; Polymorphism in Coelenterates; Corals and coral reefs.

Helminthes: General characters of Nematelminthes and Platyhelminthes; Life history of *Ascaris lumbricoides* and *Taenia solium* and their parasitic adaptations

UNIT-I UNIT-III

Practical Zoology: General

Annelida: General characters and classification up to classes; Metamerism in Trochophore larva and its significance.

Arthropoda: General characters and classification up to classes; Zoological importance of *Peripatus* and *Limulus*.
Metamorphosis in Insects.

UNIT-IV

Mollusca: General characters and classification up to classes; Torsion in Gastropoda; Pearl formation.

UNIT-V

Echinodermata: General characters and classification up to classes; Water vascular system in star fish; Echinoderm larvae and their significance.

Books Recommended:

1. Kotpal, Agrawal & Khetrapal: Modern Text-book of Zoology, Invertebrates. 11/E. Rastogi publication.
2. Nigam: Biology of Non-Chordates, Nagin Chand,
4. B.Sc. Zoology Series -Animal Diversity, Tata McGraw Hill Education Pvt. Ltd. N.Delhi
5. Jordan E.L. et al.: Invertebrate Zoology. S.Chand & Company Ltd.
6. Barnes: Invertebrate Zoology (4th ed.), Holt-Saunders.
7. Barrington: Invertebrate Structure and Function, Nelson.
8. Iyer: A Manual of Zoology, Part I. Visawanathan

and

Zoology Paper 2: CELL BIOLOGY AND GENETICS

Unit -I

Introduction to Cell biology; Cell theory
Comparative study of the Prokaryotic and Eukaryotic Cell.

Unit -II

Elementary knowledge of the structure & functions of plasma membrane;
Introduction to the organelles constituting endomembrane system
(Endoplasmic reticulum, Golgi complex, Lysosome & Peroxisome).

Unit -III

Nucleus & nucleolus; Ribosome; Mitochondria. Introduction to cytoskeleton.
Cell Division-Mitosis & Meiosis. Basic features of Cell cycle;
Elementary idea of cell transformation and cancer

Unit-IV

Mendel's law; Exceptions to Mendel's law. Incomplete dominance
and Co- dominance, Multiple alleles, Lethal alleles, Epistasis.
Sex-linked inheritance; Extra chromosomal inheritance

Unit-V

Linkage & Crossing over. Sex determination.
Chromosome structure; Euchromatin; Heterochromatin; Histones.
Polytene & lampbrush chromosomes, Eugenesis

Books Recommended:

1. Alberts et al.: Molecular Biology of the Cell, Garland Publ., New York, 1989.
2. Strickberger: Genetics, Prentice Hall, 1996.
3. DeRobertis & DeRobertis: Cell & Molecular Biology, 1996
4. Verma, P.S. and Agrwal, V. K. Cell Biology, Genetics, Molecular biology and Evolution (S. Chand & Co.)

Zoology Paper -III Taxonomy and Evolution, Biostat & Computer

Unit -I

Taxonomy: Definition & scope; relationship with Systematic, Zoological nomenclature: Binominal & Trinominal; ICZN.

Components of classification: Linnaean hierarchy. Concepts of species: Typological, Nomenclistic & Biological

Unit -II

Geological distribution of animals, period of evolution and extinction of major groups. Direct Evidences of Evolution: Type of Fossils & fossilization. Dating of fossils. Significance of fossil record.

Unit - III

Evolutionary theories: Lamarckism, Darwinism, Neo-Darwinism; Processes of Evolutionary Change: Organic variations; Isolating Mechanisms; Natural selection (Example: Industrial melanism); Types of natural selection (Directional, Stabilizing, Disruptive). Evolution of Horse

Unit -IV

Biostatistics as a tool in research. Data collection: Random & non-random sampling. Data tabulation; Data presentation (Graph, Frequency Polygon, Histogram, Bar diagram, Scatter diagram).

Measures of central tendency- Calculation of Mean, Mode, Median

Unit -V

Introduction to computers types; Components of computer (Input unit, Memory, Central Processing Unit, Output unit). Problem solving with computers. Elementary idea of memory (RAM, ROM). Uses of computers in different fields. e.g. Biology, Medical, Environment etc.

Books Recommended:

1. Ashok Verma - Animal Taxonomy
2. Ernst Mayr- Principals of Systematic
3. Simpson- Principals and Practices of Animal Taxonomy
4. Kapoor- Theory and Practices of Animal Taxonomy, Oxford & Ibh
5. Strickberger: Evolution, CBS Publ. 1994.
6. Douglas, J. Futuyma. *Evolutionary Biology*. Sinauer Associate (1997)
7. Jain P.C. : Paleontology, Vishal Publ. Co.
8. Arora M.P.: Organic Evolution, Himalaya Publ
9. Rajaraman & V. Rajaraman: Computer Primer (2nd ed.) Prentice Hall of India, New Delhi.
10. Mahajan: Methods in Biostatistics, (4th ed.) Jaypee Bros. 1984

ZOOLOGY PRACTICAL SYLLABUS (B.Sc.-Part-I)

A. Non-Chordata:

Kingdom Protista: Amoeba, Euglena, Plasmodium, Paramecium

Phylum Porifera: Sycon (including T.S. and L.S.), Hyalonema, and Euplectella

Phylum Cnidaria: Obelia, Physalia, Aurelia, Tubipora, Metridium

Phylum Platyhelminthes: Liver Fluke, Taenia solium and Study of its life history stages (*Liver Fluke*, *Taenia solium*)

Phylum Nematelminthes: Male and female Ascaris

lumbricoides Phylum Annelida: Aphrodite, Nereis,

Pheretima, Hirudinaria

Phylum Arthropoda: Palaemon, Cancer, Limulus, Palamnaeus,

Scolopendra, Julus, Apis, Peripatus

Phylum Mollusca: Chiton, Dentalium, Pila, Unio, Loligo, Sepia,

Octopus Phylum Echinodermata: Pentaceros, Ophiura, Echinus,

Cucumaria and Antedon

An "animal album" containing photographs, cut outs, with appropriate write up about the above mentioned taxa.

B. Cell Biology and Genetics:

1. Cell Structure and Cell Division- Prepared slides/photographs

2. Preparation of giant chromosome

3. Preparation of onion root tip for the stage of mitosis

4. Using suitable examples of Mendelian Inheritance and gene interactions verify the results through Chi-square test.

5. Study of Human Karyotypes (normal and abnormal).

C. Evolution:

1. Study of fossil evidences from plaster cast models and pictures

2. Study of homology and analogy from suitable specimens/ pictures and charts:

3. Phylogeny of horse with diagrams/ cut outs of limbs and teeth of horse ancestors

4. Darwin's Finches with diagrams/ cut outs of beaks of different species

5. Visit to Museums, National parks and sanctuaries and submission of report.

B. Biostatistics

Practical application of statistics- Data presentation (Bar diagram, Histogram, Frequency distribution curve and scattered diagram), Measures of central tendency (Calculation of Mean, Mode, Median).

C. Computer application

Practical demonstration –preparation of Power Point presentation, Spread sheet, Chart and Design etc.

Distribution of marks: Duration 4 hrs.

1. Spotting (10) (Protozoa to Echinodermata)
2. Exercise on Cell Biology
3. Exercise on Genetics
4. Record and Collection
5. Viva Voice
6. Sessional Marks

Total 50

