SRIDEV SUMAN UTTARAKHAND UNIVERSITY, BADSHAHITHAUL, TEHRI, GARHWAL

SYLLABUS: BOTANY COURSE FOR B.Sc. STUDENTS (3 Years)

UNDER ANNUAL SYSTEM

To tech the fundamental concept of Botany and there 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 contants 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

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**

B.Sc IInd Year

S.NO.	TITLE	PAPER CODE	MAX. MARKS
I	**Taxonomy of Angiosperms and Economic Botany**	**BBO-201**	**50**
II	**Anatomy, Embryology and Elementary Morphogenesis**	**BBO-202**	**50**
III	**Ecology and Remote Sensing**	**BBO-203**	**50**
	Lab Course	**BBO-20P**	**50**

B.Sc IIIrd Year

S.NO.	TITILE	PAPER CODE	MAX. MARKS
I	**Cytogenetics, Molecular Biology and Biotechnology**	**BBO-301**	**50**
II	**Plant Physiology and Elementary Biochemistry**	**BBO-302**	**50**
III	**Plant Breeding and Biostatistics**	**BBO-303**	**50**
	Lab Course	**BBO-30P**	**50**

Note : Examiner should follow the bellow 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.

B.Sc Ist Year

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

PAPER II (BBO-102): ALGAE AND BRYOPHYTES

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

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, Stelar 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: Pteriodophyta. S. Chand Publication, New Delhi

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

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

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, Fructicose, 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, Sargassam, Batrachospemum 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 E*quisetum*, 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 Petrifaction.

Second Year

PAPER I (BBO-201)   TAXONOMY OF ANGIOSPERMS AND ECONOMIC BOTANY

UNIT I

1. Angiosperms origin and evolution. Some examples of primitive angiosperms. Angiosperm taxonomy- fundamental components.
2. Comparasion and evolution of the system of classification as proposed by Linnaeus, Betham and Hooker and Hutchinson.
3. Nomenclature: International Code of Botanical Nomenclature (ICBN), History, scientific naming of plants, priority, types, validity, *nomina conservanda.*
4. Collection and preservation techniques of specimens for Herbarium and Museum, Botanical gardens and Herbaria, Botanical Survey of India (BSI).

UNIT II

1. Taxonomy, important distinguishing characters, classification and economics importance of the following families:

   Dicotyledonae

   Polypetalae :   Ranunculaceae, Brassicaceae, Caryophyllaceae, Rutaceae, Malvaceae, Rosaceae and Apiaceae

UNIT III

1. Gamopetalae: Solanaceae, Apocynaceae, Acanthaceae, Lamiaceae

2. Monochlamydae: Euphorbiaceae, Polygonaceae

3. Monocotyledonae: Orchidaceae, Liliaceae, and Poaceae

UNIT IV

1. Origin of cultivated plants, monophyletic and polyphyletic origin, centres of origin of some important crop plants.

2. Origin, history, botanical features and cultivation of cereals and millets: Wheat, Rice, Maize and Bajra.

3. Legumes: An introduction to the economically important legumes.

4. Oils: Castor oil, linseed oil and mustard oil.

UNIT V

1. General account of fruits (Apple, Banana, Citrus, Mango) and Vegetables (Root, stem, leaf, and fruit vegetables).
2. Fibres (Coir, Cotton, Flax, Jute) and Medicinal plants (*Aconitum, Atropa, Cinchona, Rauwolfia, Ephedra*).
3. Common Timber yielding plants of Western Himalayas (Chir, Deodar, Sal Shisham and Teak).

Suggested Readings

Singh, V. And Jain, D.K.2012. Taxonomy of Angiosperms. Rastogi Publications,, Meerut

Singh, G.2012. Plant Systematic: Theory and Practice. Oxford and IBH Pvt Ltd, New Delhi

Pandey, B.P.2001. A text book of Angiosperms. S. Chand Publication, New Delhi

Sharma, O.P.2016. Plants and Human Welfare, Pragati Prakshan, Meerut

Sharma, A.K. and Sharma, R. Taxonomy of Angiosperms and Utilization of Plants

PAPER II: (BBO-202) ANATOMY, EMBRYOLOGY AND ELEMENTARY MORPHOGENESIS

UNIT I

1. The techniques for the study of plant anatomy.

2. Meristems: Primary and secondary meristems, characteristics and functions. Various types of permanent tissues- Simple and complex tissues.

3. Structure of dicot and monocot root, stem and leaf.

UNIT II

1. Secretory structures

2. Origin structure and function of vascular cambium including anomalous behaviour with special reference to the following taxa: *Bougainvillea ,Salvadora, Nycthanthes, Dracaena, Orchids* and *Tinospora.*

3. Structure of xylem and phloem.

UNIT III

1. Structure of anther, micro sporogenesis and development of male gametophyte in angiosperms.

   Structure of ovule, mega sporogenesis and development of the female gametophyte with reference to the *Polygonum* type. Comparasion with the bio sporic and tetra sporic types

2. Pollination, fertilization and life history of a typical angiosperm.

UNIT IV

1. Endosperm and embryo development with special reference to the onagrad type.

2. Polyembryony and apomixis.

3. Seed germination and dormancy, elementary plant movements.

UNIT V

1. Basic body plan of a flowering plant- modular type of growth.

2. Diversity in plant forms in annuals, biennials and perennials. Development of tree habit in higher plants

3. Plant growth regulators: Auxin, Gibberellin, Cytokinin and Abscissic acid.

4. Physiology of flowering: Photoperiodism and vernalization.

Suggested Readings

Pandey, S.N. 1992, Plant Anatomy, Rastogi Publication, Meerut

Tayal, M.S. 1996, Plant Anatomy, Rastogi Publication, Meerut

Bhojwani, S.S. and Bhatnagar, S.P.1994. Embryology of Angiosperms

Maheshwari, P. An Introduction to Embryology of Angiosperms

PAPER III: (BBO-203)   ECOLOGY AND REMOTE SENSING

UNIT 1
1. Definition and scope of ecology, Principles of environment, atmosphere, light, temperature, water and soil.
2. Ecosystem: Types , biotic and abiotic components, food chain, food web, ecological pyramids and ecological niche.
3. Productivity, type, measurement of primary productivity, energy flow and ecological energetics, Lindeman's concept of Energy Flow.

UNIT II
1. Biogeochemical cycles: A brief discussion of concept   by citing examples of carbon, nitrogen and phosphorous cycles.
2. Population ecology: Definition, population characteristics, growth curves, carrying capacity and population fluctuation.
3. Community ecology: Structure and community characteristics, quantative, qualitative and synthetic features, life forms, biological spectrum and ecological succession.

UNIT III
1. Pollution of air, water and soil, noise incidence, thermal and radioactive pollution; prevention and control of pollution.
2. Global warming, desertification and ozone depletion.
3. Biogeographical regions of India ; Vegetation types in Uttarakhand

UNIT IV
1. Biodiversity: Basic concept, types, causes and loss of biodiversity.
2. Biodiversity conservation: In situ and ex situ conservation, gene bank, introductory account of Biosphere reserves, National parks and Sanctuaries
3. Soil erosion and conservation, conservation and management of some natural resources: forest and rangeland management.

UNIT V
1. Definition of remote sensing, aerial photography, principles and fundamentals of aerial photo interpretation.
2. Electromagnetic spectrum, satellite and sensors, remote sensing data acquisition, physical basis of remote sensing, aerial and space platforms.
3. Image interpretation, role of remote sensing in ecology.

Suggested Readings

Odum, E.P. 1983, Basics of Ecology, Saunders College Publication, New York

Tiwari, S.C.2005. Concepts of Modern Ecology, Bishen Singh Mahendra Pal Singh, Dehradun

Sharma, P. D, 2014.Ecology and Environment, Rastogi Publications, Meerut

Shukla, R.S. and Chandel. P.S. 2014. Plant Ecology. S Chand Publications, New Delhi

Shukla, R.S. and Chandel. P.S. Biostatistics. S Chand Publications, New Delhi

LAB COURSE (BBO-20P)

TAXONOMY OF ANGIOSPERMS AND ECONOMIC BOTANY

1. Identification of locally available plants belonging to the families mentioned in the syllabus, their description in semi technical language.
2. Collection of plant specimens: Herbarium and/live specimens. Excursions should be organised to acquaint the students with the local flora.
3. To identify study and comment upon the economically important plants and their economic products mentioned in the syllabus.

ANATOMY, EMBRYOLOGY AND ELEMENTARY MORPHOGENESIS

1. Demonstration of usual techniques of plant anatomy, section cutting, TS, LS of dicot and monocot leaf, stem and root.
2. Normal and abnormal secondary growth in *Boerhavia, Bougainvellia, Nyctanthes, , Dracaena, Orchid* and *Tinospora.*
3. TS of anther.
4. Study of various types of pollen grains, placentations, embryo sacs, ovules and stages of embryo development using temporary and permanent preparations.
5. Influence of growth regulators on root formation, senescence and pollen germination (hanging drop method).
6. Structure and organization of the shoot apex/ root apex.

ECOLOGY AND REMOTE SENSING

1. To determine the minimum size of quadrat by species area curve method.
2. To determine the minimum number of quadrats to be laid down for the vegetation analysis of the given area.
3. To determine the frequency, density and abundance of each species in a community by quadrat method.
4. To prepare frequency diagram and compare it with that o the Raunkiaer's normal frequency diagram.
5. To determine the mean basal cover and total basal cover.
6. To study the physical characters of soil in terms of temperature, colour, texture and pH.
7. To find out bulk density and porosity of different soils.
8. To estimate the moisture percentage of various soil samples.
9. Statistical problems of central tendencies, standard deviation, Correlation and X^2 test.
10. Study of types of aerial photographs and satellite data products.
11. Study of types of stereoscopes

THIRD YEAR
Paper I (BBO– 301) <u>CYTOGENETICS, MOLECULAR BIOLOGY AND BIOTECHNOLOGY</u>

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: Comparasion 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. Nirtogen 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, Kreb's cycle, Electron transport mechanism (Chemiosmotics 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 Psysiology. S. Chand Publicatons, New Delhi
Verma, S.K. and Verma M.2014. A text book of Plant Physiology and Biochemistry. S. Chand Publicatons, 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 disitribution.

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.

CURRICULUM

In

CHEMISTRY

For

UNDER GRADUATE COURSES (B.Sc.)
(Annual System)

PASSED BY THE BOARD OF STUDIES
IN CHEMISTRY

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

Department of Chemistry
Rishikesh Campus
Sridev Suman Uttarakhand University Badshahithaul
Tehri-Garhwal - 249001
Sri Dev Suman Uttarakhand University Badshshithaul Tehri Garhwal

Proposed Syllabus: Chemistry Course for B.Sc (Annual System)

B. Sc. Chemistry Syllabus
Objective of the course

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	Paper code	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

B.Sc. Second Year

Paper	Paper code	Course	Max. Marks	Work Hrs
I	CH-201	Inorganic Chemistry	50	60
II	CH-202	Organic Chemistry	50	60
III	CH-203	Physical Chemistry	50	60
	CH-204	Laboratory Practical	50	60
Grand Total			200	180

B.Sc. Third Year

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

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 x 1 = 12 Marks
b) Examinees to solve six short answer questions out of ten question (3 mark each) 3x6=18 Marks.
c) Examinees to solve four long answer questions out of seven (5 mark each) 4x5=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**

B.Sc. (SECOND YEAR)

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

B.Sc. (THIRD YEAR)

(i)	**Inorganic Experiment**	**10**
(ii)	**Organic Experiment**	**12**
(iii)	**Physical Chemistry Experiment**	**15**
(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-studentshall carry 13 marks.

**Three Years Degree Course Syllabus for
CHEMISTRY
B.Sc. (FIRST YEAR)**

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

Paper	Paper code	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

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

B.Sc. – I Year
Chemistry 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 shall electron pair repulsion(VSEPR) theory to NH_3, H_3O^+, SF_4, CIF_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.

**B. Sc. Ist year
Paper-II
Organic Chemistry**

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, clatherates, 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, disasteromers, threo and erythro diastereomers, meso compounds, resolution of enantionmers, inversion, retention and recemization. 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 halids, 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 kekule structure, stability and carbon-carbon

bond lengths of benzene, resonance structure, MO picture, Aromaticity: The Huckle rule, aromatic ions.

Aromatic electrophilic substitution – general pattern of the mechanism, role of σ 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_{N2} and S_{N1} 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 nucleophilc aromatic substitution reactions, Relative reactivities of alkyl halides *vs* allyl, vinyl and aryl halides, Synthesis and uses of DDT and BHC.

B.Sc. – I Chemistry
Paper-III
Physical Chemistry

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, Liquifiction 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- 80-82^0(Naphthalene), 113.5-114^0(Acetanilide) 132.5-133^0(Urea), 100^0(Distilled Water)
III. Determination of melting point:

Naphthalene 80-82^0, Benzoic acid 121.5-122^0, Urea 132.5-133^0, Succinic acid 184.5-185^0, Cinnamic acid 132.5-133^0, Sallicylic acid 157.5-158^0, Acetanilide 113.5-114^0, m-Dinitrobenzene 90^0, p-Dichlorobenzene 52^0, Aspirin 135^0

IV. Determination of boiling point:

Ethanol 78^0, Cyclohexane 81.4^0, Toluene 110.6^0, Benzene 80^0

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:

Decolorsation 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 rooms temperature.

2. To study the effect of acid strength on the hydrolysis of an ester.

3. To compare the strengths of HCl and H_2SO_4 by studying the kinetics of hydrolysis of ethyl acetate.

4. To study kinetically the reaction rate of decomposition of iodide by H_2SO_4.

Distribution Law:

1. To study the distribution of iodine between water and CCl_4.

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).

B.Sc. (SECOND YEAR)

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

Paper	Paper code	Course	Max. Marks	Work Hrs

I	CH-201	Inorganic Chemistry	50	60
II	CH-202	Organic Chemistry	50	60
III	CH-203	Physical Chemistry	50	60
	CH-204	Laboratory Practical	50	60
Grand Total			200	180

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

<div align="center">

B.Sc. – II
Chemistry Paper-I
Inorganic Chemistry

</div>

Unit – I

I.   Chemistry of Elements of First Transition Series:
        Characteristic properties of d-block elements. Binary compounds (hydrides, carbides and oxides) of the elements of the first transition series and complexes with respect to relative stability of their oxidation states, coordination number and geometry.

II.   Chemistry of Elements of Second and Third Transition Series:
        General characteristics, comparative treatment of Zr/Hf, Nb/Ta, Mo/W in respect of ionic radii, oxidation states, magnetic behavior, spectral properties and stereochemistry.

Unit – II

III.   Coordination Compounds
        Werner's coordination theory and its experimental verification, effective atomic number concept, chelates, nomenclature of coordination compounds, isomerism in coordination compounds, valence bond theory of transition metal complexes.

Unit – III

IV.   Chemistry of Lanthanide Elements
        Electronic structure, oxidation states and ionic radii and lanthanide contraction, complex formation, occurrence and isolation, ceric ammonium sulphate and its analytical uses.

V.   Chemistry of Actinides
        Electronic configuration, oxidation states and magnetic properties, chemistry of separation of Np, Pu and Am from U.

Unit – IV

VI.   Oxidation and Reduction
        Electrode potential, electrochemical series and its applications, Principles involved in the extraction of the elements.

Unit - V

VII.   Acids and Bases

Arrhenius, Bronsted-Lowry, the Lux-Flood, solvent system and Lewis concept of acids and bases.

VIII.   Non-aqueous Solvents
Physical properties of a solvent, types of solvents and their general characteristics, Reactions in non-aqueous solvents with reference to liquid NH_3 and Liquid SO_2.

<div align="center">

B.Sc. – II
Chemistry Paper-II
Organic Chemistry

</div>

Unit – I

I.   Electromagnetic Spectrum Absorption Spectra
Ultraviolet (UV) absorption spectroscopy – absorption laws (Beer-Lambert law), molar absroptivity, presentation and analysis of UV spectra, types of electronic transitions, effect of conjugation. Concept of chromophore and auxochrome, Bathochromic, hypsochromic, hyperchromic and hypochromic shifts. U.V. spectra of conjugated enes and enones.
Infrared (I.R.) absorption spectroscopy – molecular vibrations, Hooke's law, selection rules, intensity and position of I.R. bands, measurement of I.R. spectrum, finger print region, characteristic absorptions of various functional groups and interpretation of I.R. spectra of simple organic compounds.

Unit – II

II.   Alcohols
Classification and nomenclature, Monohydric alcohols – nomenclature, methods of formation by reduction of Aldehydes, Ketones, Carboxylic acids and Esters, Hydrogen bonding, Acidic nature, Reactions of alcohols.
Dihydric alcohols - – nomenclature, methods of formation, chemical reactions of vicinal glycols, oxidative cleavage [$Pb(OAc)_4$ and HIO_4] and pinacol- pinacolone rearrangement.
Trihydric alcohols - nomenclature, methods of formation, chemical reactions of glycerol.

III.   Phenols :
Nomenclature, structure and bonding, preparation of phenols, physical properties and acidic character, Comparative acidic strengths of alcohols and phenols, resonance stabilization of phenoxide ion. Reactions of phenols – electrophilic aromatic substitution, acylation and carboxylation. Mechanisms of Fries rearrangement, Claisen rearrangement, Gatterman syntheis, Hauben-Hoesch reaction, Lederer-Manasse reaction and Reimer-Tiemann reaction.

Unit – III

IV.   Ethers and Epoxides
Nomenclature of ethers and methods of their formation, physical properties, Chemical reactions – cleavage and autoxidation, Ziesel's method.
Synthesis of epoxides, Acid and base-catalyzed ring opening of epoxides, orientation of epoxide ring opening, reactions of Grignard and organo lithium reagents with epoxides.

V.   Aldehydes and Ketones:
        Nomenclature and structure of the carbonyl groups, synthesis of aldehydes and ketones with particular reference to the synthesis of aldehydes from acid chlorides, synthesis of aldehydes and ketones uses 1, 3-dithianes, synthesis of ketones from nitrites and from carboxylic acids, Physical properties. Mechanism of nucleophilic additions to carbonyl group with particular emphasis on benzoin, aldol, Perkin and Knoevenagel condensations, Condensation with ammonia and its derivatives. Wittig reaction, Mannich reaction.
        Use of acetals as protecting group, Oxidation of aldehydes, Baeyer-Villiger oxidation of Ketones, Cannizzaro reaction, MPV, Clemmensen, Wolff-Kishner, $LiAlH_4$ and $NaBH_4$ reductions. Halogenation of enolizable ketones, An introduction to O, P unsaturated aldehydes and Ketones.

Unit – IV

VI.   Carboxylic Acids:
        Nomenclature, structure and bonding, physical properties, acidity of carboxylic acids, effects of substituents on acid strength, Preparation of carboxylic acids, Reactions of carboxylic acids, Hell-Volhard-Zelinsky reaction, Synthesis of acid chlorides, esters and amides, Reduction of carboxylic acids, Mechanism of decarboxylation. Methods of formation and chemical reactions of halo acids, Hydroxy acids: malic, trartaric and citric acids. Methods of formation and chemical reactions of unsaturated monocarboxylic acids. Dicarboxylic acids: methods of formation and effect of heat and dehydrating agents.

VII.   Carboxylic Acid Derivatives
        Structure and nomenclature of acid chlorides, esters, amides (urea) and acidanyhydrides. Relative stability of acyl derivatives, Physical properties, interconversion of acid derivatives by nucleophilic acyl substitution. Preparation of carboxylic acid derivatives, chemical reaction. Mechanisms of esterificaton and hydrolysis (acidic and basic)

Unit - V

VIII.   Organic Compounds of Nitrogen:
        Preparation of nitroalkanes and nitroarenes, Chemical reactions of nitroalkanes. Mechanisms of nuclephilc substitution in nitroarenes and their reductions in acidic, neutral and alkaline media, Picric acid.
        Halonitroarenes: reactivity, Structure and nomenclature of amines, physical properties, Stereochemistry of amines, Separation of a mixture of primary, secondary and tertiary amines. Structural features effecting basicity of amines. Amine salts as phase-transfer catalysts, Preparation of alkyl and aryl amines (reduction of nitro compounds, nitrities), reductive amination of aldehydic and ketonic compounds, Gabriel-phthalimide reaction, Hofmann-bromamide reaction. Reactions of amines, electrophilic aromatic substitution in aryl amines, reactions of amines with nitrous acid. Synthetic transformations of aryldiazonium salts, azo coupling.

B.Sc. – II
Chemistry (Paper-III)

Physical Chemistry

Unit – I

I.   Thermodynamics – I

Definitions of thermodynamic terms: System, surroundings etc. types of systems, intensive and extensive properties, State and path functions and their differentials, Thermodynamic processes, concept of heat and work.

First Law of Thermodynamics: Statement, definition of internal energy and enthalpy, Heat capacity, heat capacities at constant volume and pressure and their relationship, Joule's law – Joule-Thomson coefficient and inversion temperature. Calculation of w, q, δU & δH for the expansion of ideal gases under isotheral and adiabatic conditions for reversible process.

Thermochemistry: Standard state, standard enthalpy of formation – Hess's Law of heat summation and its applications, Heat of reaction at constant pressure and at constant volume, Enthalpy of neutralization, Bond dissociation energy and its calculation from thermochemical data, temperature dependence of enthalpy, Kirchhoff's equation

Unit – II

II.   Thermodynamics – II

Second Law of Thermodynamics: Need for the law, different statements of the law, Cornot's cycle and its efficiency, Carnot's theorem. Thermodynamic scale of temperature.

Concept of entropy: Entropy as a state function, entropy as a function of V & T, entropy as a function of P & T, entropy change in physical change, clausius inequality, entropy as a criteria of spontaneity and equilibrium, Equilibrium change in ideal gases and mixing of gases.

Gibbs and Helmholtz functions: Gibbs function (G) and Helmhotz function (A) as thermodynamic quantities, A & G as criteria for thermodynamic equilibrium and spontaneity, their advantage over entropy change, Variation of G and A with P, V and T.

Third Law of Thermodynamics: Nernst heat theorem, statement and concept of residual entropy. Nernst distribution law – thermodynamic derivation, applications.

Unit - III

III.   Chemical Equilibrium

Equilibrium constant and free energy, Thermodynamic derivation of law of mass action, Le Chatelier's principle. Reaction isotherm and reaction isochore – Clapeyron-clausius equation and its applications.

Unit – IV

IV.   Electrochemistry – I:

Electrical transport: Conduction in metals and in electrolyte solutions, specific conductance molar and equivalent conductance, measurement of equivalent conductance, variation of molar equivalent and specific conductance with dilution.

Migration of ions and Kohlrausch's law, Arrhenius theory of electrolyte dissociation and its limitations, weak and strong electrolytes, Ostwald's dilution law its uses and limitations, Debye-Huckel-Onsager's equation for strong electrolytes(elementary treatment only),

Transport number, definition and determination by Hittorf's method and moving boundary method.

Applications of conductivity measurements: determination of degree of dissociation, determination of K_a of acids, determination of solubility product of a sparingly soluble salt, conductometric titrations.

V.   Solutions:

Liquid – Liquid mixtures- Ideal liquid mixtures, Raoult's and Henry's law, Non-ideal system- azeotropes – HCl-H_2O and ethanol – water systems.

Partially miscible liquids- Phenol – water, trimethylamine – water, nicotine-water systems, Immiscible liquids, steam distillation.

Unit – V

VI.   Electrochemistry – II:

Types of reversible electrodes – gas-metal ion, metal-ion, metal-insoluble salt anion and redox electrodes, Electrode reactions, Nernst equation, derivation of cell E.M.F. and single electrode potential, strandard hydrogen electrode-reference electrodes and their applications, standard electrode potential, sign conventions, electrochemical series and its significance.

Electrolytic and Galvanic cells–reversible and irreversible cells, conventional representation of electrochemical cells, EMF of a cell and its measurements, Computation of cell EMF, Calculation of thermodynamic quantities of cell reactions (QG, QH and K) Concentration cell with and without transport, liquid junction potential, application of concentration cells, valency of ions, solubility product and activity coefficient, potentiometric titrations.

Definition of pH and pK_a, determination of pH using hydrogen, quinhydrone and glass electrodes, by potentiometric methods, Buffers – Mechanism of buffer action, Henderson-Hazel equation, application of buffer solution, Hydrolysis of salts

VII.   Phase Equilibrium:

Statement and meaning of the terms-phase, component and degree of freedom, derivation of Gibb's phase rule, phase equilibria of one component system-water, 'CO_2' and 'S' systems

Phase equilibria of two component system – solid liquid equilibria simple eutectic – Bi-Cd, Pb-Ag systems, desilverisation of lead.

Solid solutions – compound formation with congruent melting point (Mg-Zn) and incongruent melting point, ($FeCl_3$-H_2O) and ($CuSO_4$-H_2O) system

B.Sc. – II (Laboratory Practical) 180 hrs. (6 hrs/week)

Atleast three practicals from each specialization should be carried out.

Inorganic Chemistry:

I.   Calibration of fractional weights, pipettes and burettes, Preparation of standard solutions, Dilution – 0.1 M to 0.001 M solutions.

Quantitative Analysis:

II.   Volumetric Analysis:

(a) Determination of acetic acid in commercial vinegar using NaOH.

(b) Determination of alkali content – antacid tablet using HCl.

(c) Estimation of calcium content in chalk as calcium oxalate by permanganometry.
(d) Estimation of hardness of water by EDTA.
(e) Estimation of ferrous and ferric by dichromate method.
(f) Estimation of copper using thiosulphate.

III.   Gravimetric Analysis:
Analysis of Cu as CuSCN and Ni as Ni (dimethylgloxime).

Organic Chemistry
Laboratory Techniques

IV.   A. Thin Layer Chromatography
Determination of Rf values and identification of organic compounds:
(a) Separation of green leaf pigments (spinach leaves may be used).
(b) Preparation of separation of 2, 4-dinitrophenylhydrazones of acetone, 2-butanone, hexan-2, and 3-one using toluene and light petroleum (40:60)
(c) Separation of a mixture of dyes using cyclohexane and ethyl acetate (8.5:1.5).

V.   B. Paper Chromatography: Ascending and Circular
Determination of Rf values and identification of organic compounds:
(a) Separation of a mixture of phenylalanine and glycine, Alanine and aspartic acid, Leucine and glutamic acid, Spray reagent – ninhydrin.
(b) Separation of a mixture of D, L – alanine, glycine, and L-Leucine using *n*-butanol: acetic acid:water (4:1:5), Spray reagent – ninhydrin.
(c) Separation of monosaccharide – a mixture of D-galactose and D-fructose using n-butanol:acetone:water (4:5:1), spray reagent – aniline hydrogen phthalate.

VI.   Qualitative Analysis:
Identification of an organic compound through the functional group analysis, determination of melting point and preparation of suitable derivatives.

Physical Chemistry
VII.   Transition Temperature
1. Determination of the transition temperature of the given substance by thermometric /dialometric method (e.g. $MnCl_2.4H_2O/SrBr_2.2H_2O$).

VIII.   Phase Equilibrium
2. To study the effect of a solute (e.g. NaCl, succinic acid) on the critical solution temperature of two partially miscible liquids (e.g. phenol-water system) and to determine the concentration of that solute in the given phenol-water system.
3. To construct the phase diagram of two component (e.g. diphenylamine –benzophenone) system by cooling curve method.

IX.   Thermochemistry
1. To determine the solubility of benzoic acid at different temperatures and to determine QH of the dissolution process.
2. To determine the enthalpy of neutralization of a weak acid/weak base versus strong base/strong acid and determine the enthalpy of ionization of the weak acid/weak base.
3. To determine the enthalpy of solution of solid calcium chloride and calculate the lattice energy of calcium chloride from its enthalpy data using Born Haber Cycle.

B.Sc. (THIRD YEAR)

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 Chemistry (Paper-I)
Inorganic Chemistry

Unit – I

I.   Metal-ligand bonding in Transition Metal Complexes
       Limitations of valance bond theory, an elementary idea of crystal field theory, crystal field splitting in octahedral, tetrahedral and square planner complexes, factors affecting the crystal-field parameters.
II.   Thermodynamic and Kinetic Aspects of Metal Complexes
       A brief outline of thermodynamics 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-onlyformula, L-S coupling, correlation of μ_s and μ_{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 $[Ti(H_2O)_6]^{3+}$ 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, Snl.
       Metal carbonyls: 18 electron rule, preparation, structure and nature of bonding in themononuclear carbonyls.
VI.   Silicones and Phosphazenes
       Silicones and phosphazenes as examples of inorganic polymers, nature of bonding intriphosphazenes.

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 Ca^{2+}.

B.Sc. – III Chemistry (Paper-II)

Organic Chemistry

Unit – I

I. Spectroscopy
Nuclear magnetic resonance (NMR) spectroscopy, Proton magnetic resonance (^{1}H NMR) spectroscopy, nuclear shielding and deshielding, chemical shift and molecular structure, spin-spin splitting and coupling constants, areas of signals, interpretation of ^{1}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}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. Hetrocyclic 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 electrophilc substitution reactions of indole, quinoline and isoquinoline.

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 intro 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 O-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, plyamides, 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.

B.Sc. – III Chemistry (Paper-III)

Physical Chemistry

Unit – I

I.   Introducton:
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 σ, $\sigma*$, π, $\pi*$ 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 anharmonic 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 σ, π and T 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 (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), $Na_3[Fe(C_2O_4)_3]$ and determination of its composition by permagnometry.
(b) Preparation of Ni-DMG complex, $[Ni(DMG)_2]$
(c) Preparation of copper tetra ammine complex. $[(Cu(NH_3)_4]SO_4$.
(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, $NaHCO_3$, 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 electrophlic 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
Coformational analysis of cyclohexanes and substituted cyclohexanes

Physical Chemistry :

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 condutometrically.
4. To determine the ionization constant of a weak acid condutometrically.
5. To titrate potentiometrically the given ferrous ammonium sulphate solution using $KMnO_4$/$K_2Cr_2O_7$ as titrant and calculate the redox potential of Fe^{2+}/Fe^{3+} system on the hydrogen scale.

IX. Refractrometry, 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. NaCl) in aqueous solution at different concentrations by ebullioscopy.
Colorimetry:

1. To verify Beer – Lambert Law for $KMnO_4/K_2Cr_2O_7$ and determining the concentration of the given solution of the substance from absorption measurement.

SRIDEV SUMAN UTTARAKHAND UNIVERSITY, BADSHAHITHAUL, TEHRI, GARHWAL

SCHEME OF EXAMINATION AND COURSE OF STUDY IN COMPUTER SCIENCE

For

B. Sc. I, II, III Years (Annual System)

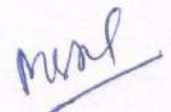(Effective from Academic Session 2019-20)

SYLLABUS COMMITTEE

1 – Dr. Krishan Kumar
Assistant Professor
Department of Computer Science,
Gurukul Kangri Vishwavidyalaya
Haridwar - 249404

Convener

Dr. Krishan Kumar
Department of Computer Science,
Faculty of Technology
Gurukul Kangri Vishwavidyalaya,
Haridwar, (Uttarakhand) - 249407
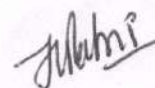
2 – Dr. Mahendra Singh Aswal
Assistant Professor
Department of Computer Science,
Gurukul Kangri Vishwavidyalaya
Haridwar - 249404

Subject Expert

3 – Dr. Jagdish Chandra Patni
Assistant Professor-SG
Department of Virtualization,
School of Computer Science
UPES, Dehradun - 248007

Subject Expert

SRIDEV SUMAN UTTARAKHAND UNIVERSITY, BADSHAHITHAUL, TEHRI GARHWAL

SCHEME OF EXAMINATION AND COURSE OF STUDY IN COMPUTER SCIENCE

For

B. Sc. I, II, III Years (Annual System)

To impart the knowledge of fundamental concepts of Computer Science and it's applications, the syllabus of Computer Science pertaining to B.Sc. (3-year degree course) has been prepared as per the demand of academic environment. The syllabus concepts are duly arranged unit wise and contents are included in such manner so that due importance is given to requisite theoretical and laboratory skills.

B.Sc. Ist Year

S.No.	Title	Paper Code	Max Marks
I	Paper –I: Computer Fundamental and Architecture	BCS-101	50
II	Paper –II: Mathematical Foundation of Computer Science	BCS-102	50
III	Paper –III: Programming in 'C'	BCS-103	50
	Practical : C Programming Lab	BCS-151	50

B.Sc. IInd Year

S.No.	Title	Paper Code	Max Marks
I	Paper –I: Operating System	BCS-201	50
II	Paper –II: C++ and Object Oriented Programming	BCS-202	50
III	Paper –III: Data Structures using C	BCS-203	50
	Practical : C++ Programming Lab	BCS-251	50

B.Sc. IIIrd Year

S.No.	Title	Paper Code	Max Marks
I	Paper –I: Java Programming	BCS-301	50
II	Paper –II: Digital Fundamentals and Computer Architecture	BCS-302	50
III	Paper –III: Database Management System	BCS-303	50
	Practical: Java Programming	BCS-351	50

Note: Examiner should set the paper covering all the units of the syllabus. The pattern of paper setting to be followed is as follows:

a) Twelve Compulsory objective type questions of one mark each, 12*1=12 marks.

b) Examinees to attempt 6 short-answer type questions out of 10 questions (3 marks each) 3*6 =18 marks.

c) Examinees to attempt 4 long-answer type questions out of seven (5 marks each) 4*5=20 Marks.

Dr. Krishan Kumar
Department of Computer Science,
Faculty of Technology
Gurukul Kangri Vishwavidyalaya,
Haridwar, (Uttarakhand) - 249404

B.Sc. (Computer Science)

B.Sc. –I Year

Paper – I   **Computer Fundamental and Architecture**   **MM - 50**

Unit – I

Introduction of Computers: Computer hardware components, Disk Storage, Memory, Keyboard, Mouse, Printers, Monitors, CD etc., and their functions, Comparison Based analysis of various hardware components.

Basic Operating System Concepts: MS-DOS, Windows, Functional knowledge of these operating systems, Introduction to Basic Commands of DOS, Managing File and Directories in various operating systems. Introduction to Networking and internet, Basic terms related with internet, TCP/IP.

Unit – II

Element of a Computer Processing System: Hardware, CPU, Storage Devices and media, VDU, Inputoutput devices, data communication equipment, Software – System software, application software.

Computer Languages: Classification, low level language, assembly language, higher level language, fourth generation languages.

Unit – III

Representation of information & Basic Building Blocks: Number System- Binary, Octal, Hexadecimal, Character Codes (BCD), SCII, EBCDIC and their conversion. Logic gates, Boolean algebra K-map simplification, Half adder, Full adder, Substractor, Decoder, Encoder, Multiplexer, Demultiplexer.

Basic Organization: Operational flow chart (Fetch, Execute, Instruction Cycle), Organization of Central Processing Unit, Micro programmed control unit, single organization, general register organization, stack, organization, addressing modes, instruction formats, data transfer and manipulation, I/O organization, Bus architecture, Programming registers.

Unit – IV

Memory Organization: Memory hierarchy, main memory (RAM/ROM) chips, Auxiliary memory, Associative memory, Cache memory, Virtual memory, Memory Management, magnetic disk and its performance, magnetic tape etc.

I/O Organization: Peripheral Devices, I/O interface, Modes of transfer, Priority interrupt, Direct memory access, Input-Output Processor and Serial Communication, I/O controllers, asynchronous data transfer.

Suggested Readings:

1. Raja Raman V, "Fundamentals of Computers"
2. Sanders D.H., "Computer Today"
3. Willam Stalling, "Computer Organization & Architecture" Pearson Education Asia
4. Mano Mirris, "Computer System Architecture" PHI

Paper – II　　**Mathematical Foundation of Computer Science**　　**MM - 50**

Unit – I

Relation: Type and compositions of relations, Pictorial representation of relations, Equivalence relations, Partial ordering relation.

Function: Types, Composition of function, Recursively defined function. Mathematical Induction: Piano's axioms,

Unit – II

Mathematical Induction, Discrete Numeric Functions and Generating functions, Simple Recurrence relation with constant coefficients, Linear recurrence relation without constant coefficients, Asymptotic Behaviour of functions.

Unit – III

Algebraic Structure: Properties, Semi group, monoid, Group, Abelian group properties of group, Subgroup, Cyclic group, Cosets, Permutation groups, Homomorphism, Isomorphism and Automorphism of groups.

Unit – IV

Prepositional Logic: Preposition, First order logic, Basic logical operations, Tautologies, Contradictions, Algebra of Proposition, Logical implication, Logical equivalence, Normal forms, Inference Theory, Predicates and quantifiers, Posets, Hasse Diagram.

Suggested Readings:

1. Liptschutz, Seymour, "Discrete Mathematics", TMH
2. Trembley, J.P. & R. Manohar, "Discrete mathematical Structure with Application to Computer Science", TMH.
3. Kenneth H. Rosen, "Discrete Mathematics and its applications", TMH.
4. Doerr Alan and Levasseur Kenneth, "Applied Discrete Structure for computer Science", Galgotia Publication Pvt. Ltd.

Paper – III   **Programming in 'C'**   **MM - 50**

Unit – I

Programming in C: Features of C and its Basic Structure, Simple C programs, Constants, Integer Constants, Real Constants, Character Constants, String Constants, Backslash Character Constants, Concept of an Integer and Variable, Rules for naming Variables and assigning values to variables, Storage classes (automatic, external, register and static), Enumerations, command line parameters, Macros, The C Preprocessor.

Operators: Arithmetic Operators, Unary Operators, Relational and Logical Operators, The Conditional Operator, Library Functions, Bitwise Operators, The Increment and Decrement Operators, The Size of Operator, Precedence of operators.

Unit – II

Data Types and Input/Output Operators: Floating-point Numbers, Converting Integers to Floatingpoint and vice-versa, Mixed-mode Expressions, The type cast Operator, The type char, Keywords, Character Input and Output, Formatted input and output, The gets() and puts() functions.

Control Statements and Decision Making: The goto statement, The if statement, The if-else statement, Nesting of if statements, The conditional expression, The switch statement, The while loop, The do...while loop, The for loop, The nesting of for loops, The break statement and continue statement.

Function: Built-in and user-defined, function declaration, definition and function call, parameter passing, call by value, call by reference, recursive functions.

Unit – III

Arrays and String: One Dimensional Arrays, Passing Arrays to Functions, Multidimensional Arrays, Strings.

Pointers: Basics of Pointers, Pointers and One-dimensional Arrays, Pointer Arithmetic, Pointer Subtraction and Comparison, Similarities between Pointers and One-dimensional Arrays, Null pointers, Pointers and Strings, Pointers and two-dimensional arrays, Arrays of Pointers.

Structures and Unions: Basics of Structures, Arrays of Structures, Pointers to Structures, Selfreferential Structures, Unions.

Unit – IV

Dynamic Memory Allocation and Linked List: Dynamic Memory Allocation, Allocating Memory with malloc, Allocating Memory with calloc, Freeing Memory, Reallocating Memory Blocks, Pointer Safety, The Concept of linked list, Inserting a node by using Recursive Programs, Sorting and Reversing a Linked List, Deleting the Specified Node in a Singly Linked List.

File Management: Defining and Opening a file, Closing Files, Input/output Operations on Files, Predefined Streams, Error Handling during I/O Operations, Random Access to Files, Command Line Arguments.

Suggested Readings:

1. V. Rajaraman, "Fundamentals of computers", PHI
2. Pater Norton's "Introduction of Computer", TMH
3. Hahn, "The Internet Complete Reference", TMH
4. Gottfried, "Programming in C", Schaum's Series Tata McGraw Hill

B. Sc-II Year

Paper-I   **Operating System**   **MM-50**

UNIT-I

Definition of operating system and functions, Evolution of OS, Simple Batch Systems, Multi-programmed Batched Systems, Time-Sharing Systems, Personal Computer system, Distributed Systems and Real-Time Systems, Operating System Structures-Command Interpreter System, Operating System Services, System Calls, Process Management: Process Concept, Process control Block, process Scheduling, Inter-Process Communication

UNIT-II

CPU scheduling Algorithms, Scheduling Criteria, FCFS, SJF, Round Robin Scheduling, Priority Based Scheduling, Definition Deadlock, Deadlock Characterizations, Method for Handling Deadlock Handling, Deadlock prevention, Deadlock Avoidance

UNIT-III

Storage Management: Basic Concepts, Logical and Physical Address Space, Swapping, Contiguous Allocation, Paging Segmentation

UNIT-IV

Virtual Memory- Demand Paging, Paging Replacement Algorithms, Thrashing.
File System: File Concept, Access Methods, Directory Structure, Protection, File System Structure. Allocation methods.

Suggested Readings:
1 – Fundamental of Operating System – Donovan
2 – Operating System – M.Deal
3 – Operating Systems – William Stallings

Paper-II   **Object Oriented Programming with C++**   **MM-50**

UNIT-I

OOP concept, Procedural vs OOP programming, OOP terminology and features, Tokens, Character set, Keywords, Data-types, Data Types declarations, Constants and variables, expressions, Standard Library and header files. Operator and Expressions: Arithmetic Operator, Increment/Decrement Operator, Relational Operator, Logical Operator and conditional operators, library functions, Logical Expressions, C++ shorthand,

UNIT-II

Flow of control statements: Selection statements, Iteration statement, Jump statement, Construction of loops and implementation, While, Do-while, For statements nested loops. If-else, switch, break, continue and Go to statements. Classes and Objects: Need for Classes, Declaration of Classes, referencing class Members, Scope of class and its members Nested Classes, Functions in a class: Inline Functions, Constant Member functions, Nesting of Member Functions, friend function, Memory allocation of objects, Arrays of objects, Static Class Member

UNIT-III

Functions, function definition, Default arguments, Constant arguments, Call by value, Call by reference, returning from a function, storage class specifier and variables, storage class specifier and Functions automatic, external and static variables, Pointer: Declarations, Passing to a function, Operations on Pointers

UNIT-IV

Arrays two dimensional and multidimensional arrays, Arrays of Pointers, Pointers and functions, Constructors and Destructor: Declaration, Definition and characteristics, Function Overloading, Inheritance: Need, Different forms, Single Inheritance, Multilevel Inheritance, C++ Memory Map: Dynamic and Static Allocation of Memory, Stacks Queues and Linked Lists, Declarations, File handling: Open, Close, Create, Process, Detecting EOF.

Suggested Readings:
1 – C++ Premier – Stephen Prata
2 – C++ Programming Language – D S Malik
3 – Programming with C++ - D. Ravichandran

Paper-III　　　　　**Data Structure Using C**　　　　　**MM-50**

UNIT-I
Structure, definition, and application, Lists, Basic Terminology, Static Implementation of Lists, Pointer Implementation of Lists, Insertion in a List, Deletion from a List, Storage of Sparse, Arrays using Linked List, Doubly Linked Lists, Circular Linked List

UNIT-II
Defining Stack and Queue, Stack Operations and Implementation, Array Implementation, Pointer Implementation, Stack Applications, Convert Number Bases by Using Stacks, Infix to Postfix Conversion, Queues: Operations and Implementation, Queue Application, Priority Queues

UNIT-III
Defining Graph, Basic Terminology, Graph Representation, Graph Traversal, Depth First Search (DFS), Breadth First Search (BFS), Shortest Path Problem, Minimal Spanning Tree, Binary Trees, In order Traversal, Post order Traversal, Preorder Traversal, Binary Search Trees, Operations on a BST, Insertion in Binary Search Tree, Deletion of a node in BST, Search for a key in BST, Height Balanced Tree.

UNIT-IV
Searching and Sorting techniques, Sequential Search, Binary Search, Internal Sort, Insertion Sort, Bubble Sort, Quick Sort, 2-way Merge Sort, Heap Sort

Suggested Readings:
1 – Data Structure Using 'C' – A K Sharma
2 – Fundamentals of Data Structures – Horowitz and Sahni
3 – Introduction to Data Structures with applications – Trembley J.P. & Sorenson P.G. Mcgraw-Hill.

Paper-I   **Java Programming**   **MM-50**

UNIT – I

Overview of Java Constants, Variables& data types, Operators & Expressions, Decision making, Branching & looping; Classes & Objects : Classes, Objects & methods, Inheritance, Arrays; Interfaces; Packages.

UNIT - II

Exception Handling Fundamentals, Exception types, Uncaught exceptions, Using try & catch, Multiple catch clauses, Nested try statements, throw, throws, finally, Java's built- in exceptions, User defined exception subclasses; Multithreaded Programming: Java thread model, Main thread, Creating thread, Creating multiple threads, Thread priorities, Synchronization, Inter-thread communication, Interrupting threads.

UNIT – III

String Handling, Java I/O Classes & interface , Stream Classes, Byte Stream, Character Stream, Serialization. AWT: Working with Windows, Graphics, Text; Control and Layout Manager.

UNIT -IV

Event Handling: Delegation Event Model, Event Classes, Sources of Events, Events Listener interfaces, Handling Mouse and Keyboard Event. Networking : Networking, Java and the Net, Inet address, TCP/IP client sockets, URL, URLconnection, TCP/IP server sockets. Applet Class: Applet basics, applet architecture, applet skeleton, Applet Display Methods, requesting repainting, Passing Parameters to applets. Servlets : Background, Life cycle of a servlet, Servlet API

Suggested Readings:

1 – JAVA Programming – K. Rajkumar
2 – Programming with Java – E. Balaguruswamy.
3 – CORE JAVA – Kiran Gurbani & Ashwin Mehta

Paper-II   Digital Fundamentals and Microprocessor Architecture   MM-50

UNIT-I

Introduction to Number system and codes: Different number systems and their conversions (Decimal, Binary, Octal , and Hexadecimal), 1's Complement and 2's complement, Floating Point numbers, Coding – BCD, Gray, ASCII Boolean algebra and Gate networks: Fundamental concepts of Boolean algebra, Inverter gates, AND gate, OR gate, NAND gate, NOR gate, X-OR gate, X-NOR gate, The universal property of NAND gate and NOR gate, Basic laws of Boolean algebra, De Morgan's theorems, Simplification of Boolean expression, Karnaugh map (SOP)

UNIT-II

Combinational circuit & Sequential circuit: Adders (Half and Full), Decoder, Encoder, Multiplexer, De-multiplexer (Introductory Concepts only). Flip-Flops (SR flip-flops, D flip-flops, JK flip-flops), Edge – Triggered flip-flops and Master Slave flip-flops, Introduction to Registers and Counters

UNIT-III

Introduction of Microprocessor: Evolution of microprocessor, Embedded microprocessor, Architecture of Intel 8085, operating model of 8085, Register organization of 8085, Intel 8086 Microprocessor, Bus Interface and Execution Unit (BIU and EU), Interrupts 8085 Read and write Bus Cycle.

UNIT-IV

Instruction Set: Instruction format, Addressing modes, Data transfer Instruction, Arithmetic Instruction, Logical Instruction Processor Control Instructing, string Instructions, Interrupts instructions, 8085 Assembly Language Programming.

Suggested Readings:
1 – Digital Design and Computer Architecture – David Harris
2 – Fundamentals of Digital Circuits – A. Anand Kumar
3 – Computer A Organization and Architecture – Rajaraman

Paper-III   **Database Management System**   **MM-50**

UNIT-I

Data, Information and Knowledge, Introducing concept of databases and different kinds of database users, Architecture of A Database, Data Dictionary, Data administration function, DBMS
Data Models, views of data-schemas and instances, Data Independence, Conventional data models & systems. Database Design using ER model : Entities, Relationships, Representation of entities, attributes, relationship attributes, relationship set, Generalization, aggregation, Structure of relational Database and different types of keys.

UNIT-II

Codd's rules, Relational data model & relational algebra, Relational model concept, Relational model constraints, Relational Algebra, Relational database language, Structured Query Language- Introduction, Data definition, views and queries in SQL, Specifying constraints and indexes in SQL, Data Manipulation, Data maintenance, Multiple Table Operations, Transaction integrity facilities,

UNIT-III

Relational Database design : Database Design – ER to Relational, Functional dependencies, Normalization, Normal forms based on primary keys (1 NF, 2 NF, 3 NF and BCNF), Loss less joins and dependency preserving decomposition

UNIT-IV

Overview of physical storage media, File organization, Organization of records in files, Data dictionary storage. Transaction And Concurrency control: Concept of transaction, ACID properties, Serializibility, States of transaction, Concurrency control : Locking techniques

Crash Recovery and Backup : Failure classifications, Recovery & atomicity, Log base recovery, Recovery with concurrent transactions, Failure with loss of Non-Volatile storage

Suggested Readings:
1 – Database Management System – V. Rajyalakshmi
2 – Database Systems: Concepts, Design and Applications – Shio Kumar Singh
3 – Introduction to Database Management Systems – Atul Kahte

Sri Dev Suman Uttarakhand University, Badshshithaul, Tehri Garhwal

Proposed Syllabus: GEOLOGY Course for B.Sc (Annual System)

Objective of the course

To teach the fundamental concepts of Geology and their applications, the syllabus pertaining to B.Sc (3 year degree course) in the subject of Geology 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 Geology consists of three year course (annual system). Total marks: 600(200 per year).

B.Sc. Geology Syllabus

B.Sc. I year

S.No.	Title Of The Courses	Maximum Marks
1.	Physical Geology	50
2.	Structural Geology	50
3.	Crystallography And Mineralogy	50
4.	Practical	50
	Total	**200**

B.sc. II year

S.No.	Title Of The Courses	Maximum Marks
1.	Petrology	50
2.	Paleontology	50
3.	Stratigraphy	50
4.	Practical	50
	Total	**200**

B.sc. III year

S.No.	Title Of The Courses	Maximum Marks
1.	Mineral distribution and ore genesis	50
2.	Elements of applied geology	50
3.	Environmental geology and Geology of Uttarakhand	50
4.	Practical	50
	Total	**200**

B.Sc. I year

Paper I: Physical Geology   **M. M. 50**

Unit-I: Introduction to geology and its branches, their relationship, aims and scope.

Unit-II Earth and solar system: origin, size, shape, mass, density and its atmosphere; A brief account of various theories regarding the origin and age of the earth; Brief idea of interior of earth and its composition.

Unit-III: External processes-Weathering and Erosion: factors, types and their effects; Geological action of wind, glacier, river, underground water and ocean.

Unit-IV: Continents and Oceans, Geosynclines and Mountains.

Unit-V: Earthquakes: nature of seismic waves, their intensity and magnitude scale; Origin of earthquake; Volcanoes: types, products and causes of volcanism; Isostasy, Island arcs.

Paper II: Structural Geology   **M. M. 50**

Unit-I: Introduction to Structural Geology; contours, topographic and geological maps; Elementary idea of bed, dip and strike; Outcrop, effects of various structures on outcrop. Clinometer/Brunton compass and their uses.

Unit-II: Elementary idea of types of deformation; Folds: nomenclature and classification; Recognition of fold on maps and in the field.

Unit-III: Faults: nomenclature, geometrical and genetic classifications, normal, thrust and slip faults; Recognition of fault on maps and in the field.

Unit-IV: Definition, kinds and recognition of joints and unconformity. Brief idea of secondary planar and linear structures.

Paper III: Crystallography and Mineralogy   **M. M. 50**

(A) Crystallography

Unit-I: Crystals and their characters: Crystal form, face, edge, solid angle; Interfacial angle; Crystal parameters, Weiss and Miller system of notations;

Unit-II: Symmetry elements and description of normal class of Isometric, Tetragonal, Hexagonal, Trigonal, Orthorhombic, Monoclinic and Triclinic systems; Twining: laws and types.

Unit-III: Crystal studies of the following: (system, type, axes and forms present) Galena, Fluorspar, Leucite, Magnetite, Garnet, Pyrite, Zircon Cassiterite, Vesuvianite, Beryl, Calcite, Baryte, Gypsum, Orthoclase, Hornblende, Axinite.

Unit-IV: Minerals: Definition and classification, Silicate structure.

Unit-V: Common physical properties of Garnet, Chlorite, Epidote, Calcite, Fluorite, Gypsum, Baryte, Beryl, Tourmaline, Kyanite, Corundum, Orthoclase, Muscovite, Biotite, Quartz, Plagioclase, Hornblende, Pyroxene, Oilivine.

Unit-VI: Polarizing microscope and its functioning; Ordinary and polarized lights; Optical properties of some common rock forming minerals (Quartz, Orthoclase, Microcline, Olivine, Augite, Hornblende, Muscovite, Biotite, Garnet, Calcite, Sillimanite).

Practical   **M. M. 50**
1. Geological maps and structural problems   10
2. Minerals in Hand Specimen   10
3. Crystal Models   05
4. Physiographic and structural Models   05
5. Geological Field Training   10
6. Sessional and Viva-voce   10

(**Geological Field Training:** Students will be required to carry out minimum 03 days field work in a suitable geological area of Himalaya to study the elementary aspects of field geology and submit a report thereon)

Books Recommended:
1.   Arthur Holmes, 1992. Principles of Physical Geology. Chapman and Hall, London.
2.   Miller, 1949. An Introduction to Physical Geology. East West Press Ltd.
3.   Spencer, E.V., 1962. Basic concepts of Physical Geology. Oxford & IBH.
4.   Mahapatra, G.B., 1994. A text book of Physical geology. CBS Publishers.
5.   Billings, M.P., 1972. Structural Geology. Prentice Hall.
6.   Davis, G.R., 1984. Structural Geology of Rocks and Region. John Wiley
7.   Hills, E.S., 1963. Elements of Structural Geology. Farrold and Sons, London.
8.   Singh, R. P., 1995. Structural Geology, A Practical Approach. Ganga Kaveri Publ., Varanasi.
9.   Dana, E.S. and Ford, W.E., 2002. A textbook of Mineralogy (Reprints).
10.   Flint, Y., 1975. Essential of crystallography, Mir Publishers.
11.   Phillips, F.C., 1963. An introduction to crystallography. Wiley, New York.
12.   Berry, L.G., Mason, B. and Dietrich, R.V., 1982. Mineralogy. CBS Publ.
13.   Nesse, D.W., 1986. Optical Mineralogy. McGraw Hill.
14.   Read, H.H., 1968. Rutley's Element of Mineralogy (Rev. Ed.). Thomas Murby and Co.
15.   Berry and Mason, 1961. Mineralogy. W.H. Freeman & Co.
16.   Kerr, B.F., 1995. Optical Mineralogy 5th Ed. Mc Graw Hill, New York.

B. Sc. II year

Paper IV: Petrology   **M.M. 50**
(A) Igneous Petrology
Unit-I: Magma: definition, composition, types and origin; Forms of igneous rocks; textures and structure of igneous rocks. Reaction Principle; Differentiation and Assimilation.
Unit-II: Crystallization of unicomponent and bicomponent (mix-crystals); Bowen's reaction series; Mineralogical and chemical classification of igneous rocks.
Unit-III: Detailed petrographic description of Granite, Granodiorite, Rhyolite, Syenite, Phonolite, Diorite, Gabbro, Perodotite, Charnockite, Basalt, Ptichstone, Obsedian.
(B) Sedimentary Petrology
Unit-IV: Processes of formation of sedimentary rocks; Classification, textures and structures of sedimentary rocks.
Unit-V: Petrographic details of important siliciclastic and carbonate rocks such as - conglomerate, breccia, sandstone, greywacke, shale, limestones.
(C) Metamorphic   Petrology
Unit-VI: Process and products of. Metamorphism; Type of metamorphism. Factors, zones and grade of metamorphism; Textures, structures and classification of metamorphic rocks.
Unit-VII: Petrographic details of some important metamorphic rocks such as - slate, schists, gneiss, quartzite, marble, granulite, migmatite.

Paper V: Paleontology   **M.M. 50**
Unit-I: Fossils, Modes of preservation, nomenclature and uses.
Unit-II: Brief idea of various Eco-systems, Origin and evolution of Life.
Unit-III: Morphology and geological distribution of following groups: Lamellibranchs, Gastropods, Cephalopods, Brachiopods, Trilobites, Echinoids.
Unit-IV: Elementary ideas about foraminifera and corals. Evolutionary history of - Dinosaur, Horse, Elephants and Man; Important Gondwana Plant fossils.
Unit-V: Study of following genera: Glycemeris, Pecten, Ostrea, Gryphaea, Trigonia, Cardita , Arca, Exogyra, Trocus, turritella, Cypraea, Conus, Cerithium, Murex, Physa, Nautilus, Ceraite, Perisphinctes, Acanthoceras, Belemnites, Pynchonella, Terebratula, Productus, Spirifer, Zaphrentis, Calceola, Hemiaster, Micraster, Glypeaster, Cidaris, Paradoxides, Calymene, Glossopteris, Gangamopteris, Vertebratia, Ptylophyllum.

Paper VI: Stratigraphy   **M.M. 50**
Unit-I: Definition, Principle of stratigraphy; Geological Time Scale and stratigraphic classification.
Unit-II: Physiographic Divisions of India, elementary idea of tectonics of Peninsula, Himalaya and Ganga Plains.
Unit-III: Study of following Precambrian succession: Dharwar, Cuddapha, Vindhyan and Delhi Supergroups; Brief idea of Palaeozoic succession of northwestern Himalaya; Triassic of Spiti; Mesozoic type seccession of Kutch and Rajasthan; Cretaceous of Tiruchirapalli;
Unit-IV: Study of following type localities: Gondwana and Deccan Trap.
Unit-IV: Palaeogene-Neogene sequences of northwest Himalaya and Assam.

Practical: **M.M. 50**
   1. Rocks in Hand Specimen   10
   2. Rocks in Thin Section   05

3. Fossils in Hand Specimen	10
4. Stratigraphic Rocks in Hand Specimen	05
5. Geological Field Training	10
6. Sessional and Viva-voce	10

(**Geological Field Training:** Students will be required to carry out minimum 05 days field work in a suitable geological area of Himalaya preferably in a fossiliefrous terrain to study the elementary aspects of field geology and submit a report thereon)

Books Recommended:

1.   Turner, F.J. & Verhoogen, J., 1960, Igneous & Metamorphic petrology. McGraw Hill Co.
2.   Bose, M.K., 1997. Igneous petrology. World press
3.   Tyrell, G. W., 1989. Principles of Petrology. Methuren and Co (Students ed.).
4.   Ehlers, WG, and Blatt, H., 1987. Petrology, Igneous, Sedimentary and Metamorphic rocks, CBS Publishers
5.   Moorhouse, WW., 1969. The study of rocks in thin sections. Harper and sons.
6.   Friedman & Sanders, 1978. Principles of Sedimentology. John Wiley and sons.
7.   Pettijohn, F.J., 1975. Sedimentary rocks, Harper & Bros. 3rd Ed.
8.   Prasad, C., 1980. A text book of sedimentology.
9.   Sengupta. S., 1997. Introduction to sedimentology. Oxford-IBH.
10.   Turner, F.J., 1980. Metamorphic petrology. McGraw Hill.
11.   Mason, R., 1978. Petrology of Metamorphic Rocks. CBS Publ.
12.   Winkler, H.G.C., 1967. Petrogenesis of Metamorphic Rocks. Narosa Publ.
13.   Moorhouse, WW., 1969. The study of rocks in thin sections. Harper and sons.
14.   Shrock, R.R. & Twenhoffel, W.H., 1952. Principles of Invertebrate Paleontology. CBS Publ.
15.   Swinerton, HH., 1961. Outlines of Paleontology. Edward Arnold Publishers
16.   Jain, P.C. & Anantharaman, M.S., 1983. Paleontology: Evolution & Animal Distribution. Vishal Publ.
17.   Lehmann, U., 1983. Fossil Invertebrate. Cambridge Univ. Press.
18.   Wadia, D., 1973. Geology of India. Mc Graw Hill Book co.
19.   Krishnan, M.S., 1982. Geology of India and Burma, 6th Edition. CBS Publ.
20.   Ravindra Kumar, 1985. Fundamentals of Historical Geology & Stratigraphy of India. Wiley Eastern.
21.   Rastogi, 1988. Organic evolution. Kedrnath and Ramnath Publ.

B. Sc. III year

Paper VII: Mineral distribution and Ore Genesis   **M.M. 50**
Unit-I: Economic Geology- Definition and Scope. Concept of ore and ore deposits. Forms, structures and Textures of Ore deposits.
Unit-II: Ore Genesis: Processes- Magmatic concentration, Contact metasomatism, Hydrothermal, Residual & Mechanical concentration, Sedimentation, Supergene enrichment, Metamorphism.
Unit-III: Distribution of important metallic and non-metallic deposits in India, Ore minerals of Fe, Mn, Cr, Ti, W, Cu, Pb, Zn and Al. Industrial minerals- Kyanite, sillimanite, Magnesite, Talc, Gypsum, Fluorite, Phosphorite, Apatite, Baryte, Corundum, Graphite, Mica, Asbestos, Ochre and Chine Clay.
Unit-IV: Origin, mode of occurrence and distribution of coal in India; Origin migration, accumulation and distribution of Hydrocarbons in India.
Unit-V: Metallogenetic epochs and Provinces, National Mineral Policy.

Paper VIII: Elements of Applied Geology   **M.M. 50**
Unit-I: Engineering properties of rocks, soils, soil groups of India.
Unit-II: Dams, Reservoirs and Tunnels, Hill roads and Landslide Hazards.
Unit-III: Ground water cycle, Hydrological properties of rocks, springs, Hot springs.
Unit-IV: Origin of groundwater; Vertical distribution of groundwater; Types of aquifers; Water bearing properties of rocks - Porosity and Permeability; specific yield, specific retention
Unit-V: Geological prospecting for ground water. Hydrological provinces of India.
Unit-VI: Surface and subsurface geophysical and geological methods of ground water exploration; Groundwater provinces of India; Ground water quality.

Paper-IX: Environmental Geology & Geology of Uttarakhand   **M.M. 50**
Unit-I: Biosphere and Man, Earth materials, concept of change.
Unit-II: Geological Hazards- Earthquakes, Volcanism, Landslides, Avalanches, Floods, Draughts, Hazard Mitigation.
Unit-III: Energy resources: Non-conventional, watershed management. Land use Planning, wastelands. Management of water resources, land reclamation.
Unit-IV: Broad setup of Himalaya; Geographic set up of Himalaya. Geological and tectonic divisions of the Himalaya; Himalaya as an orogenic belt; Characteristics of tectonic mountain; Uttarakhand- boundaries, geography and environment.
Unit-V: Geomorphology, stratigraphy, Structure & tectonics of Uttarakhand and origin of the Himalaya.
Unit-VI: Environmental geological problems of Uttarakhand, natural hazard in Uttarakhand and their remedial measures, geological resources of Uttarakhand, big dams vs. run off the rivers projects in Uttarakhand. Impact of climate change in Uttarakhand

Practical: **M.M. 50**
1. Economic Minerals in Hand Specimen   10
2. Distribution of Minerals   05
3. Environmental maps/ Hydrological problem   05
4. Plotting of important geological formations/ structural features in the map of Uttarakhand; Identification of important stratigraphic rocks of Uttarakhand in hand specimen.   10
5. Geological Field Training   10

6. Sessional and Viva-voce   10

(**Geological Field Training:** Students will be required to carry out minimum 07 days field work in a suitable geological area of Himalaya preferably nearby a river valley project to study the elementary aspects of field geology and submit a report thereon)

Books Recommended:
1.   Brown, C. and Dey, A.K.1955. Indian Mineral Wealth. Oxford Univ.
2.   Gokhale, K.V.G.K. and Rao, T.C., 1983. Ore Deposits of India. East West Press Pvt. Ltd.
3.   Jense, M.L. and Bateman A.M., 1981. Economic Mineral Deposits. John Wiley and Sons.
4.   Evans, A.M. 1993. Ore Geology and Industrial Minerals. Blackwell ScLPubl.
5.   Guilbert, J.M. and Park Jr., C.F. 1986. The Geology of Ore deposits. Freeman & Co.
6.   Brown, C. and Dey, A.K.1955. Indian Mineral Wealth. Oxford Univ.
7.   Krishnnaswamy, S., 1979. India's Minerals Resources. Oxford and IBH Publ.
8.   Deb, S., 1980. Industrial minerals and Rocks of India. Allied Publishers Pvt. Ltd.
9.   Umeshwar Prasad, 2003. Economic Geology. CBS Publishers and distributers.
10.   Sharma, N.L. and Ram, K.V.S., 1972. Introduction to India's Economic Minerals, Dhanbad.
11.   Evans, A.M. 1993. Ore Geology and Industrial Minerals. Blackwell ScLPubl.
12.   Valdiya, K.S., 1987. Environmental Geology – Indian Context. Tata McGraw Hill.
13.   Parasins, D.S., 1997. Principles of applied geophysics. Chapman Hall.
14.   Krynine D.P. and Judd W.R., 1957. Principles of Engineering Geology & Geotechnics. McGraw-Hill Book
15.   Kesavulu, N.C., 2009. A text book of engineering geology. Macmillan Publishing India Ltd.
16.   Crozier. M.J., 1989. Landslides: causes, consequences and environment. Academic Press.
17.   Bell, F.G., 1983. Fundamentals of Engineering Geology. Butterworth and Co.
18.   Clark, G.B. 1967. Elements of Mining. 3rd Ed. John Wiley & Sons.
19.   Arogyaswami, R.P.N. 1996 Courses in Mining Geology. 4th Ed. Oxford-IBH.
20.   Todd. Ground water hydrology
21.   Karanth, K. R., 1989. Hydrogeology. Tata McGraw Hill Publ.
22.   Raghunath, H. M., 1990. Groundwater. Wiley Eastern Ltd.
23.   Subramaniam, V., 2000. Water-Kingston Publ. London.
24.   Valdiya, K.S., 1980. Geology of Kumaon Lesser Himalaya.
25.   Biyani A.K. 2006. Dimensions of Himalayan. SSPH, Delhi
26.   Moon, C.J., Whateley, M.K.G., Evans, A.M., 2006, Introduction to Mineral Exploration, Blackwell Publishing

SCHEME OF EXAMINATION

AND

COURSE OF STUDY

of

Mathematics

For

B.Sc. (PCM & PGM)
(w. e. f. Session 2019--2020)

(Yearly - System)

DEPARTMENT OF MATHEMATICS

SRI DEV SUMAN UNIVERSITY, BADSHAHITHOL, TEHRI GARHWAL, UTTARAKHAND

B.A./B.Sc. I Year

S.N.	Paper	Paper code	Maximum Marks
1.	Differential Calculus	BM101	65
2.	Integral Calculus and Trigonometry	BM102	65
3	Algebra and Matrices	BM103	70

B.A./B.Sc. II Year

S.N.	Paper	Paper code	Maximum Marks
1.	Differential Equations	BM201	65
2.	Real Analysis	BM202	65
3	Advanced Algebra	BM203	70

B.A./B.Sc. III Year

S.N.	Paper	Paper code	Maximum Marks
1.	Linear Algebra & Linear programming Problems	BM301	65
2.	Complex Analysis	BM302	65
3	Numerical Analysis	BM303	70

SRI DEV SUMAN UNIVERSITY, BADSHAHITHOL, TEHRI GARHWAL, UTTARAKHAND

NAME OF THE DEPARTMENT: MATHEMATICS

B.Sc. Semester: Ist Subject Code: BM-101

Course Title: DIFFERENTIAL CALCULUS   Paper -I
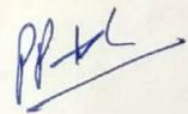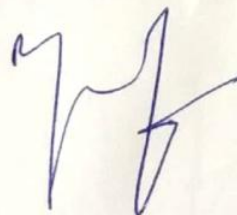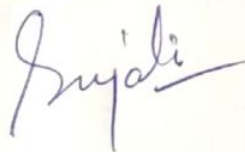
Examination Duration: 2:30Hours   Max. Marks: 65
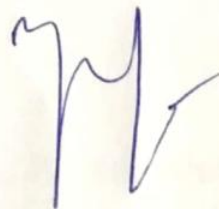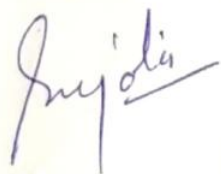
NOTE: The question paper consists of three sections A, B and C. Section A will consist 15 objective type questions (all compulsory), each of marks 1. Section B will consists of 10 short answered questions, in which 5 to be answered, each of marks 4. Section C will consist of 8 long answered questions, in which 5 to be answered, each of marks 6.

    I.   Successive Differentiation, Leibnitz's theorem, Indeterminate form.
    II.   Partial Differentiation, Euler's theorem, Homogeneous Functions, Jacobian.
    III.   Tangents and Normal, Curvature, Asymptotes.
    IV.   Singular Points, Maxima and Minima.
    V.   Curve Tracing (Cartesian, Parametric, Polar).

Books Recommended:

1. M.Ray : Differential Calculus, Shiva Lal Agarwal and Co., Agra.
2. Gorakh Prasad :Differential Calculus, Pothishala publication, Allahabad

SRI DEV SUMAN UNIVERSITY, BADSHAHITHOL, TEHRI GARHWAL, UTTARAKHAND

NAME OF THE DEPARTMENT: MATHEMATICS
B.Sc. Semester: Ist Subject Code: BM-102
Course Title: INTEGRAL CALCULUS & TRIGNOMETRY   Paper -II
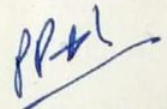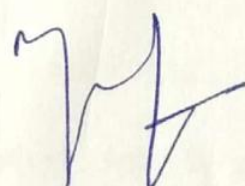Examination Duration: 2:30Hours   Max. Marks: 65
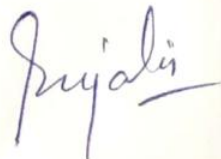
NOTE: The question paper consists of three sections A, B and C. Section A will consist 15 objective type questions (all compulsory), each of marks 1. Section B will consists of 10 short answered questions, in which 5 to be answered, each of marks 4. Section C will consist of 8 long answered questions, in which 5 to be answered, each of marks 6.
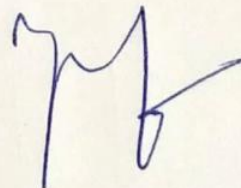
I.   Properties of Definite Integrals, Beta- Gamma functions.
II.   Rectification, Quadrature.
III.   Volumes and surfaces of solids of revolution, Double and triple integrals.
IV.   Separation into real and imaginary parts, Logarithmic of complex quantities, Hyperbolic functions with their inverses.
V.   Gregory's series, Summation of trigonometric series.
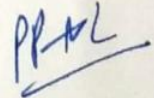
Books Recommended

1. G.B. Thomas and R.L. Finney, *Calculus*, 9th Ed., Pearson Education, Delhi, 2005.

2. H. Anton, I. Bivens and S. Davis, *Calculus*, John Wiley and Sons (Asia) P. Ltd., 2002.

3. S.L.Loney: Plane Trigonometry (Part I, II), Arihant Publications.

4. M.D.Raisinghania, H.C.Sexena& H. K.Dass : Trigonometry, S. Chand & Company Pvt. Ltd. 2002.

4

SRI DEV SUMAN UNIVERSITY, BADSHAHITHOL, TEHRI GARHWAL, UTTARAKHAND

NAME OF THE DEPARTMENT: MATHEMATICS
B.Sc. Semester: Ist Subject Code: BM-103
Course Title: ALGEBRA AND MATRICES   Paper -III
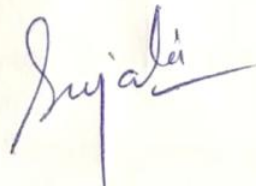Examination Duration: 2:30Hours   Max. Marks: 70

NOTE: The question paper consists of three sections A, B and C. Section A will consist 15 objective type questions (all compulsory), each of marks 1. Section B will consists of 10 short answered questions, in which 5 to be answered, each of marks 5. Section C will consist of 8 long answered questions, in which 5 to be answered, each of marks 6.

I. Sets, Operations on sets, Realtions, Equivalence relations and partition Functions, Algebraic structures, Group, Example of groups, Subgroups, Permutation group.

II. Order of an element, Cyclic -group, Coset- decomposition, Lagrange's theorem and its consequences.

III. Quotient group, Homomorphism, Isomorphism.

IV. Rank of a matrix, Invariance of rank under elementary transformations, Adjoint of matrices, Inverse of matrices, Reduction to normal form.

V. Solutions of linear homogeneous and non-homogeneous equations with number of equations and unknowns upto four, Solutions of a system of linear equations using matrices, Eigen values, Eigen vectors and Characteristic equation, Cayley Hamilton theorem and its Applications.

Books Recommended

1.John B. Fraleigh, A First Course in Abstract Algebra, 7th Ed., Pearson, 2002.
2. Joseph A Gallian, Contemporary Abstract Algebra, 4th Ed., Narosa, 1999.
3.A.I. Kostrikin, Introduction to Algebra, Springer Verlag, 1984.

4.Richard Bronson, Theory and Problems of Matrix Operations, Tata McGraw Hill, 1989.

SRI DEV SUMAN UNIVERSITY, BADSHAHITHOL, TEHRI GARHWAL, UTTARAKHAND

NOTE: The question paper consists of three sections A, B and C. Section A will consist 15 objective type questions (all compulsory), each of marks 1. Section B will consists of 10 short answered questions, in which 5 to be answered, each of marks 4. Section C will consist of 8 long answered questions, in which 5 to be answered, each of marks 6.

I. First order exact differential equations, Integrating factors, Rules to find an integrating factor, First order higher degree equations solvable for x, y, p, methods for solving higher-order differential equations.

II. Basic theory of linear differential equations, Wronskian, and its properties, Solving a differential equation by reducing its order.

III. Linear homogenous equations with constant coefficients, Linear non-homogenous equations, The method of variation of parameters.

IV. The Cauchy-Euler equation, Simultaneous differential equations, Total differential equations.

V. Order and degree of partial differential equations, Concept of linear and non-linear partial differential equations, Formation of first order partial differential equations. Linear partial differential equation of first order, Lagrange's method, Charpit's method.

Books Recommended:

1. MShepley L. Ross, Differential Equations, 3rd Ed., John Wiley and Sons, 1984.

2. I. Sneddon, Elements of Partial Differential Equations, McGraw-Hill, International Edition, 1967.

SRI DEV SUMAN UNIVERSITY, BADSHAHITHOL, TEHRI GARHWAL, UTTARAKHAND

NAME OF THE DEPARTMENT: MATHEMATICS
B.Sc. Semester: IInd 　　　　　　　　　　Subject Code: BM-202
Course Title: REAL ANALYSIS 　　　　　　　　Paper -II
Examination Duration: 2:30Hours 　　　　　　Max. Marks: 65

NOTE: The question paper consists of three sections A, B and C. Section A will consist 15 objective type questions (all compulsory), each of marks 1. Section B will consists of 10 short answered questions, in which 5 to be answered, each of marks 4. Section C will consist of 8 long answered questions, in which 5 to be answered, each of marks 6.

I. Finite and infinite sets, Examples of countable and uncountable sets, Real line, Bounded sets. Suprema and infima, Completeness property of R, Archimedean property of R, Intervals, Concept of cluster points and statement of Bolzano-Weierstrass theorem.

II. Real Sequence, Bounded sequence, Cauchy convergence criterion for sequences. Cauchy's theorem on limits, Order preservation and squeeze theorem, Monotone sequences and their convergence, Monotone convergence theorem without proof.

III. Infinite series, Cauchy convergence criterion for series, Positive term series, Geometric series, Comparison test. Convergence of p-series, Root test, Ratio test, Alternating series, Leibnitz's test (Tests of convergence without proof), Definition and examples of absolute and conditional convergence.

IV. Rolle's theorem, Mean Value theorems, Taylor's theorem with Lagrange's and Cauchy's forms of remainder, Taylor's series, Maclaurin's series of sin x, cos x, e^x, log (1+x), $(1+x)^m$.

V. Sequences and series of functions, Point wise and uniform convergence. Mn-test, M-test, Statements of the results about uniform convergence and integrability and differentiability of functions, Power series and radius of convergence.

Books Recommended

1. T. M. Apostol, *Calculus* (Vol. I), John Wiley and Sons (Asia) P. Ltd., 2002.

2. R.G. Bartle and D. R Sherbert, *Introduction to Real Analysis*, John Wiley and Sons (Asia). P. Ltd., 2000.

3. K.A. Ross, *Elementary Analysis- The Theory of Calculus Series*- Undergraduate Texts in Mathematics, Springer Verlag, 2003.

4. Texts in Mathematics, Springer Verlag, 2003

7

SRI DEV SUMAN UNIVERSITY, BADSHAHITHOL, TEHRI GARHWAL, UTTARAKHAND

NAME OF THE DEPARTMENT: MATHEMATICS
B.Sc. Semester: IInd
Course Title: ADVANCED ALGEBRA
Examination Duration: 2:30Hours

Subject Code: BM-203
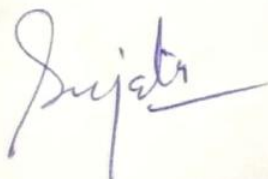Paper –III
Max. Marks: 70

NOTE: The question paper consists of three sections A, B and C. Section A will consist 15 objective type questions (all compulsory), each of marks 1. Section B will consists of 10 short answered questions, in which 5 to be answered, each of marks 5. Section C will consist of 8 long answered questions, in which 5 to be answered, each of marks 6.
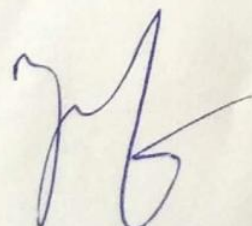
    I.   Cayley's theorem, Normalizer and center of a group.
    II.   Normal subgroups and their properties, Simple group.
    III.   Rings, various types of rings, Subrings, Properties of rings.
    IV.   Ideals, Principal ideal ring, Quotient rings, Characteristics of a ring.
    V.   Integral domain, Field, Skew field; Examples and its characterizations.

Books Recommended

1.   John B. Fraleigh, A First Course in Abstract Algebra, 7th Ed., Pearson, 2002.

2.   Joseph A Gallian. Contemporary Abstract Algebra, 4th Ed., Narosa, 1999.

3.   Khanna & Bhambhari, A course in Abstract Algebra, 4th ED, Vikash Publication 2006.

SRI DEV SUMAN UNIVERSITY, BADSHAHITHOL, TEHRI GARHWAL, UTTARAKHAND

NAME OF THE DEPARTMENT: MATHEMATICS

B.Sc. Semester: IIIrd Subject Code: BM-301

Course Title: LINEAR ALGEBRA & LPP   Paper –I

Examination Duration: 2:30Hours   Max. Marks: 65

NOTE: The question paper consists of three sections A, B and C. Section A will consist 15 objective type questions (all compulsory), each of marks 1. Section B will consists of 10 short answered questions, in which 5 to be answered, each of marks 4. Section C will consist of 8 long answered questions, in which 5 to be answered, each of marks 6.

I. Vector spaces, Subspaces, Algebra of subspaces, Quotient spaces, Linear combination of vectors, Linear span, Linear independence, Basis and dimension, Dimension of subspaces. Linear transformations, Null space, Range, Rank and nullity of a linear transformation, Matrix representation of a linear transformation, Algebra of linear transformations.

II. Dual Space, Dual basis, Double dual, Characteristic polynomial, Eigenvalues and eigen vectors, Isomorphisms, Isomorphism theorems, Invertibility and isomorphisms, Change of coordinate matrix.

III. Linear programming problems, Graphical approach for solving some LPP. Convex sets, Supporting and separating hyper planes.

IV. Theory of simplex method, Optimality and unboundedness, The simplex algorithm, Simplex method in tableau format, Introduction to artificial variables.

V. Two-phase method, Big-M method and their comparison. Duality, formulation of the dual problem, Primal-dual relationships, Economic interpretation of the dual.
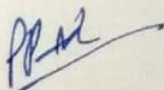
Books Recommended

1. Stephen H.Friedberg, Arnold J.Insel, Lawrence E.Spence, *Linear Algebra*, 4thEd., Prentice-Hall of India Pvt. Ltd., New Delhi, 2004.
2. David C.Lay, *LinearAlgebra and its Applications*, 3rdEd., Pearson Education Asia, Indian Reprint, 2007.
3. S. Lang, *Introduction to Linear Algebra*, 2nd Ed., Springer, 2005
4. F.S.HillierandG.J.Lieberman, *Introduction to Operations Research*, 8thEd., TataMcGrawHill, Singapore, 2004.
5. Hamdy A. Taha, *Operations Research*, An Introduction, 8th Ed., Prentice-Hall India, 2006.

SRI DEV SUMAN UNIVERSITY, BADSHAHITHOL, TEHRI GARHWAL, UTTARAKHAND

NAME OF THE DEPARTMENT: MATHEMATICS

B.Sc. Semester: IIIrd
Course Title: COMPLEX ANALYSIS
Examination Duration: 2:30Hours
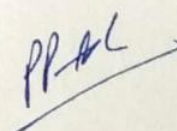
Subject Code: BM-302
Paper –II
Max. Marks: 65

NOTE: The question paper consists of three sections A, B and C. Section A will consist 15 objective type questions (all compulsory), each of marks 1. Section B will consists of 10 short answered questions, in which 5 to be answered, each of marks 4. Section C will consist of 8 long answered questions, in which 5 to be answered, each of marks 6.

I. Complex numbers and basic properties, Geometric representation of complex numbers, Trigonometrical and hyperbolic complex functions, Analytical, Cauchy-Riemann equations. Harmonic functions.

II. Conformal Mapping: Geometric representations, transformations, Theorems on Conformal mapping , Magnification, The circle, Inverse point w.r.t. a circle, Some elementary Transformations, Bilinear Transformations, Some special Bilinear Transformations, Fixed point and Normal form of a Bilinear Transformations.

III. Complex integration: Cauchy's Integral Theorem, Cauchy's fundamental theorem of integration, Cauchy's Integral formula, Cauchy's Integral formula for the derivative of Analytic functions, Morera's theorem.

IV. Cauchy's Inequality, Taylor's theorem, Laurent's series, Liouville's theorem.

V. Zeros and singularities of Analytic functions.

Recommended Books

1. James Ward Brown and Ruel V. Churchill, *Complex Variables and Applications,* 8th Ed., McGraw – Hill International Edition, 2009.

2. G C sharma & M. jain: Complex Analysis, Y.K. Publishers.

3. Mark J. Ablowitz & A. S. Fokas: Complex Variables: Introduction & Applications Cambridge Univ. Press.

10

SRI DEV SUMAN UNIVERSITY, BADSHAHITHOL, TEHRI GARHWAL, UTTARAKHAND

NAME OF THE DEPARTMENT: MATHEMATICS
B.Sc. Semester: IIIrd Subject Code: BM-303
Course Title: NUMERICAL ANALYSIS   Paper –III
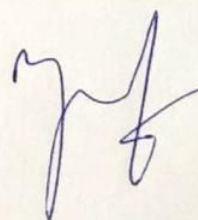Examination Duration: 2:30Hours   Max. Marks: 70

NOTE: The question paper consists of three sections A, B and C. Section A will consist 15 objective type questions (all compulsory), each of marks 1. Section B will consists of 10 short answered questions, in which 5 to be answered, each of marks 5. Section C will consist of 8 long answered questions, in which 5 to be answered, each of marks 6.

I.   Finite difference, Difference Operator, Factorial notation, Interpolation with equal Intervals.
II.   Interpolation with unequal intervals, Divided difference, Central differences Stirling and Bessel formula (application only).
III.   Numerical differentiation and Integration, Simpson's 1/3 and 3/8 rule, weddle's rule Trapezoidal rule and their accuracy.
IV.   Numerical solution of algebraic and transcendental equation, iterative bisection, Regula Falsi, Newton Raphson, Graeffe method.
V.   Numerical solution of differential equation, Picard's Euler, Modified Euler, Runge-Kutta Method.

Recommended Books

1. B. Bradie, *A Friendly Introduction to Numerical Analysis*, Pearson Education, India, 2007.
2. M.K.Jain, S.R.K. Iyengar and R.K.Jain, Numerical Methods for Scientific and Engineering Computation, 5th Ed., New age International Publisher, India, 2007.

DEPARTMENT OF PHYSICS

Sridev Suman Uttarakhand University, Badshaithaul, Tehri Garhwal

Syllabus

For

Undergraduate Courses

2020-2021

(Annual System)

This syllabus will be prospective and will be enforced at the entry level from the academic year

B. Sc. Part I

PHYSICS

PAPER-I: MECHANICS

UNIT I: Laws of Motion and Conservation Laws

Laws of Motion: Frames of reference, Inertial and Non-inertial frames of reference, Newton's Laws of motion, Dynamics of a system of particles, Centre of Mass, Motion of centre of mass.

Momentum and Energy: Conservation of momentum, Work and energy, Work energy principle, Conservative forces, Conservative force as the negative gradient of potential energy, Conservation of energy, System of variable mass-Motion of rockets.

UNIT II: Rotational Motion

Angular velocity and angular momentum, Torque, Conservation of angular momentum, Equation of motion, Moment of inertia, Theorem of parallel and perpendicular axis, Moment of inertia of rod, rectangular lamina, ring, disc, solid sphere, spherical shell, Kinetic energy of rotation, Rolling along a slope.

UNIT III: Gravitation

Newton's Law of Gravitation, Motion of a particle in a central force field (motion is in a plane, angular momentum is conserved, areal velocity is constant), Gravitational field, potential and potential energy, Gravitational potential and field intensity for spherical shell, Kepler's Laws of planetary motion, Satellite in circular orbit and applications, Geosynchronous orbits, Basic idea of global positioning system (GPS).

UNIT IV: Elasticity:

Hooke's law- Stress-strain diagram, Elastic moduli-Relation between elastic constants, Poisson's Ratio, Expression for Poisson's ratio in terms of elastic constants, Work done in stretching a wire and work done in twisting a wire, Twisting couple on a cylinder, Determination of Rigidity modulus by static torsion, Torsional pendulum, Determination of Rigidity modulus and moment of inertia (Y, η and σ) by Searle's method.

UNIT V: Fluids:

Surface Tension: Synclastic and anticlastic surface, Excess of pressure: Application to spherical and cylindrical drops and bubbles, Variation of surface tension with temperature - Jaegar's method.

Viscosity: Viscosity - Rate flow of liquid in a capillary tube, Bernoulli's theorem, Poiseuille's formula, Determination of coefficient of viscosity of a liquid, Variations of viscosity of a liquid with temperature.

Reference Books:
• University Physics. FW Sears, MW Zemansky and HD Young13/e, 1986. Addison-Wesley
• Mechanics Berkeley Physics course, vol1: Charles Kittel, et. al. 2007, Tata McGraw-Hill.
• Physics – Resnick, Halliday & Walker 9/e, 2010, Wiley
• University Physics, Ronald Lane Reese, 2003, Thomson Brooks/Cole.
• Mechanics: D. S. Mathur and P. S. Hemne, S Chand Publications, 2014, New Delhi.
• Mechanics: J. C. Upadhyaya, Ram Prasad and Sons, Agra.
• Mechanics and General Properties of Matter: P. K. Chakrabarti, Books and Allied Pvt. Ltd.

B. Sc. Part I

PHYSICS

PAPER-II: ELECTRICITY AND MAGNETISM

UNIT I: Vector Field:

Scalar and Vector field, Gradient, Divergence, Curl and their significance, Vector Integration, Line, surface and volume integrals of Vector fields, Gauss-divergence theorem and Stoke's theorem of vectors.

UNIT II: Electrostatics:

Electrostatic Field, electric flux, Gauss's theorem of electrostatics, Applications of Gauss theorem- Electric field due to point charge, infinite line of charge, uniformly charged spherical shell and solid sphere, Electric field and potential as line integral of electric field, electric potential due to a point charge, electric dipole, uniformly charged spherical shell and solid sphere, Calculation of electric field from potential, Capacitance of an isolated spherical conductor, Parallel plate, spherical and cylindrical condenser, Energy per unit volume in electrostatic field, Dielectric medium, Polarization, Displacement vector, Parallel plate capacitor completely filled with dielectric.

UNIT III: Magnetostatics:

Biot-Savart's law and its applications- straight conductor, circular coil, solenoid carrying current, Lorentz force, Divergence and curl of magnetic field, Magnetic vector potential, Ampere's circuital law, Magnetic properties of materials: Magnetic intensity, magnetic induction, permeability, magnetic susceptibility, Brief introduction of dia-, para- and ferro-magnetic materials.

UNIT IV: Electromagnetic Induction and Alternating current:

Field due to Helmholtz coil, solenoid and current loop, Faraday's laws of electromagnetic induction, Lenz's law, self and mutual inductance, Self-inductance (L) of single coil, mutual inductance (M) of two coils, Energy stored in magnetic field, Alternating current, Alternating voltage across R-C, L-C, R-L and LCR circuits, condition of resonance.

UNIT V: Maxwell`s equations and Electromagnetic wave propagation:

Equation of continuity of current, Displacement current, Maxwell's equations, Poynting vector, energy density in electromagnetic field, electromagnetic wave propagation through vacuum and isotropic dielectric medium, transverse nature of EM waves, polarization.

Reference Books:
• Electricity and Magnetism, Edward M. Purcell, 1986, McGraw-Hill Education.
• Electricity and Magnetism, J. H. Fewkes and J. Yarwood. Vol. I, 1991, Oxford Univ. Press.
• Electricity and Magnetism, D. C. Tayal, 1988, Himalaya Publishing House.
• University Physics, Ronald Lane Reese, 2003, Thomson Brooks/Cole.
• Introduction to Electrodynamics, D. J. Griffiths, 3rd Edn, 1998, Benjamin Cummings.
• Electricity and Magnetism, K. K. Tiwari, 3rd ed., 2007, S. Chand Publications.
•Electricity and Magnetism, Brijlal and Subrahmanyam.
•Electricity and Magnetism, C. J. Smith.
•Principles of Electromagnetics, Matthew N. O. Sadiku, 2015, Oxford Univ. Press.
• Fundamentals of Electricity and Magnetism, D. N. Vasudeva.

B. Sc. Part I

PHYSICS

PAPER-III: WAVES, OSCILLATIONS AND ACOUSTICS

UNIT I: Wave Motion

Characteristics, Differential equation of wave motion, Transverse waves on a string. Travelling and standing waves on a string. Normal modes of a string, Group velocity and phase velocity. Plane waves, spherical waves. Wave intensity.
Fourier's theorem and its applications to square wave, saw tooth wave and triangular wave.

UNIT II: Simple Harmonic Motion:

Simple harmonic motion, Differential equation of SHM and its solutions, Kinetic and Potential Energy, Total Energy and their time averages, Simple harmonic oscillations in mechanical and electrical systems.
Superposition of Two Collinear Harmonic oscillations: Linearity and Superposition Principle, (1) Oscillations having equal frequencies and (2) Oscillations having different frequencies (Beats).
Superposition of Two Perpendicular Harmonic Oscillations: Graphical and Analytical Methods, Lissajous Figures (1:1 and 1:2) and their uses.

UNIT III: Damped Harmonic Oscillations

Damped harmonic oscillations, Differential equation of damped harmonic oscillations and its solutions, power dissipation in damped harmonic oscillator, relaxation time and quality factor, Electrically damped harmonic oscillator (LCR circuit).

UNIT IV: Forced Harmonic Oscillations

Differential equation of Forced harmonic oscillations and its solutions, Forced harmonic oscillations in mechanical and electrical system, Transient and steady state behaviour, Resonance, Sharpness of resonance, Bandwidth, Energy dissipation, Quality factor of forced oscillator, Mechanical and electrical impedances.

UNIT V: Ultrasonics and Acoustics

Sound: Intensity and loudness of sound - Decibels - Intensity levels - musical notes - musical scale.
Ultrasonics: Generation of ultrasonic waves, their detection and applications, Piezo electric effect, quartz crystal.
Acoustics of buildings: Reverberation and time of reverberation, Absorption coefficient, Sabine's formula- measurement of reverberation time, Acoustic aspects of halls and auditoria.

Reference Books:
• Waves and Oscillations, Brijlal and Subrahmanyam, 2nd ed, 2018, Vikas Publishing House.
• The Physics of waves and oscillations, N. K. Bajaj, 2017, McGraw Hill Education.
• Acoustics Waves and Oscillations, S. K. Sen, 2nd ed. 1990, New Age Int. Pvt. Ltd.
• Waves and Oscillations, R. N. Chaudhuri, 2010, New Age Publishers.
• A Textbook of Oscillations, Waves and Oscillations, M. Ghosh, D. Bhattacharya, 2007, S. Chand Publications.

B. Sc. Part I
PHYSICS
PRACTICAL LIST
(Any Sixteen Experiments as per facilities in the Institution)

1. Measurements of length (or diameter) using vernier calipers, screw gauge, spherometer and travelling microscope.
2. To determine the Moment of Inertia of a Flywheel.
3. To determine the Moment of Inertia of an irregular body by Inertia Table Flywheel.
4. To determine the Young's Modulus of a Wire by Bending of Beam Method.
5. To determine the Modulus of Rigidity of a Wire by Maxwell's needle.
6. To determine the Modulus of Rigidity of a Wire by Barton's Apparatus (Vertical Pattern).
7. To determine the Modulus of Rigidity of a Wire by Barton's Apparatus (Horizontal Pattern).
8. To determine g by Bar Pendulum.
9. To determine g by Kater's Pendulum
10. To determine the Elastic Constants of a Wire by Searle's method.
11. To study the Motion of a Spring and calculate (a) Spring Constant (b) Value of g
12. To determine the Coefficient of Viscosity of water by Capillary Flow Method (Poiseuille's method).
13. To determine surface tension of liquid by Jaeger's method.
14. To use a Multimeter for measuring (a) Resistances, (b) AC and DC Voltages, (c) DC Current, and (d) checking electrical fuses.
15. To compare capacitances using De' Sauty bridge.
16. To study the Characteristics of a Series RC Circuit.
17. To determine a Low Resistance by Carey Foster's Bridge.
18. Conversion of galvanometer into voltmeter.
19. Conversion of galvanometer into ammeter.
20. Comparison of two resistances by potentiometer.
21. Internal resistance by potentiometer.
22. Variation of magnetic field of coil and to find out radius of coil.
23. To verify Kirchoff's law.
24. Measurement of field strength B and its variation in a Solenoid (Determine dB/dx).
25. To study the series LCR circuit and determine its (a) Resonant Frequency, (b) Quality Factor
26. To study a parallel LCR circuit and determine its (a) Anti-resonant frequency and (b) Quality factor Q
27. To study damping effect of simple harmonic motion using simple pendulum.
28. To determine the frequency of AC main by sonometer.
29. To determine the frequency of AC main by Melde's method.
30. To study Lissajous Figures.

Reference Books:

• Advanced Practical Physics for students, B. L. Flint and H. T. Worsnop, 1971, Asia Publishing House.
• Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers
• A Text Book of Practical Physics, Indu Prakash and Ramakrishna, 11th Edition, 2011, Kitab Mahal, New Delhi.
• Physics Practical: Gupta & Kumar, Pragati Prakashan
• Physics Practical: Goyal, Kedar Nath & Sons

B. Sc. Part II

PHYSICS

PAPER-I: THERMAL PHYSICS AND STATISTICAL MECHANICS

UNIT I: Thermodynamical concept and First Law of Thermodynamics:

Thermodynamic Description of system, Equilibrium and thermodynamic variables of a system, Zeroth Law of thermodynamics and temperature. First law and internal energy, conversion of heat into work, Various Thermodynamical Processes, Applications of First Law: General Relation between CP& CV, Work Done during Isothermal and Adiabatic Processes, Compressibility & Expansion Coefficient,

UNIT II: Second and Third Law of Thermodynamics:

Inadequacy of first law of thermodynamics, Reversible & irreversible processes, Principle of heat engine and refrigerator, Second law of thermodynamics & Entropy, Carnot's cycle & theorem, Entropy changes in reversible & irreversible processes, Entropy-temperature diagrams, Third law of thermodynamics, Unattainability of absolute zero.

UNIT III: Thermodynamic Potentials:

Enthalpy, Gibbs free energy, Helmholtz and Internal Energy functions, Maxwell's relations & applications - Joule-Thompson Effect, Clausius- Clapeyron Equation, Expression for (C_P – C_V), C_P/C_V, TdS equations.

UNIT IV: Kinetic Theory of Gases:

Derivation of Maxwell's law of distribution of velocities and its experimental verification, Mean free path (Zeroth Order), Transport Phenomena: Viscosity, Conduction and Diffusion (for vertical case), Law of equipartition of energy (no derivation) and its applications to specific heat of gases; mono-atomic and diatomic gases.

UNIT V: Theory of Radiation:

Blackbody radiation, Spectral distribution, Concept of Energy Density, Derivation of Planck's law, Deduction of Wien's distribution law, Rayleigh-Jeans Law, Stefan Boltzmann Law and Wien's displacement law from Planck's law.

Reference Books:
• Thermal Physics, S. Garg, R. Bansal and C. Ghosh, 1993, Tata McGraw-Hill.
• A Treatise on Heat, Meghnad Saha, and B. N. Srivastava, 1969, Indian Press.
• Thermodynamics, Enrico Fermi, 1956, Courier Dover Publications.
• Thermodynamics, Kinetic theory & Statistical thermodynamics, F. W. Sears & G.L.Salinger. 1988, Narosa
• University Physics, Ronald Lane Reese, 2003, Thomson Brooks/Cole.
• Statistical Mechanics, Gupta Kumar, Pragati Prakashan.
• Statistical Mechanics, Satyaprakash, Kedar Nath Ram Nath and Sons.
• Statistical Mechanics, E. S. Rajgopal
• Statistical Physics, F. Rief, Mcgraw Hill.

B. Sc. Part II

PHYSICS

PAPER-II: OPTICS

UNIT I: Geometrical Optics:

Fermat's Principle: Principle of extremum path and its application to deduce laws of reflection and refraction, Aplantic points of a sphere, Gauss's general theory of image formation: Coaxial symmetrical system, Cardinal points of an optical system, general relationship, thick lens and lens combinations, Lagrange equation of magnification, telescopic combinations, telephoto lens.

UNIT II: Optical Instruments:

Entrance and exit pupils, need for a multiple lens eyepiece, Ramsden's, Hygen's and Gaussiaqn eyepieces, Astronomical refracting telescope, Spectrometer, Aberrations in images: Chromatic aberrations, achromatic combination of lenses in contact and separated lenses, Monochromatic aberrations and their reduction: aspherical mirrors and Schmidt corrector plates, aplantic points, oil immersion objectives meniscus lens.

UNIT III: Interference of Light:

The principle of superposition, two slit interference, coherence requirement for the sources, optical path retardations.
Division of amplitude and division of wavefront, Fresnel's Biprism, Phase change on reflection: Stokes' treatment,
Interference in Thin Films: parallel and wedge-shaped films, Fringes of equal inclination (Haidinger Fringes); Fringes of equal thickness (Fizeau Fringes), Newton's Rings: measurement of wavelength and refractive index.
Michelson's Interferometer: Idea of formation of fringes and its application for determination of wavelength, Wavelength difference, Refractive index, Visibility of fringes.
Fabry Perot interferometer.

UNIT IV: Diffraction of Light:

Fresnel Diffraction: Half-period zones, Zone plate, Fresnel Diffraction pattern of a straight edge, a slit and a wire using half-period zone analysis.
Fraunhofer diffraction: Diffraction of a Single slit; Double Slit, Multiple slits and Diffraction grating.
.

UNIT V: Polarization of Light

Transverse nature of light waves, Concept of Plane polarized light – production and analysis, Malus law, Brewster's law, Nicol prism, Circular and elliptical polarization, Double refraction. Optical rotation: Rotation of plane of polarization, origin of optical rotation in liquids and in crystals, polarimeter, half shade and biquartz.

Reference Books:

• Fundamentals of Optics, F A Jenkins and H E White, 1976, McGraw-Hill
• Principles of Optics, B. K. Mathur, 1995, Gopal Printing
• Fundamentals of Optics, H. R. Gulati and D.R. Khanna, 1991, R. Chand Publication
• A Textbook of Optics, N. Subramanyam and Brijlal.
• Optics and Atomic Physics, D. P. Khandelwal.
• Physical Optics, A. K. Ghatak.
• Optics, Eugene Hecht, Pearson Publishers.
• Optics, Satya Prakash.

B. Sc. Part II

PHYSICS

PAPER-III: SOLID STATE PHYSICS

UNIT I: Crystal Structure
Solids: Amorphous and Crystalline Materials, Lattice with a Basis – Central and Non-Central Elements, Bravais lattice and primitive vectors, Lattice Translation Vectors, Unit Cell (primitive, Wigner-Seitz cell and non-primitive), Seven crystal systems and Fourteen Bravais lattices, sc, bcc and closed packed structures (fcc, hcp and diamond structures), Sodium chloride, Cesium chloride and Zinc blende structures.
Reciprocal Lattice. Types of Lattices. Brillouin Zones. Diffraction of X-rays by Crystals. Bragg's Law. Atomic and Geometrical Factor.

UNIT II: Reciprocal Lattice
Reciprocal lattice: Definitions, examples and properties, Reciprocal lattice as Bravais lattice, Brillouin Zones, Reciprocal lattice of sc, bcc and fcc lattices, Lattice planes and Miller indices, X-Ray Diffraction, Bragg's law, Laue, powder and rotating crystal methods of X-ray diffraction, Introductory electron and neutron diffraction.

UNIT III: Elementary Lattice Dynamics
Lattice Vibrations and Phonons: Linear Monoatomic and Diatomic Chains, Acoustical and Optical Phonons, Qualitative Description of the Phonon Spectrum in Solids, Dulong and Petit's Law, Einstein and Debye theories of specific heat of solids, T^3 law

UNIT IV: Free Electron Theory of Metals
The outstanding properties of metals, Outline and limitation of Lorentz- Drude Theory, Thermal conductivity, Electrical conductivity, Widemann- Franz relation, Sommerfeld theory of free electrons, Electrical conductivity and Ohms law, Electronic specific heat, Thermoionic emission, escape of electrons from metal, Failures of the free electron Model.

UNIT V Elementary band theory
Kronig Penny model, Band Gaps, Distinction between Conductors, Semiconductors and insulators, intrinsic and extensive semiconductors, P and N type Semiconductors, Conductivity of Semiconductors, mobility, Hall Effect, Hall coefficient.

Reference Books:
• Introduction to Solid State Physics, Charles Kittel, 8th Ed., 2004, Wiley India Pvt. Ltd.
• Elements of Solid-State Physics, J. P. Srivastava, 2nd Ed., 2006, Prentice-Hall of India
• Introduction to Solids, Leonid V. Azaroff, 2004, Tata Mc-Graw Hill
• Solid State Physics, Neil W. Ashcroft and N. David Mermin, 1976, Cengage Learning
• Solid-state Physics, H. Ibach and H Luth, 2009, Springer
• Elementary Solid-State Physics, 1/e M. Ali Omar, 1999, Pearson India
• Solid State Physics, M.A. Wahab, 2011, Narosa Publications

B. Sc. Part II
PHYSICS PRACTICAL LIST
(Any Sixteen Experiments as per facilities in the Institution)

1. To determine the coefficient of thermal conductivity of copper by Searle's Apparatus.
2. To determine the coefficient of thermal conductivity of a bad conductor by Lee and Charlton's disc method.
3. To determine Stefan's Constant.
4. To verify Newton's Law of Cooling.
5. To determine J by Joule's calorimeter.
6. To verify the laws of probability distribution throwing one coin, two coin and ten coin.
7. To show that deviation of probability from theoretical value decreases with increase in number of events.
8. Study of statistical distribution from the given data and to find most probable, average and rms value.
9. Study of random decay of nuclear disintegration and determination of decay constant using dices.
10. To determine Mechanical Equivalent of Heat, J, by Callender and Barne's constant flow method.
11. To determine the Coefficient of Thermal Conductivity of Cu by Angstrom's Method.
12. To determine the Coefficient of Thermal Conductivity of rubber tube.
13. To determine the Coefficient of Thermal Conductivity of glass.
14. Measurement of Planck's constant using black body radiation.
15. Familiarization with Schuster`s focussing; determination of angle of prism by Mercury Lamp.
16. To determine the Refractive Index of the Material of a given Prism using Mercury Light.
17. To determine Dispersive Power of the Material of a given Prism using Mercury Light.
18. To determine wavelength of sodium light using Newton's Rings.
19. To determine the cardinal points of a combination of lenses using nodal slide arrangement.
20. To determine the resolving power of a telescope.
21. To determine specific rotation of cane sugar by polarimeter.
22. To determine refractive index of calcite prism.
23. To determine wavelength of Mercury light using plane diffraction Grating.
24. To investigate the motion of coupled oscillators.
25. To determine the value of Cauchy Constants of a material of a prism.
26. To determine the Resolving Power of a Prism.
27. To determine wavelength of sodium light using Fresnel Biprism.
28. To determine the wavelength of Laser light using Diffraction of Single Slit.
29. To determine wavelength of Sodium light using plane diffraction Grating.
30. To determine the Resolving Power of a Plane Diffraction Grating.

Reference Books:

- Advanced Practical Physics for students, B. L. Flint & H. T.Worsnop, 1971, Asia Publishing House.
- Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers
- A Text Book of Practical Physics, Indu Prakash and Ramakrishna, 11th Edition, 2011, Kitab Mahal, New Delhi.
- A Laboratory Manual of Physics for Undergraduate Classes, D. P. Khandelwal, 1985, Vani Publication

B. Sc. Part III

PHYSICS

PAPER-I: QUANTUM MECHANICS

UNIT I:
Origin of Quantum theory, Failure of Classical Physics to explain the phenomena such as Black body spectrum, Photoelectric effect, Characteristics and Einstein's explanation, Planck's quantum hypothesis, Planck's constant and light as a collection of photons; Compton scattering.

UNIT II:
De Broglie hypothesis of matter waves and De Broglie wavelength; Davisson-Germer experiment, Position measurement- gamma ray microscope thought experiment; Wave-particle duality, Heisenberg uncertainty principle- impossibility of a particle following a trajectory; Estimating minimum energy of a confined particle using uncertainty principle; Energy-time uncertainty principle. Two slit interference experiment with photons, atoms and particles;

UNIT III:
Schrodinger's equation (Time independent and Time dependent), Postulates of Quantum Mechanics, Properties of Wave Function, Physical interpretation of Wave Function, Probability and probability current densities in three dimensions; Conditions for Physical acceptability of Wave Functions, Normalization, Eigenvalues and Eigenfunctions, Operator, position, momentum and Energy operators; Expectation values, Wave Function of a Free Particle.

UNIT IV:
General discussion of bound states in an arbitrary potential- continuity of wave function, boundary condition and emergence of discrete energy levels; Applications of Schrodinger's equation to particle in one dimensional box, Transmission across a potential barrier, Potential well of finite and infinite depths, Potential step, Quantum Mechanics of one dimensional simple harmonic oscillator-energy levels and energy eigenfunctions.

UNIT V:
Application of Schrodinger's equation to particle in three dimensional box, Quantum theory of hydrogen-like atoms: time independent Schrodinger equation in spherical polar coordinates; separation of variables for the second order partial differential equation; angular momentum operator and quantum numbers; Radial wavefunctions from Frobenius method; Orbital angular momentum quantum numbers l and m; s, p, d,.. shells (idea only)

Reference Books:
• A Text book of Quantum Mechanics, P. M. Mathews & K. Venkatesan, 2nd Ed., 2010, McGraw Hill
• Quantum Mechanics, Robert Eisberg and Robert Resnick, 2ndEdn., 2002, Wiley.
• Quantum Mechanics, Leonard I. Schiff, 3rdEdn. 2010, Tata McGraw Hill.
• Quantum Mechanics, G. Aruldhas, 2ndEdn. 2002, PHI Learning of India.
• Quantum Mechanics, Bruce Cameron Reed, 2008, Jones and Bartlett Learning.
• Quantum Mechanics for Scientists & Engineers, D.A.B. Miller, 2008, Cambridge University Press

B. Sc. Part III

PHYSICS

PAPER-II: MODERN PHYSICS

UNIT I:
Thomson model, Rutherford model, Bohr model and spectra of hydrogen atoms, Shortcomings of these models, Bohr-Sommerfeld's model, Stern-Gerlach Experiment, Bohr magneton, Larmor's precession, Vector atom model, Spatial quantization and electron spin.

UNIT II:
Optical spectra and spectral notations, L-S and J-J coupling, selection rules and intensity rules, Explanation of fine structure of sodium D line, Normal Zeeman effect, X-ray spectra (Characteristic and continuous), Moseley's law.

UNIT III:
Absorption, spontaneous and stimulated emission processes, Metastable states, population inversion and pumping process, Einstein's A and B coefficients, Conditions of lasing action, Idea of Laser and Maser, Examples of Laser (Ruby Laser, He-Ne Laser, Semiconductor laser) and some applications of Lasers.

UNIT IV:
Size and structure of atomic nucleus and its relation with atomic weight; Impossibility of an electron being in the nucleus as a consequence of the uncertainty principle, Nature of nuclear force, Packing fraction and binding energy, NZ graph and semi-empirical mass formula, Liquid drop model and Shell Model.

UNIT V:
Radioactivity: stability of nucleus; Law of radioactive decay; Mean life and half-life; α decay; β decay - energy released, spectrum and Pauli's prediction of neutrino; γ-ray emission.
Fission and Fusion: mass deficit, relativity and generation of energy; Fission - nature of fragments and emission of neutrons. Nuclear reactor: slow neutrons interacting with Uranium 235; Fusion and thermonuclear reactions.
Particle Detectors (Ionization Chamber, proportional and G. M. Counter)

Reference Books:
- Concepts of Modern Physics, Arthur Beiser, 2009, McGraw-Hill.
- Modern Physics, John R. Taylor, Chris D. Zafiratos, Michael A.Dubson,2009, PHI Learning.
- Six Ideas that Shaped Physics: Particle Behave like Waves, Thomas A. Moore, 2003, McGraw Hill.
- Modern Physics, R. A. Serway, C. J. Moses, and C. A. Moyer, 2005, Cengage Learning.
- Modern Physics, Agrawal and Agrawal, Pragati Prakashan.
- Basic Nuclear Physics, B. N. Srivastava, Pragati Prakashan.
- Nuclear Physics, D. C. Tayal, Himalaya Publishing.
- Lasers and Non Linear Optics, B. B. Laud.

B. Sc. Part III

PHYSICS

PAPER-III: BASIC ELECTRONICS

UNIT I: Semiconductor Diodes

Intrinsic and extrinsic semiconductors, p and n type semiconductors, Semiconductor Diodes, Barrier Formation in PN Junction Diode, Qualitative Idea of Current Flow Mechanism in Forward and Reverse Biased Diode, PN junction and its characteristics, Static and Dynamic Resistance, Zener diode, Principle and structure of Opto-electronic devices (1) LEDs (2) Photodiode (3) Solar Cell.

UNIT II: Power Supply

Half-wave Rectifiers, Centre-tapped and Bridge Full-wave Rectifiers, Calculation of Ripple Factor and Rectification Efficiency, Basic idea about capacitor, inductor filters, Clippers and clamping circuits, Voltage multiplier (Doubler and Tripler), Regulated Power supply, Zener Diode as a Voltage Regulator.

UNIT III: Transistor Amplifiers

Bipolar Junction transistors: n-p-n and p-n-p Transistors, Characteristics of CB, CE and CC Configurations, Current gains α and β, Relations between α and β, Load Line analysis of Transistors, DC Load line and Q-point, Active, Cutoff, and Saturation Regions, Transistor biasing circuits for CE Amplifier, Current, Voltage and Power Gains, Class A, B, and C Amplifiers, Field effect Transistor, UJT.

UNIT IV: Oscillators

Negative and positive feedback, Barkhausen's Criterion for Self-sustained Oscillations, Determination of Frequency (no mathematical derivation) of RC Oscillator (Wein bridge and phase-shift oscillator) and LC oscillator (Collector tuned and Colpit oscillator), Crystal Oscillator, Multivibrator (Mono, astable and bistable)

UNIT V: Digital Circuits

Difference between Analog and Digital Circuits. Binary Numbers, Decimal to Binary and Binary to Decimal Conversion, AND, OR and NOT Gates (Realization using Diodes and Transistor), NAND and NOR Gates as Universal Gates, XOR and XNOR Gates.
De Morgan's Theorems, Boolean Laws, Simplification of Logic Circuit using Boolean Algebra, Fundamental Products, Minterms and Maxterms, Conversion of a Truth Table into an Equivalent Logic Circuit by (1) Sum of Products Method and (2) Karnaugh Map.
Binary Addition. Binary Subtraction using 2's Complement Method), Half Adders and Full Adders and Subtractors, 4-bit binary Adder-Subtractor.

Reference Books:
• Integrated Electronics, J. Millman and C.C. Halkias, 1991, Tata Mc-Graw Hill.
• Electronic devices and circuits, S. Salivahanan and N.Suresh Kumar, 2012, Tata Mc-Graw Hill.
• Microelectronic Circuits, M.H. Rashid, 2ndEdn.,2011, Cengage Learning.
• Digital Principles & Applications, A. P. Malvino, D. P. Leach & Saha, 7th Ed.,2011, Tata McGraw Hill
• Fundamentals of Digital Circuits, A. Anand Kumar, 2nd Edition, 2009, PHI Learning Pvt. Ltd.
• Principle of Electronics, V. K. Mehta.
• Hand Book of Electronics, Gupta and Kumar
• Basic electronics and linear circuits, N. N. Bhargava, D. C. Kulshrestha and S. C. Gupt

B. Sc. Part III

PHYSICS

PRACTICAL LIST
(Any Sixteen Experiments as per facilities in the Institution)

1. Frank-Hertz Experiment.
2. Determination of 'h' Planck's constant by Photoelectric effect.
3. Spectrum of Hydrogen and Rydberg constant.
4. Speed of light by Lecher's wires.
5. 'e/m' by Thomson method.
6. 'e/m' by Magnetron method.
7. 'e/m' by Helical method.
8. Measurement of Magnetic field strength.
9. Child Langmuir Law.
10. Identification and checking of electronic components; resistors, diodes, capacitor, transistors.
11. To verify truth table of AND, OR, NOT, NAND and XOR gates.
12. To verify De Morgan's Theorem.
13. To construct half adder and full adder.
14. To construct half subtractor and full subtractor.
15. To study I-V characteristics of p-n junction diode in forward and reverse bias.
16. To study I-V characteristics of Zener diode.
17. To study I-V characteristics of light emitting diode (LED).
18. To study half-wave rectifier with and without filter.
19. To study full-wave rectifier with and without filter.
20. To study p-n-p transistor in CE configuration.
21. To study n-p-n transistor in CE configuration.
22. To study JFET characteristics.
23. To design a CE amplifier of a given gain (mid-gain) using voltage divider bias.
24. To design a Wien Bridge Oscillator.
25. Study of regulated power supply.
26. To study characteristics of photo cell.
27. To measure (a) Voltage, and (b) Frequency of a periodic waveform using a CRO to minimize a given logic circuit.
28. To determine energy band gap of a semiconductor.
29. To study MOSFET characteristics.
30. To study UJT characteristics.

Reference Books:
• Basic Electronics: A text lab manual, P. B. Zbar, A. P. Malvino, M. A. Miller, 1994, Mc-Graw Hill.
• Electronics: Fundamentals and Applications, J. D. Ryder, 2004, Prentice Hall.
• Electronic Principle, Albert Malvino, 2008, Tata Mc-Graw Hill.

Department of Zoology

Sri Dev Suman Uttarakhand University, Badshaithaul

New Tehri

Course Contents & Syllabus

Based on

Annual System

for

Undergraduate Course

BOS held on 7th February 2020

Sri Dev Suman University, Badshahithaul, Tehri Garhwal
B.Sc. (Zoology)
(All affiliated colleges)

The BSc examination will be spread over three years. There will be three theory papers and one practical examination every year. Each theory paper has been divided into five units. There will be 12 objective questions (1 mark each) (Multiple choice/true & false, fill in the blanks); Six short answer questions type (3 marks each) and four long answer type (5 marks each). There will be internal choice in short and long answer questions. The total duration of paper will be 2.30 hours.

Course Content and Teaching Schedule:

Class		No of lecture/periods 45 minutes, 25 weeks	Teaching hours		
B.Sc. 1st Year			Weekly	Total	MM
Paper-1st	Non-Chordata (Animal Diversity)	50	1.5	37.5	50
Paper 2nd	Cell Biology and Genetics	50	1.5	37.5	50
Paper 3rd	Taxonomy, Evolution, Biostats & Computer	50	1.5	37.5	50
Practical based on paper 1,2 &3		100	03	75	50
B.Sc. 2nd Year			Weekly	Total	MM
Paper 4th	Chordata	50	1.5	37.5	50
Paper 5th	Animal Physiology and Biochemistry	50	1.5	37.5	50
Paper 6th	Molecular Biology, Microbiology and Biotechnology	50	1.5	37.5	50
Practical based on paper 4,5 &6		100	03	75	50
B.Sc. 3rd Year			Weekly	Total	MM
Paper-7th	Endocrinology and Applied Zoology	50	1.5	37.5	50
Paper 8th	Ecology, Conservation biology and Animal Behaviour	50	1.5	37.5	50
Paper 9th	Developmental Biology and Toxicology	50	1.5	37.5	50
Practical based on paper 7,8 &9		100	03	75	50

20% marks will be on the basis of internal assessment (10% for attendance + 10% for performance in the practical).

UNIT-I

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

UNIT-III

Annelida: General characters and classification up to classes; Metamerism in Trochphore 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 Edu 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

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 & lampbhrush chromosomes, Eugenesis

Books Recommended:
1. Alberts et al.: Molecular Biology of the Cell, Garland Pulb., 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.)

Unit -I

Taxonomy: Definition & scope; relationship with Systematic, Zoological nomenclature: Binominal & Trinominal; ICZN.
Components of classification: Linnaean hierarchy. Concepts of species: Typological, Nomenalistic & 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

PRACTICAL SYLLABUS B.Sc. First Year (Zoology)

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 Nemathelminthes: 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

Sri Dev Suman University, Badshahithaul, Tehri Garhwal
B.Sc. 2ⁿᵈ Year (Zoology)
Paper 4ᵗʰ: Chordata

Unit- I

Protochordates: General features and Phylogeny of Protochordats. Body organization of Balanoglossus, Herdmania and *Amphioxus*.

Unit - II

Agnatha: General features of Agnatha and classification of cyclostomes up to Classes, Comparison between Lampreys and Hagfishes.
Pisces: General features and Classification up to orders; Scales and fins of fishes, Hill stream adaptations

Unit - III

Amphibia: General features and Classification up to orders; Parental care; Neoteny
Reptiles: General features and Classification up to orders; Poisonous and non-poisonous snakes; Biting mechanism in snakes; Venum and antivenum.

Unit - IV

Aves: General features and Classification up to orders; Feathers in Birds; Adaptations for aerial mode of life;

Unit - V

Mammalia: General features; Origin of mammals; distribution and affinities of Prototheria, Metatheria and Eutheria; Aerial and aquatic adaptations in mammals.

Books Recommended:
1. Pandey B.N. and Mathur V. Biology of Chordates, PHI Learning, 2018
2. R.L. Kotpal: Modern Text-book of Zoology, Vertebrates. Rastogi Publication.
3. E.L. Jordan and P.S. Verma: Chordate Zoology. S. Chand & Co. Ltd.
4. Hildebrand: Analysis of Vertebrate structure.
5. Romer & Parsons: The Vertebrate Body, Saunders.

Paper 5th: Animal Physiology & Biochemistry

Unit - I

Digestion: Intracellular and Extracellular digestion. Digestion and absorption of Carbohydrates, Lipids and Proteins.

Respiration: Pulmonary ventilation, Respiratory volumes and capacities,. Transport of Oxygen and Carbon dioxide in Blood. Dissociation of oxyhaemoglobin

Unit - II

Circulation: Composition of blood; Blood coagulation; Structure of Heart; Origin and conduction of the cardiac impulse, Cardic cycle.

Excretion: Structure of nephron; Physiology of urine formation

Unit - III

Nervous system: Types of neurons; Myelinated and non-myelinated nerve fibres. Initiation and conduction of nerve impulse; Resting and action potential; Synapse and chemical transmission.

Muscles: Types of muscles; Ultrastructure of skeletal muscles; Molecular and Chemical basis of muscle contraction; Brief idea of tetanus and fatigue

Unit – IV

Carbohydrates Metabolism: Glycolysis, Kreb's Cycle, Gluconeogenesis, Glycogenesis and Glycogenolysis; Lipids: Biological significance, structure and classification.

Unit-V

Proteins: structure and classification; Transamination and Deamination

Enzymes: types and properties, factors affecting their functions. Mechanism of enzyme Action,

Books recommended:

1. Singh & Neeraj: Graduate Animal Physiology & Biochemistry, Vishal Publ

2. Prosser and Brown: Comparative Animal Physiology, Wiley.

3. Nielson: Animal Physiology, Cambridge.

4. Jain A.K: Textbook Of Physiology 6/E, Avichal Publishing Company

5. Conn and Stumpf: Outlines of Biochemistry. John Wiley.

6. Pandey B N: B.Sc. Zoology Series-Biochemistry, Physiology, Endocrinology; Tata McGraw Hill Edu Pvt. Ltd. N. Delhi

Unit I

Structure of DNA: nucleosides, nucleotides, polynucleotide chain, Watson and Crick DNA double helix model. DNA as genetic material, Packaging of DNA, Types of DNA

Unit II

Enzymes involved in prokaryotic and eukaryotic DNA replication; Mechanism & Type of replication.

DNA damage and repair: causes and types of DNA damage, mechanism of DNA repair:

Unit III

RNA: Structure and types of RNA, Clover leaf model of tRNA,

Transcription in prokaryotes: Prokaryotic RNA polymerase, role of sigma factor, promoter, Initiation, elongation and termination of RNA chains.

Processing of pre-mRNA: 5' cap formation, polyadenylation, splicing, rRNA and tRNA splicing.

Unit IV

Biotechnology: Definition and scopes; Enzyme used in genetic engineering, Recombinant DNA technology, DNA fingerprinting. A Brief knowledge of PCR and its significance.

Biotechnological innovations in the area of medical, agriculture, industrial and forensic sciences

Unit V

General account of Cyanobacteria, fungi, yeast and viruses,

Bacteria: Structure, classification, nutrition and reproduction.

Books recommended:

1. Alberts et al.: Molecular Biology of the cell. Garland Publ., New York.

2. De Robertis- Cell and Molecular Biology

3. Friefelder: Molecular Biology. Narosa Publ. House.

4. Smith: Biotechnology. Cambridge.

5. Verma, P.S. and Agrwal, V. K. Cell Biology, Genetics, Molecular biology, Evolution and Ecology (S. Chand & Co.)

6. Tortora- Microbiology: an Introduction

A. Chordata:

Protochordata: *Balanoglossus, Herdmania, Branchiostoma, Agnatha: Petromyzon*
Pisces: *Sphyrna, Pristis, Torpedo, Labeo, Exocoetus, Anguilla, Tor putitora,* Hill stream fishes
Amphibia: *Ichthyophis/Ureotyphlus, Salamandra, Bufo, Hyla, Axolotal larva*
Reptilia: Chelone, Hemidactylus, Chamaeleon, Draco, Vipera, Naja, Crocodylus, Gavialis
Key for Identification of poisonous and non-poisonous snakes
Aves: Study of six common birds from different orders
Mammalia: Sorex, Bat, Funambulus, Loris,
An "animal album" containing photographs, cut outs, with appropriate write up about the above mentioned taxa.

B. Physiology

Preparation of hemin crystals, Estimation of Haemoglobin percentage, Blood group test
Examination of permanent slides of spinal cord, duodenum, liver, lung, kidney, bone, cartilage etc.

C. Biochemistry

Identification of unknown carbohydrates in given solutions (Starch, Sucrose, Lactose, Galactose, Glucose, Fructose)
Colour reactions to identify functional group in the given solution of proteins
Study of activity of salivary amylase under optimum conditions

D. Molecular biology and Biotechnology:

Study of Watson & Crick Model of DNA through model/photographs
Study of Clover leaf structure of tRNA through model/photographs
Agarose gel electrophoresis of genomic DNA & plasmid DNA
Preparation of restriction enzyme digests of DNA samples

E. Microbiology

Media preparation and sterilization, Gram's staining of Bacterial Cell

Distribution of marks: Duration 4 hrs.

1. Spotting (05) 15
2. Exercise on Molecular Biology/Biotechnology 05
3. Exercise on Immunology 05
4. Exercise on Microbiology 05
5. Record and Collection 05
6. Viva Voice 05
7. Sessional Marks 10

Total 50

Sri Dev Suman University, Badshahithaul, Tehri Garhwal
B.Sc. 3rd Year (Zoology)
Paper 7th: 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.

Sri Dev Suman University, Badshahithaul, Tehri Garhwal
B.Sc. 3rd Year (Zoology)
Paper 8th: 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

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 9th: 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, thmus, 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 CO2, 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 bhaviour/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