वीर कुँवर सिंह विश्वविद्यालय, आरा

CONTENTS

B. Sc. PART – I

GENERAL, SUBUSIDIARY AND HONOURS

■■■

वीर कुँवर सिंह विश्वविद्यालय, आरा

CONTENTS

B. Sc. PART – II

GENERAL, SUBUSIDIARY AND HONOURS

■■■

वीर कुँवर सिंह विश्वविद्यालय, आरा

CONTENTS

B.SC. PART-III

GENERAL, SUBSIDIARY AND HONOURS

❖❖❖

B.Sc. BOTANY HONOURS

There shall be eight papers each consisting of 100 marks.

B.Sc. Part-I

(BOTANY HONOURS)

There shall be two theoretical papers each carrying 75 marks and one practical paper carrying 50 marks.

Paper-I

Time : 3 Hours Full marks : 100

The paper will consists of ten questions. Out of which question No. 1 will be of objective type and compulsory, covering the entire syllabus. Remaining 9 questions has to be set from all the five groups : Four questions have to be answered besides, Questions No.1, selecting one question from each group.

1. PLANT KINGDOM :

Group-1. Classification of Plant Kindow and criteria lease on mayer`s sellen kingdoms Biodiversities of plant, orgin evolution and phylogeny of land plant

Group-2 General Characters, Classification, evolutionary trends, Ultra structure of Algal cell and economic importance of Algae, Salient features and life-history of Cyanophyceae chlorophyceae-volvox, Oedogonium, Coleochaete; Xanthophyceae-Vaucheria; Phaeophyceae-Ectocarpus, Fucus and Rhodophyceae- Polysiphonia.

Group-3 FUNGI, LICHENS AND PLANT DISEASES:

General Characters, Modern classification; types of fungal spores and mode of their dispersal and their economic importance Salient features and life history of Mastigomycotina–Pythium, Phyto phthora, Zygomycotina-Mucor, Ascomycotina–Eurotium,Peziza, Basidiomycotina–Puccinia, Ustilago, Agaricus, Deiuteromycotina-Alternaria, Cercospora. General idea of Lichens, Classification and their types.

Group-4 BRYOPHYTES:

Classification and comparative account of morphology, anatomy and reproduction in Hepaticopsida-Riccia and Marchantia; Anthoceroptopsida-Anthoceros; Bryyopsida-Funaria; Evolution of sporophytes and gametophytes; ecological aspect and economic importance

Group-5 : PTERIDOPHYTES:

Salient features of primitive vascular plants; classification; comparative account of morphology, ahatomy and reproduction in Psilopsida-Rhynia and Psilotum, Luycopsida-Lycopodium, Selaginella, Sphenopsida-Equistum and Pteropsida-Marsilea,

Group-6 Gymnosperms:Salient features and classification; Evolution significance, Comparative account of morphology, anatomy and reproduction in cycadopsida-Cycas, coniferopsida-Pinus, Genetopsida-Gnetum and their economic relevance.

Plant Fossils-Definition and its scope, conditions of fossilization and mode of preservation. A brief account of Lyginodendron and Williamsonia. A brief reference of plant fossils found in Bihar.

7. Anqious perm : Vnique features and diversity, Primitive and advance features.

Paper-II
CELL BIOLOGY AND GENETICS

Time : 3 Hours Full Marks :75

Ten questions has to set. Out of which Question No. 1 will be of objective type and compulsory covering the entire syllabus. Out of remaining 9 questions which has to be set from all the two groups, four questions has to be answered besides Question No.-1. selecting one from Group-A; two from Group-B and one from Group-C

Group-A : CELL BIOLOGY

1. Cell :

Historical background shape. size and structure of the cell; comparative account of Prokaryotic and Eukaryotic cell;

2. Nucleus :

Ultrastructure of nuclear envelop, unclear pore comples, matrix and nucleoplasm, DNA and histones;

3. Ribsome:

Structure of ribsomes and its functional significance in protein synthesis.

4. **Mitochondria and chloroplast:**
Origin structure, biogenesis and function of mitochonndria and chloroplast.
5. **Structure and function of other organelles:**
Golgicomplex, Endoplasmic reticulum, Lysosome, Peroxisome, Glyoxysome, Microbodies and cytoskeleton.
6. **Cell wall and Cell membrane:**
Origin, ultrastructure, chemical constituents and their functions;
7. Techniques in Cell Biology :
Principles of Light and electron microscope; chromatography; TLC GLC and HPLC, Gel electrophoresis and Autoradiography and its applications.

Group-B : GENETICS

1. Mendel`s experiments and the laws of inheritance.
2. Gene interaction and modified dihybrid ratio–Complementary. Supplementary, Duplicate, Epistatis and inhibitory factors.
3. Multiple allelisms.
4. Linkage and crossing over.
5. Balance theory of sex determination and sex linked inheritance.
6. Extra-nuclear inheritance
7. Population Genetics and Evolution : Evolution by natural selection, genes in populations: Hardy Weinberg equilibrium, Genetic diversity, Neo-Darwinian evolution.
8. Brief of Human genetics such as Genetic diseases, Genes and cancer, Gene therapy,
9. Mutation and its role in crop improvement, change in chromosome structure (Chromosomal aberrations) and change in chromosome numbers (Polyploidy).
10. Methods of crop improvement: Inroduction; pureline and mass selection; hybridization in self and cross pollinated crops; acclimatization; mutation and polyploid breeding;
11. Germplam conservation and its role in crop improvement.

PRACTICAL PAPER

Basedon Paper-I & II

Time : 4 Hours Full Mark : 50

1. Morphology and structural details of the forms prescribed in the syllabus and their temporary stained microscopic slides–
   (a) Algae–(Any two) 2+2=04
   (b) Fungi–one 03
   (c) Bryophytes–one 03
   (d) Pteridophytes–one 05
   (e) Gymnosperms–one 05
2. Study of different stages of chromosomes in Mitosis/Meiosis by smear or squash technique of onion root tip or pollen grains of flax vicia. 05
3. To study experiments on modified Mendelian ratio with the help of coloured seeds. 08
4. Emasculation and pollination technique in the flower provided by the lot. 02
5. To comment upon the Spot (any five) 05
6. Class Records 05
7. Viva–Voce 05

B.Sc. SUBSIDIARY COURSES OF BOTANY

There shall be two papers in B.Sc. Botany subsidiary courses, each containing 100 marks which shall be opted in First (B.Sc.-I) and Secong (B.Sc.-II) years of another Honours course as described below-

B.Sc. PART-I SUBSIDIARY COURSES

There shall be one theoretical paper, carrying 75 marks and one practical paper carrying 25 marks in First year of B.Sc. Honours examinations.

Paper-I

BIODIBERSITY OF MICROBES AND CRYPTOGAMS; CYTOGENETICS AND CROP IMPROVEMENT STRUCTURE, DEVELOPMENT AND REPRODUCTION IN PLANTS

Time : 3 Hours Full Marks :75

Ten questions has to be set. Question No. 1 will be objective type and compulsory covering the entire syllabus. Remaining 9 questions have to be set from three groups (A, B, C) in which four questions are to be answered basides Question No.1, selecting at least one from each group.

Group-A

BIODIVERSITY OF MICROBES AND CRYPTOGAMS

1. General account of viruses, cyanobacteria and Mycoplasma; Structure, nutrition and reproduction in Bacteria, theri economic importance. Role of microbes in fermentation and N_2–fixation.
2. general characters, classification and economic importance; diagnostic features and life cycle of chlorophyceae–Oedogonium. Xanthophyceae–Vaucheria, Phaeophyceae–Saragassum and Rhodophyceae–Polysiphonia.
3. **Fungi:** General characters and classification; important features and life cycle of Mastigomycotina–Phytophthora, zygomycotina–Mucor, Ascomycotina–Peziza Basidiomycotina–Puccinia, Deuteromycotina–Cercospora; General account of Lichens and their economic utilizations.
4. **Bryophyta:**Structure, reproduction and classification of Hepaticopsida Marchantia, Anthoceroptopsida–Anthoceros and Bryopsida–Funaria and their economic utilization.
5. **Pteridophyta:** Structure, reproduction and classification of Psilopsida–Psilotum, Lycopsida–Selaginella, Sphenopsida–Equisetum and Pteropsida–Marsilea.

Group-B

CYTOGENETICS AND CROP IMPROVEMENT

1. Structure of the cell as seen under electron microscope; Mitosis and Meiosis; structure of chromosomes;
2. Mendelian laws of inheritance; DNA as a hereditary material and its function; Mutation; Linkage and crossing Crossing over.

Group-C

STRUCTURE, DEVELOPMENT AND REPRODUCTION IN PLANTS

1. The basic body plan of a flowering plant– mosular type of growth.

2. Shoot system: Meristems, Initation, activity and functions of cambium; Amomalous secondary in Boerhaavia and Dracaena; Root-stem transition and Periderm.
3. Embryological development: Development of anther, pollengrains, embryosac, fertilization, endosperm and embry;
4. Significance of seed.
5. Vegetative reproduction: Vegetative propagation, grafting, economic aspects.

PRACTICAL PAPER BASED ON

Paper-I

Time : 3 Hours Full Marks :25

1. Observation of disease symptoms in hosts infected by Virus, Mycoplasms and fungi, section cutting of diseased material and identification of the pathogens (of the Genera mentioned in theory paper) 05
2. Morphology and structural details of Algae, fungi, Bryophyta, pteridophyta, included in theory paper and identifications 05
3. Study of different stages of mitosis/meiosis or study of Primary and secondary (both. normal and abnormal) structures of roots and stems of angiospermic plants.

   Or, To study the structure of anther and pollen grains or ovule and embryo sac development or simple experiments to show vegetative propagation–leaf cutting in Bryophyllum, stem cutting in rose/ sugarcane. 05
4. To identify and Comment upon forms I-V 05
5. Practical records 05
6. Viva-Voce 02

B.Sc. GENERAL COURSE OF BOTANY

There shall be three papers in B.Sc. Botany General Course, each containing 100 marks.

B.Sc. Botany : Part-I

(GENERAL)

There shall be one theoretical paper carrying 75 marks and one practical paper carrying 25 marks in First year examinations

Paper-I

BIODIVERSITY OF MICROBES, CRYPTOGAMS, CELL BIOLOGY, GENETICS AND PLANT DISEASES

Time : 3 Hours Full Marks :75

Ten questions have to be set. Question No. 1 will be objective type and compulsory covering the entire syllabus. Remaining 9 questions have to be set from four groups (A&D, B,C) out of which four questions have to be answered besides question No. 1, selecting at least one from each group.

Group-A

BIODIVERSITY OF MICROBES

1. General account of viruses, Cyanobacteria and mycoplasma; Structure, nutrition and reproduction in Bacteria; their economic importance, Role of microbes in agriculture and industries.

Group-B
CRYPTOGAMS

1. **Algae:** General characters, classification and economic importance; Diagnostic features and life cycle of chlorophyceae- volvox, Oedogonium, Xanthophyceae–Vaucheria, Phaeophyceae– Ectocarpus and Rhodophyceae–Polysiphonia.
2. **Fungi:** General characters and classoification Important features and life cycle of Mastigomycotina–Phytophthora, Zygomycotina–Mucor, Ascomycotina–Peziza, Basidiomycotina–Puccinia, Deuteromycotina–Cercospora, General account of Lichens and their economic utilizations.
3. **Bryophyta:** Structure, reproduction and calssification of Hepaticopsida–Marchantia, Anthoceroptopsida–Anthoceros and Bryopsida Funaria and their economic utilizations.
4. **Pteridophyta:** Structure, preproduction and classsification of Psilopsida–Psilotum; Lycopsida–Selaginella, Sphenopsida–Equisetum and Pteropsida–Marsilea.

Group-C
CELL BIOLOGY & GENETICS

1. Structure of the cell and cell organelles; Mitosis and Meiosis, Physical and chemical structure of chromosomes.
2. Mendelian laws of inheritance; DNA as a hereditary meterial; structure, replication and function of DNA and RNA
3. Linkage and Crossing over
4. Mutation
5. Polyploidy

Group-D
PLANT DISEASES

Etiology, symptoms and centrol of important plant diseases of Bihar–

(a) Tobacco mosaic virus
(b) Late blight of Potato
(c) Rust of wheat
(d) Red rot of sugarcane

PRACTICAL PAPER BASED ON
Paper-I

Time : 3 Hours Full Marks : 25

1. Observation of disease symptoms in hosts infected by virus.Mycoplasma and fungi; section cutting of diseased material and identification of the pathogens as per general mentioned in theory paper. 05
2. Morphology and structural details of Algae, Fungi, Bryophyta, Pteridophyta inclued in the syllabus of the theory paper and their temporary slide preparation and identification 05
3. Study of different stages of mitosis/meiosis. 05

B.Sc. Part-II :

Botany Honours

There will be two theoretical and one practical paper in second year B.Sc. Part-II examination carrying 75 marks in each theory paper and 50 marks in practical paper.

Paper-III

PLANT PHYSILOGY AND ECOLOGY

Time : 3 Hours Full Marks : 75

The paper will consist of ten questions, out of which Question No. 1 will be objective type and compulsory covering the entire syllabus. Outremaining 9 questions five questions shall be from Group-A and four from Group-B.Four questions has to be answered besides Question No. 1 selecting at least two questions from each groups.

Group-A : PLANT PHYSIOLOGY

1. Physiology of Plant Cell : Colloidal system, imbibition, diffusion, osmois and plasmolysis.
2. Plant-water relationships : water potential and chemical potential, transpiration and its significance, factors affecting transpiration, mechanism of stomatal movement.
3. Mineral nutrition : Criteria of essentiality of elements, macro and role of micronutrients, essential elements, mineral deficiency and plant disorders, nutrient uptake and transportmechanisms,
4. Photosynthesis:Historical background and its significance, structure of photosynthetic apparatus, photosynthetic pigments, accessory pigments reaction centre complexes, photochemical reactions, photosynthetic electron transport, phtophosphory-lation, the calvin cycle- C_4cycle
5. Respiration: Glycolysis, TCA cycle and its regulation,electron transport system, pentose phosphate pathway ,cyanide-resistant respiration.
6. Transport of organic substances:Mechanism of translocation in the phloem.
7. Nitrogen metabolism : Biologogical nitrogen fixation, reduction of N_2 into ammonia, nif-genes, regulation of nitrate reductase and nitrogenase, nitrate and ammonium assimilation.
8. Growth and development : General aspect of definitions, Phases of growth, kinetics of growth, physiology of dormancy and seed germination, concept of photoperiodism,
9. Physiology of flowering : Florigen concept of phytohormones and their role, vernalization, senescence and fruit ripening. physiological role and mechanism of action of phytohormones-Auxins, Cytokinins, Gibberellins, Abscisic acid and Eethylene, phytomorphogenesis, phytochrome, their role and mechanism of action. Signal transduction-basic concept, plant movement-tropic and nastic, Biological clock

Group-B: ECOLOGY

1. **Introduction :** Ecological factors (Biotic and abiotic) ecological amplitude, triggering factors-soil, water and atmosphere.
2. **Ecological adaptation:**Ecological groups of plants : Hydrophytes, Xerophytes, Halophytes.
3. **Community :** Definition, composition, development of community and its structure, Method of study of communities, Succession such as hydrosere, lithosere.
4. **Ecosystem :** Concept, component and organization, energy flow, ecological efficiencies, cycling of C, N and P, characterization and structure of ecosystem, biotic and abiotic components, their inter-relationships, the trophic organization, auto trophy, heterotrophy, parasitism and detritus, food chain, food web and ecological pyramid.
5. **Flow of Energy and materials :** Flow of energy and materials within ecosystem, models of energy flow, ecosystem productivity, biogeochemical cycles, major types of ecosystem.
6. **Phytogeography :** General principles, vegetation in India.
7. **Soil :** Types of soil in India water hodding capacity, soil conservation & relclamation

Paper-IV
DEVELOPMENT OF PLANTS AND THEIR UTILIZATIONS

Time : 3 Hours Full Marks : 75

Ten questions has to be set. Out of which Question No. 1 will be of objective type and complusory the entire syllabus. Out of remaining 9 questions. There will be five questions from Group-A and four from Group-B. Four questions has to be answered besides Question No.-1 selecting at least two questions from each group.

Group-A : DEVELOPMENTS OF PLANTS

1. **Organization of the higher plant body :**
   The shoot and the root system, variations in habit and longevity; environmental influences.
2. Meristems and development: Theories of shoot and root apical meristems, lateral meristems and their functions,
3. Range of forms and structure of root, stem and leaf, their tissues and functions, mechanical tissues, organization of tissues in relation to environment.
4. Secondary growth in Plants : Vascular cambium, secondary xylem (basic structure of wood), secondary Pholem and Periderm, Anomalous secondary growth (Boerhaavia, Mirabilis Achyranthes, Nyctanthes, Dracaena).
5. **Embryology and Developmental Processes:**
   Microsporogensis and development of male gametophyte, megasporogenesis and development of female gametophyte, endosperm (morphological nature) and embryogeny. An outline of experimental embryology-anther and embryo culture.

Group-B : PLANT RESOURCE UTILIZATION

1. Plant biodiversity: Concept, status utilization in India.
2. Origin of crop Plants and historical perspective of economic Botany and Ethnobotany.

3. **Domestical of Plants:** Primary and secondary centres of biodiversity, new introduction.

4. General account of **Seeds producing oils-** mustard, groundnut, soyabean and coconut, Pulses- Chickpea (Bengal Urad Gram), red gram (Arhar), gram, pea, masoor and mung, cereals-rice, wheat, maize, sorghum, bajara, sugar yielding-sugarcane, fibre yielding cotton, jute, coir, **Vegetables**-potato, brinjal, Timber and firewood-any ten species of your locality, Medicinal plant species at least 10 species of your locality locality Rubber yielding plants, essential oil yielding plants.

5. Ornamental Plants : Familiarity with seasonals and perennials species grown in your locality.

6. Recycling of wastes and biogas resources.

PRACTICAL PAPER

Based on Paper-III& IV

Time 4 Hours Full Marks-50

1. Experiments based on (i) Osmosis, Diffusion, Transpiration, photosynthesis, Respiration (ii) Separation of chloroplast pigments by either paper chromatography or solvent method

   OR

   To extract enzymes and to study their activity-amylase, lipase, acid phosphatase catalase and peroxidase.

   OR

   Bioassay of plant hormones-auxin, ethylene, G.A., ABA and cytokinin. 12

2. Determination of the minimum size of the quadrate by species area curve method.

   OR

   To study ecological adaptations in plants

   OR

   To study selected soil properties such (any one) as texture, pH, carbonate, nitrat base deficiency and reductivity. 12

3. Internal anatomy of Primary and secondary structure of angiospermic plants-normal and abnormal characters.

   OR

   Embryo dissection (e.g Tridax procumbens) 12

4. To comment upon spots (1-6) based on developments of plants and plant resource utilizations 06

5. Class records 05

6. Viva-voce 03

B.Sc.-II

BOTANY

SUBSIDIARY COURSES

There shall be one theoretical paper carrying 75 marks and one Practical paper arrying 25 marks in B.Sc. Subsidiary-II examinations as mentioned below

PAPER-II

BIODIVERSITY OF SEED PLANTS AND THEIR SYSTEMATICS; UTLIZATION OF PLANTS; PLANT-PHYSIOLOGY AND ENVIRONMENTAL-BIOLOGY

ime : 3 Hours Full Marks : 75

Ten questions has to be set. Question No. 1 will be objective type and compulsory overing the entire syllabus. Remaining 9 questions have to be set from three groups A,B,C) in which four questions are to be answered besides Question No.- 1 selecting t least from each group.

Group-A

BIODIVERSITY OF SEED PLANTS AND THEIR SYSTEMATICS

1. **Gymnosperms :** Origin, evolution and classification, Biodiversity; Geological time scale; fossilization and fossils.
2. Morphology of Vegetative and reproductive parts; Anatomy of root, stem and leaf; Reproducting and life cycle of Pinus, Cycas and Gnetum; their economic value.
3. Angiosperms :Origin and evolution, characteristic features of primitive angiosperms; Important rules of plant nomenclature (Binomial nomenclature)
4. Salient features of system proposed by Bentham and Hooker; Hutchinson
5. Diversity in members of the families : Ranunculaceae, Rutaceae, Apiaceae, Apocyanaceae, Asclepiadaceae, Lamiaceae, Chenopodiaceae, Euphorbiaceae and Poaceae

Group-B

UTILIZATION OF PLANTS

1. Food crops : Rice, Wheat, Maize, Potato, Sugarcane.
2. Vegetable oils : Mustard Coconut, Groundnut.
3. Pulses : Gram, Arhar, Mung, Masoor.
4. Forest Wealth of Bihar with reference to timber yielding plants.
5. Important yielding plants of your region.
6. **Beverages :** Tea and Coffee.
7. Rubber.

Group-C

PLANT PHYSIOLOGY AND ENVIRONMENTAL BIOLOGY

1. Transpiration: Role of major and minor elements
2. Enzymes : Nature, types and Properties
3. **Photosynthesiis:**Photophosphorylation, Calvin Cycle.
4. Respirations : Glycolysis, Kreb`s Cycle.

5. Nitrogen fixation
6. Plant and environment : Water, soil, atmosphere, light, temperature and biota.
7. Morphological, anatomical and physiological responses of plantsto water (hydrophytes and xerophytes), temperature (vernalization), light (photoperiodism) and salinity.
8. Plant community and ecosystems; succession-Hydrosere and Xerosere.
9. **Pollutions :** Soli, water and Air.

PRACTICAL PAPER BASED ON PAPER-II

Time : 3 Hours Full Marks : 25

1. Morphological and anatomical study of Gymnosperms-Pinus, Cycas and their temporary slide preparation and identification 05
2. Description and identification of plants out of families included in the syllabus 05
3. To comment upon plant physiological experiments set up amongst-
   (a) T/A ratio.
   (b) **Ganong`s potometer :** Rate of transpiration/Farmer`s photometer–rate of transpiration.
   (c) O_2 evolved during Photosynthesis.
   (d) Moll`s experiment
   (e) Anaerobic respiration.
4. Anatomical ecological adaptation in Hydrophytes, Xerophytes, Mesophytes, Parasites and Epiphytes
   OR Comment upon spots (I-V) of utilization of plants as described in syllabus 05
5. Class records 03
6. Viva-Voce 02

B.Sc. Part-II

BOTANY

GENERAL

There shall be one theoretical paper carrying 75 marks and one practical paper carrying 25 marks.

Paper-II

BIODIVERSITY OF SEED PLANTS AND THEIR SYSTEMATIC AND STRUCTURE, DEVELOPMENT AND REPRODUCTION IN FLOWERING PLANTS

Time : 3 Hours Full Marks : 75

Ten question has to be set Question No. 1 wil be objective type and compulsory covering the syllabus. Remaining 9 questions have to be set from three group (A, B) in which four questions are to be answered besides Question No. 1, selecting at least two from each group.

Group-A

BIODIVERSITY OF SEED PLANTS AND THEIR SYSTEMATICS

1. Gymnosperms : Origin, evolution and classiffication, Biodiversity, Geological time scale, fossillization and fossils.

2. Morphology of vegetative and reproductive parts; anatomy of root, stem and leaf, Reproduction and life cycles of Pinus, Cycas and Ephedra, their economic values.

3. Angiosperms : Origin and evolution, Characteristic features of primitive angiosperms, Important rules of plant nomenclature (Binomial nomenclature)

4. Salient features of systems proposed by Bentham and Hooker Hutchinson

5. Diversity of members of the families : Ranunculaceae, Rutaceae, Apiaceae, Acanthaceae, Apocynaceae, Asclepiadaceae, Lamiaceae, Chenopodiaceae, Euphorbiaceae, Cyperaceae and Poaceae.

Group-B

STRUCTURE, DEVELOPMENT AND REPRODUCTION IN FLOWERING PLANTS

1. The basic body plan of a flowering plant– Modular type of growth.

2. Shoot system : Meristems; Initiation, activity and functions of cambium, Anamolous secondary growth in Boerhaavia, Achyranthes and Dracaena, Root-stem transition and Periderm.

3. Embryological development : Development of anther, pollen grains, embryosac, fertillization, endoperm and embryo, Brief idea of experimental embryology.

4. Signification of Seed.

5. **Vegetative reproduction :** vegetative Propagation, grafting economic aspects.

PRACTICAL PAPER BASED ON

Paper-II

(GENERAL)

Time : 3 Hours Full Marks : 25

1. Morphological and structural details of Gymnosperms included in the syllabus and their temporary slide preparation. 04
2. Description of Angiospermic plants belonging to the families described in the syllabus of theory paper and their identification upto family level. 04
3. Study of primary and secondary (both normal and abnormal) structures of roots and stems of angiospermic plants. 04
4. Study the structure of anther and pollen grains or ovule and ambryo sac development. 03

   OR Simple experiments to show vegetative propagation–Leaf cuttings in Bryophyllum, stem cutting in rose/sugarcane. 03
5. To identify and comment upon forms (I-V) 05
6. Practical records 03

   Viva-Voce 02

B.Sc. Part-III
BOTANY HONOURS

There would be three theoretical and one practical papers in B.Sc. Part-III examinations carrying 100 marks in each paper.

Paper-V
BIOCHEMISTRY-MOLECULAR-BIOLOGY AND BIOTECHNOLOGY

Time : 3 Hours Full Marks : 100

Ten questions has to be set. Question No. 1 will be objective type and :ompulsory covering the entire syllabus. Remaining 9 questions have to be set from three groups (A,B,C). Four questions are to be answered besides Question No. 1, selecting at least one from each group.

Group-A BIOCHEMISTRY :

1. Cellular **Chemistry** : Covalent and non covalent interactions; Hydrogen -bond ; stucture properties and biological significance of water ; pH and its significance; Buffers, (Both inorganic and orgainc) and its importance;
2. **Energy flow and enzymology :** Concept of free energy, energy transfer and redox potential;Classification and nomenclature of enzymes mode of action enzymes as biocatalysts; isoenzymes
3. **Nucleic acids :** Composition of nucleic acids and synthesis of nucleotides; DNA Structure - A,B & form of DNA; Denaturation and renaturation of DNA replication, DNA polymerases Different from of RNA and their roles.
4. **Aminoacids and protein** :Metabolism stucture characteristics and classification of aminoacids ;protein and non protein aminoacids; Types and structure of Proteins; Protein biosynthesis and its regulation.
5. **Carbohydrate:** Metabolism Classification and structure of various types of carbohydrates; biosynthesis and degradation of sucrose and starch. Lipid:Metabolism Saturated and unsaturated fatty acids, biosynthesis of fatty acids, Oxidation of fatty acids. Storage and mobilization of-fatty acids and liquids.

Outline of secondary plant metabolites and their roles.

Group-B MOLECULAR BIOLOGY

1. DNA as genetic material : (Both Prokaryotes and Eukaryotes)
2. **Genetic code ;**
3. **Gene structure expression and regulation:** Gene concept; Organization of gene in Prokaryotes and eukaryotes; Operon concept; Gene regulation (Lac operon and tryp operon)
4. Interrupted genes; RNA Splicling
5. **Recombinant DNA Technology :**
   'Role of Vectors, Restriction enzymes; Cloning Strategies genomic andc-DNA libraries; Southern and Northern blots; Polymerase chain reaction; DNA fingerprinting.

Group-C : PLANT-BIOTECHNOLOGY

1. Basic concept and scope of plant Biotechnology.
2. Plant cell and tissue culture: History, scope, concept of cellular differentiation and totipotency.
3. Organogenesis and embryogensis : Fundamental aspects
4. Somatic hydridization: Isolation and culture of protoplast
5. Application of Plant tissue culture: Clonal propagation, elementary knowledge of conservation and storage of germplasm
6. **Genetic engineerings** of Plants:Aims and development of transgenic plants; Agrobacterium as a natural genetic engineer.

Paper-VI

MICROBIOLOGY, PLANT PATHOLOGY AND AEROBIOLOGY

Time; 3 Hours Full Marks :100

Ten questions has to set. Question No. 1 will be object type and compulsory covering the entire syllabus . Remaining 9 question have to be set from two groups (A,B) in which four question are to be answered besides Question No. 1 selection at least one from each group.

Group-A

MICROBIOLOGY

1. **Discovery of microorganisms:Systematic** position of micro organisms in biological world ; classificaton and characteristic features of various group
2. Methods in microbiology : Sterilization methods; Preparation of culture media. Technique of isolation of microorganism, Staining of Bacteria.
3. Ultra structure of microorganism:Structure and nature of TMV and Bacteriophage-T4 structure of Bacterial cells, General account Mycoplasma and Actinomycetes.
4. Nutrition in Bacteria

5. Genetic recombination in Bacteria.
6. Role of microorganism in biogeochemical cylings of N_2 and C cycle; Biological N_2,-fixation
7. **Industrial application of microorganisms:** Organic acids, Alcohol, Food processing, Milk Products, Antibiotics, Biopesticide- Preparations, Products from Genetically engineered microbes.
8. Microbial degradation of food grain in storage.

Group-B

PLANT PATHOLOGY

1. General account of diseases caused by plant pathogens
2. Role of toxins and enzymes in plant diseases.
3. Important plant diseases of Bihar, Its etiology and control:
   (a) Rust disease of wheat.
   (b) Smut disease of wheat.
   (c) Blast disease of rice juice.
   (d) White rust of crucifers
   (e) Late blight of Potato
   (f) Wilt of Arhar
   (g) Tobacco Mosaic virus,
   (h) Tundu disease of wheat.
   (i) Citrus Canker
   (j) Little leaf of Brinjal
4. Definition, scope and concept & Aerobiology
5. Morphology & common, airborne biopartic lates pollen grains & fungas spores.
6. A brief idea of allergic and respiratory diseases-Asthma and rhinitis,

Paper-VII

SYSTEMATICS OF ANGIOSPERMS AND ENVIRONMENTAL BIOLOGY

Full Marks : 100

Time : 3 Hours

Ten questions has to be set. Question No. 1 would be objective type and compulsory covering the entire syllabus. Remaining 9 Questions have to be set from two groups. Four questions are to be answered besides Question No. 1, selecting not more than two from any group.

Group-A

SYSTEMATICS OF ANGIOSPERMS

1. Introduction : Definition of systematics, aims and components of systematics, its significance, Origin of systematics with some exploration from Indian old treatises and modern systems of classifications.

2. Systematics in Practice : Importance of herbarium specimens and their preparations, Role of herbaria and Botanical gardens; Keys for identification of plants.
3. Botanic nomenclature : Binomial nomenclature; ICBN principles Rules, Rank and names, Type methods, Principles of priority and its limitations, Names of hybrids and cultivars.
4. Phylogeny of angiosperms: A general account of the origin and evolution of angiosperms.
5. **System of Classification** : Bentham and Hooker's system, Hutchinson's system and Cronquist's system.
6. **Modern trends in systematics** : Taxonomy in relation to morphology, anatomy, embryology.
7. **A comparative account of the diagnostic features relationship; and economic importance of the following families:**
   Magnoliacease, Ranunculaceae, Nyctaginaceae, Amaranthaceae, Euphorbiaceae, Cucurbitaceae, Rubiaceae, Scrophulariaceae, Acanthaceae, Cyperaceae and Poaceae.

Group-B
ENVIRONMENTAL BIOLOGY

1. **Introduction** : Definition of environmental biology, the components and dynamisms, homeostasis, relevance in welfare of human society.
2. **Earth as system** :Biosphere (Biomes)-hydrosphere, atmosphere and lithosphere;
3. **Environment** : Definition and concept; general account ana adaptations-water, soil and atmosphere, Components of environment-abiotic and bioticindividuals, species, Populations, communities and their characteristics.
4. **Impact of human activity:**Pollution of water, soil and air, a brief account of environmental toxicology; incidence of noise pollution; Prevention and control of pollution; Global warming and Ozone depletion Bjomagnification.
5. Role of national and international organizations in environmental management ; Formulation of optimal models.
6. Bio-indicators.

Paper-VIII
PRACTICALS BASED ON
Paper-V, VI & VII

Time : 6 Hours Full Marks : 100

1. Chemical tests to demonstrate the presence of any one of the following: starch, sugar, fat, alkaloids, flavonoids, tannins and protein in plant materials.

   Or

   To identify the amino acids in a mixture by resolving through paper chromatography or TLC 15
2. Colorimetric estimation of DNA using diphenyleamine/RNA using orcinol. 15
3. Preparation of media for tissue culture, sterillization and inoculation of Plant material.

   Or Demonstration of techniques of in vitro culture of various explants. 15
4. Preparation of a solid culture medium or isolation and innoculation of Alternaria/Fusarium/CoHetotrichun or study of local microbial diseases.

   Or Identification of aerospora by cellotape method 10
5. Description of the locally available plant Genus only from the families Prescribed in the course.
6. To identify the Bacteria using method of Gram's Staining 10
7. Class records, herbaria and Tour Report. 10
8. Viva-Voce,

Part-III
B.Sc. BOTANY GENERAL

There shall be one theoretical paper carrying 75 marks and one practical paper carrying 25 marks.

Paper-III
Plant physiology, Biochemistry, Biotechnology, Ecology and utilization of Plant

Time : 3 Hours Full Marks: 75

Ten question has be set. Out of which Question 1 would be objective types compulsory. Remaining 9 Questions have to be set from two group in which four questions are to be answered besides Question. 1, selecting not more than two from any group.

Group-A

Plant physiology, biochemistry and biotechnology

1. **Plant-water relationship** : Diffusion and osmosis; absorption, transport, of water and transpiration, physiology of stomata.
2. **Mineral nutrition** :Essential macro and micro-elements and their role, mineral uptake, deficiency and toxicity symptoms.
3. **Transport of organic substance** : Mechanism of Phloem transport, source-sink relationship
4. **Photosynthesis :** Mechanism and factors; Respirations: aerobic and anaerobic (glycolysis, Kreb"s cycle and electron transport)
5. **Nitrogen metabolism:Nitrate** reduction, amino-acids. Protein-Structure and types; N_2 Fixation.
6. **Enzymes** : Nomenclature, characteristics and types of enzymes; Regulation of activity and mechanism of action.
7. **Phytohormones:** Auxins, Gibberellins and cytokinis
8. **Growth and development :** Definition, Phases of growth and development; seed germination.
9. **Movements** : Tropic movement
10. **Biotechnology** :Definition, Basic aspect of Plant tissue culture, cellular totipoteney, differentiation and morphogenesis; salient achievement in crop technology. Brief idea of Restriction enzyme, cloning vector. Products of genetic engineering.

Group-B

ECOLOGY ENVIRONMENTAL BIOLOGY AND UTILIZATION OF PLANTS

1. Plant-and environment: Water, soil, atmosphere, light, temperature and biota.
2. Morphological, anatomical and physiological responses of plants to water (Hydrophytes and Xerophytes), temperature (vernalization), light (photoperiodism) and salinity.
3. Plant community and ecosystems; succession-Hydrosere and Xerosere
4. Major vegetational types of India: Forests and Grasslands.
5. Pollutions ; Rice, Maize, Potato, Sugarcane
6. Food Plants: Rice,maize, Potato, Sugarnace.
7. Fibres : Cotton and jute

8. Vegetable Oils : Mustard, Coconut, Groundnut
9. Pulses : Gram, Arhar, Masoor, Mung.
10. Forest weath of Bihar with reference to timber yielding plants
11. Important drug yielding plants of your region
12. Beverages : Tea & Coffee
13. Rubber

PRACTICAL PAPER BASED ON

Paper-III

Time:3 Hours Full Marks:25

1. Ecological adaptation in Hydrophytes, Xerophytes ,Mesophytes. Parasites and Epiphytes

   Or To detemine minimum size of quadrates repaired for reliable estimate of biomass in grasslands 05

2. Study of pH of different types of soil with the help of pH meter. 05

Or To measure dissolved O2 content in pollued and unpolluted water-samples.

3. Test for carbohydrate. Protein, amino acids and lipids. 05

   Or Comparer the rate of transpiration between mesophytes and Xerophytes Or O2 is evolved during photosynthesis

   Or Compare the rate of imbibition of fatty and starchy seeds Or Compare the rate of absorption and transpiration Or Moll's experiment.

   Or Demonstation of the technique of micro propagation by using different explants e.g. axillary buds shoot meristems

4. Comment upon spots 1-4 of utilization of plants as described in syllabus 05

5. **Class records** 03

6. Viva-voce 02

Chemistry (Hons)

PAPER-I (A)

PHYSICAL CHEMISTRY

Full Marks : 50

There will be TEN questions each of ten (10) marks including Question No. 1 (one) will be of objective type and compulsory covering the entire syllabus. Three questions will be set from each group out of which FOUR to be answered selecting at least ONE from each group.

GROUP-A

1. GASEOUS STATE :

Kinetic theory of gases, derivation of kinetic gas equation, deduction of gas laws, calculation of gas constant and kinetic energy, maxwell-Botzman distribution law of velocities and energy (derivation not needed), distribution curves at different temperatures, calculation of most probable "average and root mean square velocities of molecules, Rea and ideal gases, compressibility factor, deviations from ideal behaviour of gases, equation of state for real gases. Van der Waal equation of state and its application. Boyle`s temperature, critical
Phenomenon, Law of corresponding state and reduced equation of state.

2. PHYSICAL PROPERTIES OF LIQUIDS :

Molar volume, vapour pressure, surface tension, parachor and viscosity.

3. SOLID STATE :

Types of solid, crystal forces, seven crystall systems and Bravais lattice, law of crystallography; weiss indices, miller indices and indexing of planes, crystallography and Braggs equation analysis of cubic crystal system and elementary idea of crystall defects.

GROUP-B

1. CHEMICAL EQUILIBRIUM :

Reversible and Irreversible reaction, statement of law of mass action and its kinetic derivation, equilibrium constant for homogenous and heterogeneous reactions, relationship between Kc, Kp and Kx. Le-chatelier`s principle and its applications.

2. THERMOCHEMISTRY :

Heats in chemical reactions, enthalpy, standard enthalpy changed, Hess`s law, Kirchhoff`s law, Bond energies and their calculation.

3. THERMODYNAMICS :

Thermo dynamic terms; systems, extensive and intensive properties, thermodynamic process, state functions, first law of thermodynamics. Maximum work done in a reversible, irreversible isothermal and adiabatic changes, heat capacities (Cp & Cv and relation between them).

GROUP-C

1. CHEMICAL KINETICS :

Rate of reaction, order and molecularity, expression for specific rate constant of first and second order reaction, half life period, unit of rate constants, Determination of order of reactions.

2. THEORY OF DILUTE SOLUTIONS :

Colligative properties, osmosis, osmotic pressure and its experimental

determination, Van`t Hoft factor, vapour pressure of solution and Raoult`s law, Relative lowering of vapour pressure, experimental determination of relative lowering of vapour pressure, molecular Wt determination, relation between somotic pressure and lowering of vapour pressure, ideal and non-ideal solutions and Azeotrope. Elevation of Boiling point, depression of freezing point, experimental determination, abnormal colligative properties.

3. IONIC EQUILIBRIUM :

Ionic product of water, pH, pKa, pKb, and pKw. Buffer solution, pH of buffer solution, buffer index, buffer capacity, buffer range and idea of buffer solutions in day to day life. Dissociation constant of acids and bases. Solubility product and its application in salt analysis, common ion effect. HSAB Concept.

Paper-I (B)

INORGANIC CHEMISTRY

Full Marks : 50

There will be TEN questions each of ten (10) marks including Question No. 1(one) will be of objective type and compulsory covering the syllabus. Three questions will be set from each group out of which FOUR to be answered selecting at least ONE from each group.

GROUP-A

1. ATOMIC STRUCTURE :

Bohr`s Postulates and its applications. Bohr-Sommerfeld theory.

Orbital and their shapes. Question numbers. Pauli`s exclusion principle, Hund`s rule Aufbau principle. Electronic configuration of elements.

2. **CHEMICAL BONDING :**

Ionic bond; Energetics involved on ionic bond formation, Born-Haber cycle, lattice neergy, radius ration rule, Fajan`s rule, and inert pair effect. Covalent bond ;Exceptions to octet rule, sigma (s), Pi (p) and Tau (t) bond hybridization. Van der Wall`s forces and Hydrogen bonding.

3. **CLASSIFICATION OF ELEMENTS AND PERIODICITY :**

Classification of elements based on electronic configuration. Periodicity; Atomic size, atomic/ionic radii, ionisation energy, electron affinity, electro negativity, metallic character, hardness and softness, M.Pt. & B.Pt., Lattice energy and hydration energy.

GROUP-B

HYDROGEN AND HYDRIDES:

Position in P.T., isotopes of hydrogen, different forms of hydrogen, hydrides, ionicm, covalent metallic and interstitial, H_2O_2 : Preparation, properties, structure, uses and strength.

2. **PRINCIPLE OF METALLURGY:**

(a) Metallurgical terms, general methods for the extraction and refining of metals including choromatogrophic, ion exchange, solvent extraction, oxidative refinings, zone refining, Kroll`s process, Van Arkel de Boer method and Mond`s process.

(b) Chemistry of the following metals : Li, Be, Ra, Sn and Pb.

3. CHEMISTRY OF HALOGENS :

Preparation/Extraction, Oxidation states and halides. Inter-halogen compounds.

GROUP-C

1. NOMENCLATURE OF INORGANIC COMPOUNDS :
   IUPAC rule for nomenclature of inorganic compounds (Hetero and isopolyanions)
2. (a) MOLECULAR SYMMETRY :
   Symmerty elements and symmetry operations, centre of symmerty, axis of symmerty and plane of symmerty
   (b) ELEMENTARY MAGNETOCHEMISTRY :
   Types of magnetic behaviours, para, dia and ferromagnetism.
3. (a) Principles involved in the volumetric estimations of Cu++, iron and Ca++
   (b) Principles involved in the gravimetric estimation of Ni^{++}, Ba^{++} and SO_4^-

Paper-I (C)

ORGANIC CHEMISTRY

Full Marks : 50

There will be TEN questions each of ten (10) marks including Question No. 1(one) will be of objective type and compulsory covering the syllabus. Three questions will be set from each group out of which FOUR to be answered selecting at least ONE from each group.

GROUP-A

1. (a) Shapes and structure of organic molecules; hybridisation, Bond angle, bond length and bond energy, shapes/structures of methane ethane, acetylene and benzene molecules.
   (b) Nomenclature of organic compounds, acquaintance with IUPAC nomenclature of aliphatic and aromatic compounds.
2. REACTION MECHANISM :
   Cleavage of bonds, inductive effect, electromeric effect and mesomeric effect, resonance, types of reagents and reaction intermediates.
3. STEREOCHEMISTRY :
   Brief idea of geometrical and Optical Isomerism.

GROUP-B

1. Study of the following compounds:
   (a) **Alcohol :** Monohydric, dihydric, trihydric and unsaturated alcohols.
   (b) Aldehydes and Ketones.
2. Study of the following compounds :
   (a) Carboxylic acids, mono and dicarboxylic acids.
   (b) Organometallic compounds of Mg and its synthetic application
   (c) Amines and Urea.
3. Aromaticity and Structure of Benzene Monosubstituted benzene derivatives, orientation and directive influence of different group in benzene.

GROUP-C

1. ANALYTICAL ORGANIC CHEMISTRY :
   (a) Qualitative and quantitative estimation of C, H, N, S, P and Halogens in organic compounds.
   (b) Molecular weight determination of organic acids by silver salt method and organic based by Platinichloride method.

2. PURIFICATION OF ORGANIC COMPOUNDS:

Different method of purification of organic compounds and criteria of purity, Chromatography.

3. (a) Synthetic fibres, Rubber and Plastics.

(b) Soaps and detergents including chemistry of their actions.

B.Sc. CHEMISTRY (Hons)

Paper-II

PRACTICAL

Time : 6 Hours Full Marks : 50

1. Inorganic mixture analysis
   Six redicals inclusive of interfering radicals. 25
2. Organic Detection : Detection of Nitrogen in Organic Compounds.
   Detection of the following functional groups in organic compounds-
   (i) –OH (Phenolic) (ii) –CHO
   (iii) >C=O (iv) –COOH
   (v) $-NH_2$ (vi) $-NO_2$ 15
3. Note book and viva-voce. (5+5)

Chemistry (Sub & Gen)

B.Sc. Part-I

Full Marks : 75

There will be TEN questions each of fifteen (15) marks including Question No. 1 (one) will be of objective type and compulsory covering the entire syllabus.

Three questions will be set from each group out of which FOUR to be answered selecting at least ONE from each group.

GROUP-A

PHYSICAL CHEMISTRY

1. GASEOUS STATE :

Kinetic theory of gases; postulates, derivation of kinetic gas equation, deduction of gas laws, calculation of gas constants and kinetic energy. Real and ideal gases. Deviations from edeal behaviour and van der waals equation of state.

2. THERMOCHEMISTRY :

Heat in chemical reactions, enthalpy, standard enthalphy changes, Hess`s laws, Kirchhoff`s law, Bond energies and determination.

3. IONIC EQUILIBRIUM :

Ionic product of water, pH, pKa, Pkb, Pkw, Buffer solution, idea of role of buffer solution in day to day life. Solubility product and its applications in salt analysis, common ion effect, conductance, specific conductance equivalent conductance and molar conductance.

4. COLLIGATIVE PROPERTIES :

Collogative properties, osmosis, osmotic pressure and its determination, vapour pressure, Raoult`s law of lowering of vapour pressure. Relation between Osmotic pressure and lowering of vapour pressure. Elevation of Boiling point and depression of freezing point.

GROUP-B
INORGANIC CHEMISTRY

1. ATOMIC STRUCTURE :

Bohr`s postulates and explanation of hydrogen spectra, shapes of orbitals. Quantum numbers. Paulis exclusion principle. Hund`s rules, Aufbau principle, Electronic configuration of elements.

2. CHEMICAL BONDING :

Ionic and covalent bonds, Sigma (s) Pi (p) and Tau (t) bonds, hybridisation.

3. Chemistry of following elements–

Li, Sn, Pb, Fluorine, Chlorine and iodine

4. ISOTOPES :

Brief idea of detection and separation of isotopes, tracer techniques, radiocarbon dating.

GROUP-C
ORGANIC CHEMISTRY

1. STRUCTURE AND MECHANISM :

Hybdrisation, bond angle, bond length, inductive effect, electromeric effect and mesomeric effect, bond fission and fission products. Elementary idea of reagents and types of reactions.

2. NOMENCLATURE :

Acquaitance with IUPAC nomenclature of aliphatic and aromatic compounds.

3. Study of following compounds–
   (a) Alcohols; monohydric and Glycerol.
   (b) Grignard reagent.
   (c) Aldehydes and ketones.
4. Purification of organic compounds; criteria of purity and chromatography.

B.Sc. Part-I
(Sub & Gen.)
CHEMISTRY PRACTICAL

Time : 5 hours Full Marks :25

1. Inorganic mixture analysis with four radicals with our Interferring radicals 12
2. Organic Detection –Detection of Nitrogen in Organic Compounds. Detection of the following functional groups in organic compounds– 8

   (i) OH (Phenolic) (ii) CHO
   (iii) >C=O, (iv) –COOH,
   (v) $-NH_2$ and (vi) $-NO_2$
3. Record of Class work and viva-voce. 5

B.Sc. Part-II
Paper- III (A)
CHEMISTRY (HONS)

Full Marks : 50

There will be TEN questions each of ten (10) marks including Question No. 1 (one) will be of objective type and compulsory covering the entire syllabus. Three questions will be set from each group out of which FOUR to be answered selecting at least ONE from each group.

GROUP-A

1. SOLID STATE:

Lattice energy, its calculations and applications, crystal structure of NaCl, KCl Zns and diamond, Radius ration rule and co-ordination numbers.

Properties of solids: Magnetic properties, Electrical properties and Dielectic properties, Idea of liquid crystals.

2. **COLLOIDS:**

Definitions, classification. Lyophilic and Lyophobic colloids, Preparation of colloids; peptization, purfication of colloids Dialysic, properties of colloids, Brownian Movement, Tyndall effect, electrophoresis,Origin of charge, electrokinetic potential, size determination,coagulation,Hardy schulze rule, Protection of Colloids Goldnumber, Gel, Emulsion and Mecelles.

3. **CATALYSIS :**

Definition and classification of catalyst, characteristics of catalyst, theory of catalysis, acid-base catalysis, auto-catalyisis enzyme catalysis, zeolite catalysis, promoter, inhibitors, catalytic Poison.

GROUP-B

1. THERMODYNAMICS:

Second law of thermodynamics, Carnot theorem, Cornot Cycle, Entropy and its probability entropy change for reversible and irreversible processes and ideal gases, entropy of mixing of ideal gases, free energy and work function, criteria of chemical reactions, Gibbs-Helmholtz equation, clausius-clapeyeron equation and its applications.

2. **PHASE EQUILIBRIUM:**

Phase rule, terms and derivation, one component water and Sulphur systems, two component solid and liquid systems (Ag-Pb; Mg-Sn, Kl-H_2O, $FeCl_3$–H_2O), Eutectic mixture, azeotropic mixture, congruent and incongruent compounds.

3. **DISTRIBUTION LAW:**

Nernst distribution law, Factors affecting partition co-efficient, thermodynamic derivation, limitations and applications, modification in case of association dissociation and chemical change.

GROUP-C

1. CHEMICAL KINETICS:

Effect of temperature on reaction rate (Arrhenius equation), effect of catalyst on reaction rate. Energy of activation and its determination. Experimental measurement of order in acid catalysed hydrolysis of methyl acetate, saponification of ester and inversion of cane sugar, first order gas phase reaction (LindemannTheory)

2. CONDUCTANCE:

Conductance of electrolytes, cell constant, specific conductance, equivalent conductance and 'Molar conductance, effect of dilution on various types of conductance and their measurement. Kohlrausch`s law independent migration of ions and its applications, conductometric titration.

3. IONIC EQUILIBRIUM:

Ostwald`s Dilution Law, Determination of dissociation constant of acetic with the help of conductance measurement, Relative strength of acids and bases, salt hydrolysis constant, degree of hydrolysis. Application of conductance measurement; solubility product, degree of ionisation and ionic product of water. theory of acid base indicators.

Paper-III (B)
INORGANIC CHEMISTRY

GROUP–A

1. ATOMIC STRUCTURE :

Determination of electronic charge and e/m ratio. Bohr frequency condition, Dual nature of electrons, Uncertainty principle. idea of ground state term symbols. Excited state term symbol for d^2 system

2. CHEMICAL BONDINA:

(a) Explanation of valence Bond Theory, Qualitative treatment, simple applications, Sidgwick-Powell theory, structures of BF3, NH_3,H_2O, PCl_5, ClF_3, SF_4, SF_6, IF_7, CO_3, NO_3, SO_4, I_3^-

(b) Metallic bond-Idea of free electron theory and V.B.T.explanation, conductors, semiconductors.

3. COORDINATION CHEMISTRY:

Double salts and co-ordination compounds, I.U. P.A.C. nomenclature of co-ordination compounds including complexes with unsaturated molecules or groups and bridging group. Werner postulates, EAN rule, Valence bond theory ofCo - ordination compounds, Isomerism, Types with examples. Shapes of d-orbitals, C.F.T. and its applications, chelates.

GROUP-B

1. General chemistry, structure and bonding of--
   (a) Noble gas compounds.
   (b) Pseudo halogens and polyhhalides
2. Transition metals and comparative chemistry of--
   (a) Sc, Y, La (b) Ti, Zr, Hf
   (c) Fe, Co, Ni
3. Chemistry of Group-IV Elements :

C, Si Ge : Carbides silicates and tetrahalides idea of fullerenes and zeolites.

GROUP–C

1. SPECTROSCOPY:

Elementary idea of principles and simple applications of the following : I-R Spectroscopy, U-V and Visible spectroscopy.

2. ANALYTICAL CHEMISTRY:
   (a) Use of complexation reactions in qualitative. inorganic mixture analysis. Organic reagents in inorganic analysis: EDTA, dimethyl glyoxime, Oxine, a-nitroso b-naphthol, cupeferron, thiosalicylic acid.
   (b) Theory behind the group separation in inorganic qualitative cationic analysis.
3. (a) Outline of chemistry involved in the following and allied phenomena; cement, steel, water, fuel and industrial gases.
   (b) Idea of major chemical pollutants in environment.

Paper-III (C)
ORGANIC CHEMISTRY

GROUP–A

1. ISOMERISM :

Tautomerism, Keto-enol tautomerism, Estimation of Keto and enolic content. Stereoisomerism, projection formulae elements of symmetry, geometrical and optical isomerism, E-Z and R-S modes of nomenclature, elementary idea of cofiguration, diastereoisomerism, Asymmetry and dismmetry, walden inversion.

2. Electrophilic substitution in benzene nucleus, mechanism of nucleophilic substitution at saturated carbon.
3. Name reaction with their mechanism; Friedel-craft reactions, Sandmeyer Reactions, Gattermann-koch reactions, Cannizzaro`s reaction, Benzoin Condendation, Perkin reaction, Reimer-Tiemann reaction

GROUP-B

1. **CARBOHYDRATES :**

Nomenclature, classification, structure and configuration of glucose and fructose, Ring structure, Ruff degradation, killiani Fischer Synthesis, Osazone formation, mechanism, Epimerisation and interconversion (lower to higher carbohydrate & vice-versa, Aldose to ketose & vice-versa.

2. AROMATIC COMPOUNDS:

Aromaticity and Huckel`s rule, Preparation and properties of benzene, toluene, benzene sulphonic acid, nitrobenzene, aniline, diazonium salt, phenol benzaldehyde, Bennoic acid.

3. HYDROXY ACIDS:

Lactic acid, citric acid general methods of preparation and distinction between a and b hydroxy acids, stereochemistry of hydroxy acids.

GROUP-C

1. Synthetic applications of the following reagents in organic chemistry

Raney Ni, $LiAlH_4$, $AlCl_3$, Al $(OCH<^{CH_3}_{CH_3})_3$ and HNO_2

2. Brief introduction of TLC, Paper and gas chromatography.
3. (a) Organic polymers and resins
   (b) Brief idea of proteins.

DEGREE-II (HONOURS)
Paper-IV
CHEMISTRY PRACTICAL

Full Marks :50

[A] VOLUMETRIC ANALYSIS: 25

(1) Estimate the amount of NaOH and Na_2CO_3 each in One Litre of the supplied mixture solution with the help of standard acid solution.

(2) Estimate the amountof Na_2CO_3 and $NaHCO_3$ each in One litre of the supplied mixture solution with the help of standard acid solution.

(B) REDOX TITRATION:

(1) Preparation of N/10 $KMnO_4$ solution and its standardisation with N/10 oxalic acid solution.

(2) Estimate the amount of Fe^{2+} in one litre of the supplied Mohr`s salt solution using standard $KMnO_4$ solution.

(3) Estimate the amount of H_2SO_4 and $H_2C_2O_4$ each in one litre of supplied mixture solution using standard $KMnO_4$ solution.

(4) Estimate the amount of Fe^{3+} in one litre of the supplied solution with the help of $K_2Cr_2O_7$ solution or estimation of Ni^{2+}, SO_4^- and Ba^{2+} in one litre of the given solution gravimetrically.

(5) Estimate the amount of copper in one litre of supplied solution with the help of standerd $Na_2s_2O_3$

2. Preparation of anyone of the following– 15

(a) Acetylation of salicylic acid, aniline and P-toluidine.

(b) Benzoylation: Preparation of benzanilide and benzoyl derivative of P-toluidine.

(c) Nitration: Preparation of p-nitroacetaniliide, Picric acid and m- dinitrobenzene.

(d) Reduction :Preparation of m-nitroaniline from meta dinitrobenzene.

(e) Oxidation: Preparation of (1) Benzoic, acid from benzaldehyde and (ii)anthranilic acid from anthracene.

(f) Esterification : Prepasation of ethyl benzoate

3. Note Book and viva-voce. 10

B.Sc.Part-II
CHEMISTRY
(SUBSIDIARY AND GENERAL)

Full Marks :75

There will be TEN questions each of fifteen (15) marks including Question No.1 (one) will be objective type and compulsory covering the entire syllabus. Three questions will be set from each group out of which FOUR to be answered selecting at least ONE from each group.

1. STATES OF MATTER:

(a) Gaseous State : vander waals equation of state, units and significance of a & b, critical constants, liquefaction of gases critical constants, collision no, collision frequency,. Mean free, path, Law of Corresponding state.

(b) **Solid State:** Tyoesof cryystalline solids, Laws of crystallography lattice, unit cell and their types, Bragg`s equation, Lattice energy, Born-Haber cycle. Stoichiometric and non- stoichiometric defects in simple ionic solids.

2. **THERMODYNAMICS:**

Definition of terms : System, extensive, intensive properties first and second laws of thermodynamics. carnot theorem and carnot cycle.

3. (a) **Ionic Equilibrium** : Ostwald`s dilution law, conductance measurement of dissociation constant of acetic acid, salt Hydrolysis, idea of theory of acid base indicators.

(b) **Phase Rule :** Terms, equation (no derivation required, Sulphur-system)

4. CHEMICAL KINETICS :

Rate of reaction,order and molecularity, expression for rate constant of 1st and 2nd order re- actions, half life period and its units. effect of temp on reaction rate, Arrhenius equation.

GROUP-B

1. (a) Atomic Structure and Bondina : de Broglie`s wave equation, He is enberg uncertainty principle, Schrodinger wave equation (no derivation), wave function, Eigen value and Eigen function. Covalent Bond :Simple treatment of V.B.T., Hybridization, van derwaals forces and Metallic bonding.

   (b) Complex Compounds :

   Double and complex Salts, Werner`s Poslutales, I.U.P.A.C nomenclature complexes, Isomerism in complexes (only structural).

2. TRANSITION METALS :

General characteristics of transition metals with reference of oxidation state, complex formation, magnetic behaviour and colour of their compound.

3. CHEMISTRY OF GROUP-IV ELEMENTS : C, Si, Fullerenes and Zeolites, Major chemical pollutants in environment.

4. Chemistry of following elements and their compounds.

   (a) Fe, Co, Ni (b) Cr (c) Mn

GROUP-C

1. STRUCTURE AND MECHANISM: Different types of Isomerism, E-Z-nomenclature, Electronic substitution in benzene nucleus and mechanism of nucleophilic substitution at saturated carbon (SN^1 & SN^2).

2. NATURAL PRODUCTS :

   Carbohydrates : Nomenclature, classification, open chain structure of glucose and fructose, elementary idea of glycosides.

3. (a) Structure of Benzene, preparation and properties of benzene diazonium chloride and benzaldehyde.

   (b) Lactic Acid and Citric Acid.

4. Brief idea of polymers, resins, proteins, sulpha drugs and antibiotics.

B.Sc. Part-II
CHEMISTRY PRACTICAL
(SUBSIDIARY AND GENERAL)

Time : 5 hrs. Full Mark : 25

GROUP-A

1. VOLUMETRIC ANALYSIS :

   (a) Estimate the amount of NaOH and Na_2CO_3 each in one litre of the supplied mixture solution with the help of standard acid solution.

   (b) Estimate the amount of Na_2CO_3 and $NAHCO_3$ each in one litre of the supplied mixture solution with the help of standard acid solution .

   (c) Preparation of N/10 $KMnO_4$ solution and its standardi stion with N/10 oxalic acid solution.

   (d) Estimate the amount of H_2SO_4 and $H_2C_2O_4$ each in one litre of supplied mixture solution using standard $KMnO_4$ solution.

2. ORGANIC PREPARATION : 8 Marks
   (a) Acetylation of aniline and p-toludines,
   (b) Nitration of nitrobenzene.
   (c) Oxidation of benzaldehyde.
   (d) Hydrolysis of esters like ethyl benzoate and methyl salicylate.
3. Records of class work and viva-voce.

B.Sc. Part-III

PRACTICAL PAPER

Time : 3 Hrs Full Marks : 25

The course shall include the following examents.

1. Junction Diode Characteristics.
2. Zenor Diode Characteristics.
3. FET Characteristics
4. BJT Characteristics (Common-base)
5. BJT Characteristics. (Common-emitter)
6. Frequency response of R-C Coupled amplifer
7. Study of logic gates (AND. OR, NOR)
8. e/m by Helical method.

Chemistry (Hons)
B.Sc. Part-III
Paper-V
PHYSICAL CHEMISTRY

Full Marks: 100

There will be TEN question each of twenty (20) marks including Question No.-1(one) will be of objective ..type and compulsory covering the entire syllabus. Three questions will be set from each group out of which FOUR to be answered selecting at least ONE from each group.

GROUP-A

1. GASEOUS STATE :

Collision number, collision frequency, collision diameter and mean free path of molecules of a gas (including temperature and pressure dependence). Viscosity of gases, relation between mean free path and Co-efficient of Viscosity, temperature and pressure dependence of Viscosity (11), degree of freedom motions, principle of equipartition of energy, its use for determination of Avogardo's number.

2. SPECTROSCOPY :

Basic principles of different types of absorption, idea of IR. UV-VIS Spectroscopy.

3. PHOTOCHEMISTRY :

Basic principles, Lambert-Beer Law. Molar extinction coefficient, stark Einstein law of photochemical equivalence, primary and secondary processes, examples of low and high quantum yield. Photochemical reaction such as $H_2+Cl_2 \rightarrow HC1$, $H_2+Br_2 \rightarrow$ HBr and decomposition of HI. Phosphorescence and fluoresence.

Elementary idea of electron spectroscopy and area of its applications.

GROUP-B

1. THERMODYNAMICS:

Derivations of law of mass action, modal elevation and molal depression constants, van't Hoff reaction isochore and isotherms, Maxwell thermodynamic relations, partial molar quantities chemical potential, variation of chemical potential with temp and pressure, Chemical potential in an ideal gas mixture, Absolute entropy and third !aw of thermodynamics.

2. PHASE EQUILIBRIUM.

Three component systems, idea of sorting out triangular coordinates, partially miscible liquids and role of added salts Cl (NH_4) SO_4-H.,0. Phase diagram of cement.

3. WAVE MECHANICS:

de-Brogile equation uncertainty principle, Schrodinger wave equation and its application of H- atom (only interpretation of solution and no solution). Idea of operators.

GROUP-C

1. CHEMICAL KINETICS:

Kinetics of third order reactions, half period, and its unit, kintics of comples reaction-side reactions, opposing reactions and consecutive reaction, chain reactions.

2. ELECTROCHEMISTRY:

(a) Reversible and irreversible cells and electrodes, E.M.F. of a cell and its measurement, Galvanic cells, electrode potential and its origin, standard, electrode potential, Nernst equation, determination of electrode potential concentration cells, definition,, classification, E.M.F. of concentration cells with and without transference, liquid junction potential, application of e.m.f. measurements.

(b) Electrodes:Hydrogen electrote, calomel, electrode, quinine hydroquinone electrode, glass electrode, measurement of pH using hydrogen electrode.

(c) Transport number and its determination by Hittorf's and moving boundary methods. Abnormal transport number. Determination of men activity by e.m.f. method.

3. SURFACE CHEMISTRY:

Types of adsorption, adoption isotherms, Freundlich, Langmuir and Gibbs adoption isotherms, Limitations and applications.

B.Sc. Part-III (Hons)

Paper-VI

INORGANIC CHEMISTRY

Full Marks : 100]

There will be TEN questions each of twenty (20) marks including Qiion.m No. 1 (one) will be of objective type and compulsory covering the entire

Three questions wil] be set from each group out of which FOUR to be answered selecting at least ONE from each group.

GROUP-C

1. ATOMIC STRUCTURE:

Idea of wave mechanical model of atom, schrodinger equation and its derivation, significance of wave functions, Norman and orthogonal wave functions, Probability density pattern for H-atom (qualitative idea only and no derivation required), radial and angular wave functions, sign of wave functions.

2. CHEMICAL BONDINA :

(a) Molecular orbital method (qualitative treatment only), LCAO combinations of s-s, p-p, p-d orbitals. Rules of LCAO bonding antibonding and non-bonding orbital simpleM.O.diagrams of homonuclear diatomic molecules, calculation of bond order. Resonance.

(b) Metalic Bondina: M.O. method of explanation of bonding in metals,outline of structure of interestitial alloys and substitution alloys, super conductivity and its applications.

3. NUCLEAR CHEMISTRY :

Ground state properties of nucleus-constituents of nucleus, nuclear properties, binding energy per nucleon and-stability of nucleus, a,b and g emissions and their properties, concept of potential barrier, radioactive decay law, partial decay constant, half life and mean life periods. Features of 4n, 4n+2, 4n+3 and 4n+1 radioactive series, Nuclear fusion and stellar energy, synthesis of transuranic elements.

GROUP-B

1. General chemistry of the following elements with reference to their periodic position, important, compound their structures and uses.

(a) Nitrogen, Phosphorus, arsenic, antimony and bismuth.

(b) Oxygen, sulphur, selenium, tellurium.

2. Comparative chemistry of the following transition metals with reference to their P.T. position, oxidation states,complex formation and formation of organ metallic compounds.

(a) V, Nb and Ta

(b) Cr,Mo and W

(c) Platinum metals.

3. General Chemistry off-block elements: Electronic configuration and periodic position of lanthanides and actinides, lanthanoide contraction and consequences,magnetic properties of lanthanides.

GROUP-C

1. Organometallic Chemistry :

Definitions, nomenclature of simple organ o metallic compounds E.A.N rule ionic and electron deficient compounds, metal alkyls of group, 1,2 and 13 elements. Elementary idea of carbonyls, nitrosyls and ferrocenes.

2. Inorganic Chemistry in Biological System:

Elementary idea of the role of the following biological systems : Na, K, Mg, Ca, Fe and Co.

3. Inorganic Chains, Rings Cages and clusters:

Elementary idea of the terms involved with examples, idea of catenation and intercatation chemistry and heteropolyanions, borazenes, boranes and metal-metal bonding.

B.Sc. Part-III (Hons)
Paper-VII
ORGANIC CHEMISTRY

Full Marks : 100

There will be TEN questions each of twenty (20) marks including. Question No. 1 (one) will be of objective type and compulsory covering entire syllabus. Three questions will be set from each group out of FOUR to be answered selecting at least. ONE from each group.

1. GENERAL PRINCIPLES:

Hyperconjugation, mesomeric effect, hydrogen bond, intermediate species; their detection and characterisation, carbocation, carbanion, canbenes. nitrene and benzyne.

2. TYPES OF REACTIONS :

Nucleophilic substitution at saturated and unsaturated carbon electrophilic and nucleophilic substitution in benzene nucleus. Addition reactions:Electrophilic and nucleophilic elimination reactions- H of mahn's rule and -saytzeff s rule.

3. Name Reactions and Rearrangements (Definition & Mechanism only) Aldol condensation, kneovenagel reaction, claisen condensation, Mannich reaction, Michael reaction, Pinacol-Pinacolone rearrangement, Wagner-Meerwein Mermein rearrangement, Benzilic acid rearrangement.

GROUP-B

1. (a) Polynuclear hydrocarbons. Naphthalene, Anthracene and Phenathrene.

(b) Amino acids.

(c) Heterocyclic compounds, Furan, Thiophene, Pyrrole, Pyridine, quinolin and isoquinoline.

3.. (a) Dyes :

AZO, TPM dyes Phthalein dyes, Zanthene dyes, Vat dyes (indigo including its structure and sterochemistry).

(b) Alkaloigs and Terpenses: Brief idea of general methods of isolation and structural elucidation.

GROUP-C

1. DRUGS;
   Sulpha drugs, Antimalerials, Antibiotics, Analgesics, Pyrigenic Sedatives, Antiseptics.
2. (a) Synthelic fuels and propellants. (b) Explosives, insecticides, adhesives.
3. USES OF REAGENTS;
   HIO_4, Lead Tetra Acetate, N.B.S. Br_2 SeO_2

B.Sc. Part-III (Hons)
CHEMISTRY PRACTICAL
Paper-VIII

Time : 6 Hrs. Full Marks :100

1. Anyone experiment from the following :— 50 Marks
   (a) Determination of molecular weight of volatile liquids by victor-Meyer method,
   (b) Determination of surface tension of liquids using stalagamometer and calculation of parachor values.
   (c) Determination of co-efficient of viscosity of liquids using ostwald viscometer.
   (d) Determination of partition co-efficient of solutes between two immiscible liquids.
   (e) Determination of rate constant for hydrolysis of ester catalysed by H^+ ions at room temperature.
   (f) Determination of refractive index of liquids by Abbe refractometer and calculation of molecular refractivity.
   (g) **Thermochemistry :** Heat of solution of solute in a solvent, heat of neutralization.
2. Granmetric Analysis of any one estimation of Ag+ Cu^{2}+. Ni^{2}+, Ba^{++},Cl^- and So_4^{2} 25 Marks
3. Viva-Voce 15 Marks
4. Note book 10 Marks

B.Sc Part-III (General)
GROUP-A
PHYSICAL CHEMISTRY

Full Marks : 75

There will be TEN questions each of fifteen (15) marks including Question NO. 1 (one) will be of objective type and compulsory covering the entire syllabus. Three questions will be set from each group out of which FOUR to be answered selecting at least ONE from each group.

1. Physical properties of liquids and their application in establishing molecular structure: viscosity, surface tension and refractive index.
2. ELECTRO CHEMISTRY:
   (a) Standard electrode potential E.M.F. and application of e.m.f. measurements.
   (b) Transport number and its measurement by Hittorf's method
3. CHEMICAL KINETICS AND CATALYSIS:
   (a) Idea of side reactions, opposing reactions and consecutive reaction, Chain reactions.
   (b) Catalysis : Definition and classification, Theory of catalysis, ideas of acid base and enzyme catalysis.
4. PHOTOCHEMISTRY:
   (a) Basic principles, Lambert-Beer Law, Star-Einstein Law of Photo chemical Equivalence, H_2+Cl_2 and H_2+Br_2 reactions (only reactions) Quantum yield, Phosphore-sience, Fluorescence, Elementary idea of photoelectron spectrograph.

GROUP-B
INORGANIC CHEMISTRY

1. (a) Atomic Structure and Bonding : Idea of VBT and MOT (qualitative treatments only) MO correlation diagram for homonuclear diatomic molecules. Calculation of bond order on its basis.
   (b) Complexes: E.A.N. rule, shapes of d-orbitals, Nomenclature, Isomerism.
2. Outline of the chemistry involved in the following industries cement, fule and industrial gases.
3. Uses of organic reagents in inorganic analysis : EDTA Dimethyl glyoxime, L-nitroso, n-riapthol, cupeferron.
4. Chemistry of the following elements and important compounds.
   (a) N, P As. (b) O, S, Se.

GROUP-C
ORGANIC CHEMISTRY
STRUCTURE AND MECHANISM :

Hyperconjugation, carbonium and carbanion, carbene nitrene(imp. reactions involving nitrene formation) Addition reactions, electrophilic and nucleophilic elimination reactions, saytzeff rule. Friedal Craft .reaction, Pinacole-pinacolone rearrangement.

2. SYNTHETIC ORGANIC CHEMISTRY:
   (a) Malonic ester and use in synthesis Acetoacetic ester (MC).
   (b) Use of the following reagents in organic chemistry:
   Na, NHO, $LiAlH_4$ and $AlCl_3$
3. Aromaticity and Huckel's Rule

B.Sc. Part-III (General)
CHEMISTRY PRACTICAL
PHYSICAL CHEMISTRY

TIME :5 hours Full Marks 25

1. One experiment to be set :— 20 marks
   (a) Determination of surface tension of liquids (e.g. Benzene, Acetone, Choloroform) using stalagmometer.
   (b) Determination of Co-efficient of viscosity of liquid e.g. Benzene. Acetone, Choloroform using Ostwald Viscometer.
   (c) Determination of Partition co-efficient of solutes between two immisicible liquids.
   (d) Determination of Molecular Weight of volatile liquid by victor Meyer Method.
2. Record of class work and viva-voce. 5 Marks

COURSE OF STUDY
FOR
PHYSICS (HONOURS)
PART–I

The Course shall consist of two Theory Papers–I and II each of 75 marks. The pass marks in the two theory papers taken together will be. 67 and the examination in each will be of 3 hours duration. There will be one practical paper of 50 marks. The pass marks will be 23 and the examination will be of 6 hours duration in this paper.

The following will be detailed Course :

Paper-I
THEORY

Time : 3 Hours Full Marks : 75

10 questions to set, 5 to be answered. Question number one will be objective (15 Question) and it will be Compulsory. 2 questions will be set from group A and C each, and 5 from group B. At least one question from each group is to be answered. All questions will be of equal marks.

Group-A

SPECIAL THEORY OF RELATIVITY : 2 Questions

Galilean Transformation, Inertial frame of reference, Michelson- Morley experiment, Lorentz–Fitzyerald contraction, Einstein postulates, Lorentz Transformations and its Consequences, Length Contraction and time delation. Addition of velocities Dragging of light by moving medium, Relativistic Doppler effect for propagation of light waves, Aberration of light, Variation of mass with velocity. Mass Energy relation.

Group-B

MECHANICS AND PROPERTIES OF MATTER : 5 Question

Intertial frame and non-inertial frame of reference. Corioli`s and Centrifugal forces and their simple applications, Generalised Coordinates, Constraints (holonomic-non holonomic), D`Alembert`s Principle and Lagrange`s equations of motion, Hamiltonian`s equation of motion and their simple applications.

Gravitational potential and filed due to bodies of regular geometrical shape. Motion in Central field, Kepler`s laws, Two particle motion in a central field.

Elasticity and elastic Constants, Bending of beams and Cantilever. Torsion of cylinder and rigidity modulus by flat spiral spring, Non flat spiral spring, Effect of temperature and pressure on elasticity.

Surface tension and surface energy. Principle of virtual work and its application to surface tension, Ripples and gravity waves. Surface tension by the method of ripples. Effect of temperature and pressure on surface tension.

Perfect fluids, Equation of Continuity, Euler`s equation for perfect fluids, Bernoulli`s equation, viscosity of liquids, Critical velocity, Poiseuille`s formula with correction, Flow of a Compressible fluid through a narraw tube, Viscosity of gasses, Rankins method, Effect of temperature and pressure on viscosity.

Group-C

SOUND : 2 Question

Differential equation of waves, Equation of Progressive and stationary waves,

Compression waves in fluid and extended solids. Free, damped and forced oscillations in One dimension. Fourier`s Series and its applications to rectangular and saw-tooth waves. Vibration of strings.

Intensity and loudness of sound and their measurement. Acoustics of building.

Paper-II

THEORY

Time : 3 Hours Full Marks : 75

10 Questions to be set 5 to be answered question number One will be objective (15 Questions) and it will be compulsory. 4 Questions will be set from group A and 5 from group B. Atleast one question from group A and two from group B have to be answered. All questions will be of equal marks.

Group-A

HEAT : 4 Question

Derivation of Maxwell`s law of distribution of velocities and its experimental verification. Equilibration of energy. Mean free path.

Transport phenomean-Viscosity, Conduction and diffusion. Brownian motion–Langevin and Einstein`s Theories and experimental determination of Avogadro`s numbers.

Rectilinear flow of heat in metal rod, Conductivity by periodic flow method, Relation between thermal and electrical Conductivities. Vander waal`s equation of state from virial theorem.

Group-B

THERMODYNAMICS: 5 Question

Zeroth law of thermodynamics, Definition of temperature, First and Second law of thermodynamics, Carnot`s engine and Carnot`s theorem, Absolute scale of temperature, Classius`s inequality, Entropy, Entropy changes in reversible and irreversible processes, Enthalpy, Helmholtz and Gibb`s function, Gibb`s-Helmholtz equation , Maxwell`s equaltion and its application to simple physical problems.

Thermodynamic description of phase transition, Chemical potential, Latent heat of transition, Clapeyron equation.

Joule–Thomson effect, Liquefiction of gasses with special reference to hydrogen and helium, Production and measurement of low temperature.

Black body radiation, Kirchhoff`s law, Stefan`s law, Wiens`s Law, Planck`s law and its experimental verification.

Einstein and Deby Theories of specific heat of solids

PRACTICAL PAPER

Time : 6 hrs. Full Marks :50

The course shall include the following experiments–

1. 'g' by Kater`s Pendulum.
2. Young`s modulus by Flexure of beam.
3. Elastic Constants by Searle`s method.
4. Rigidity modulus by–
   (i) Barton`s apparatus
   (ii) maxwell`s needle.
5. Moment of inertia of Fly-Wheel.

6. Surface Tension by Jaeger`s method.
7. Surface Tension by method Ripples.
8. Surface Tension of Soap bubble.
9. Co-efficient of viscosity of gas by Rankines` method.
11. Co-efficient of viscosity of water by Capillary flow method.
12. Laws of Transverse vibrations by sonometer.
13. Frequency of Tuning Fork by Melde` method.
14. Specific heat of solid by radiation correction.
15. Specific heat of liquid by Cooling method.
16. Thermal Conductivity of Copper.
17. Thermal Conductivity of Ebonite by Lee`s Disc method.
18. Determination of 'J' by Mechanical method.
19. n of wire by dynamics method.
20. Velocity of sound by kund`s tube.

B.Sc. PHYSICS (Sub/Gen)

Part-I

The course shall consist of one Theory paper of 75 marks. The pass marks will be 23 and the examination will be of 3 hours duration. There will be One Practical paper of 25 marks. The pass marks will be 10 and the examination will be of 3 hours duration.

The following will be the detailed Courses–

Paper-I

THEORY

Time : 3 Hours Full Marks : 75

10 questions to be set, 5 to be answered. Question number one will be objective (15 Questions) and it will be Compulsory. 4 questions will be set from Group-A, 2 from Group-B and 3 from Group-C Atleast one question from each group is to be answered. All questions will be of equal marks.

Group-A

RELATIVITY, MECHANICS, GENERAL PROPERTIES OF MATTER: 4 Questions

Galilean Transformation, Inertial frame of reference, Michelson- Morley experiment, Lorentz-Fitzerald construction, Einstein postulates, Lorentz Transformation and its Consequences, Lengt Contraction and time dilation. Addition of velocities, Relativistic Doppler`s eddect for propagation of light waves, variation of mass with velocity. Mass Energy relation.

Inertial frame and non-inertial frame of reference. Corioli`s and Centrifugal forces and their simple applications. Motion in Central field. kepler`s law. generalised Coordinates, Constraints (holonomic– non-holonomic). Lagrange`s equations of motion and their simple applications.

Elasticity and elastic Constants, Relation between elastic Constants, Bending of beams and Cantilever. Torson of cylinder and rigidity modulus by flat spring. Effect of temperature and pressure on elasticity. Surface tension and surface energy. Ripple and gravity waves. Surface tension by the method of ripples, Effect of temperature and Pressure on surface tension.

Perfect fluids, Equation of Continuity, Euler`s equation for perfect fluids. Bernoulli`s equation.

Viscosity of liquids, Critical velocity, Poiseuuille`s formula with correction, Flow of a Compressible fluid through a narraw tube, Viscosity of gasses, Rankin`s method. Effect of temperature on visciosity.

Group-B

WAVES AND ACOUSTICS: 2 Questions

Differential equation of wave, Equation of Progressive waves, Stationary waves. Compression waves in fluids and in extended solids. Free, damped and forced oscillations. Fourier analysis. Vibration of string. Intensity and loudness of sound and their measurement. Acoustics of buildings Ultrasonics.

Group-C

HEAT AND THERMODYNAMICS 3 Questions

Maxwell`s law of distribution of velocities and its experimental verification. Degree of freedom and Equipartition of energy. Mean free path and its experimental verification. Perfect gas equation and Vander wall`s equation of state. Laws of thermodynamics, Absolute scale of temperature. Carnot`s engine.

Entry and its calculation in simple cases. Thermodynamics relations and their application to simple physical problems. Clausius–clapeyron equation. Joule-Thomson effect, Liquifiction of gases with special reference to Helium, Super fluidity of helium. Kirchhoff`s law and black body radiation. Stefan-Boltzeman law and its experimental verification.

PRACTICAL PAPER

Time : 3 hrs. Full Marks :25

The course shall include the following experiments–

1. 'g' by Bar Pendulum.
2. Young`s modulus by bending of beam.
3. Moment of inertia by Fly Wheel.
4. Specific heat of solid with radiation correction.
5. Specific heat of liquid by Cooling method.
6. Thermal Conductivity of copper.
7. Thermal Conductivity of Ebonite by Lee`s Disc method.
8. 'J' by joule`s calorimeter.
9. Frequency of Tuning Forks by meld`s experiment.
10. Surface Tension by Capillary tube method.
11. Elastic Constants by Searle`s method.
12. Rigidity modulus by Barton`s apparatus.
13. Rigidity modulus by Maxwell needle.
14. Laws of transverse vibration by sonometer.
15. Coefficient of viscosity by Poisseule`s method.

B.Sc. PHYSICS
Part-II
(HONOURS)

The Course shall consist of two Theory papers III and IV each of 75 marks. The pass marks in the two theory papers taken together will be 67 and the examination in each will be of 3 hours duration. There will be Two practical paper of 50 marks. The pass marks will be 23 and the examination will be of 6 hours duration in this paper.

The following will be the detailed Courses–

Paper-III
THEORY

Time : 3 Hours Full Marks :75

10 questions to be set, 5 to be answered. Question number one will be objective (15 Questions) and it will be Compulsory. 6 questions will be set from group A, and 3 from group B. Atleast one question from each group is to be answered. All questions will be of equal marks.

Group-A

OPTICS: 6 Questions

Fermat`s principle and mirror and lens formula. Cardinal points of thick lens and thick lens formula.

Interference phenomena by division of wave front and division of amplitude. Michelson Interferometer. Fabreyperot Interferometer, L.G. Plate, Echelon Grating.

Diffraction– Fresnel`s and Fraunhoffer`s diffraction, Half Period Zones. Zone Plate, Fresnel`s diffraction at straight edge and single narrow wire. Fraunhoffer`s diffraction at n slits circular aperture. Plane diffraction grating, Concave grating and Eagle`s mounting. Resolving power of Prism, Telescope and microscope.

Production of plane, Circularly and elliptically polarized light. Nicol`s prism. Quarter wave plate. Babinate`s Compensator and
analysis of elliptically polarised light. Rotatory polarisation and Polarimeter. Principle of Laser action, Ruby Laser, He-Ne Laser.

Group-B

ELECTROMAGNETIC THEORY: 3 Questions

Maxwell`s field equations, Poynting vector, Electromagnetic momentum, Maxwell`s stress Tensor, Pressure of radiation. Plane electromagnetic waves. Reflection, Refraction and total internal reflection of polarised light. Double refraction in crystals. Theory of dispersion, Optical properties of metals and dispersion in metals Scattering by free and bound charges.

Paper-IV
THEORY

Time : 3 Hours Full Marks :75

10 questions to be set, 5 to be answered. Question number one will be objective. (15 Questions) and it will be Compulsory. 2 questions will be set from group-A, 4 from group-B and 3 from group-C. Atleast one question from each group is to be answered. All questions will be of equal marks.

Group-A

ELECTROSTATICS, MAGNETISM: 2 Questions

Boundary Condition at the surface of separation of two dielectrics and refraction

of lines of force.

Scalar potential in electrostatics. The potential of system of charges. Dipole and Quadrupole moment. Energy stored in an electrostatic field. Poisson`s and Laplace`s equation in Cartesian, Polar and cylindrical Co-ordinates and their solutions for simple geometrics, Dielectric polarisation Relation between $\vec{D}$. $\vec{E}$ and $\vec{P}$.

Properties of ferromagnetic material, Hysteresis Curve, Method for obtaining B-H Curve, Energy loss per cycle of magnetisation, Magnetic flux density (B) by (a) B.G. and search coil (b) Grassot fluxmeter. Energy stored in a magnetic field. Measurement of Susceptibility of liquid by quinke`s method. Langevin`s and Weiss theories of dia, Para and ferromagnetism.

Group-B

CURRENT ELECTRICITY: 4 Questions

Thermodynamic treatment of see back, Peltier and Thomson effects and their applications. Self inductance and Mutual Inductance. Growth and decay of current in circuits Containing L, C, and R. Simple applications of these circuits Moving coil galvanometer, A periodic and ballistic galvanometers, A.C. and A.C Circuits. Use of Vectors and Complex numbers in A.C. Circuits. Theory, Series and parralel resonant Circuits, Power in A.C. Circuits, Wattmeter, A.C. Bridges (i) De Sauty`s bridge (ii) Anderson bridge (iii) Carey Foster bridge (iv) Schering bridge. Three phase A.C. Systems. Mutually Coupled Circuits. Rotating magnetic fields. Polyphase and single phase induction motors. The transformer–Equivalent Circuit and vector diagram. Iron and copper losses in transformer.

Group-C

MODERN PHYSICS: 3 Questions

Measurement of charge by Millikan`s method and specific charge of an electron by thomson`s method, Natural radio-activity, Rutherford- soddy`s Theory of radio-active decay, Geiger Muiller Counter, Discovery of Neutron. Isotopes, Artificial radio activity, Elementary ideas about nucleus and its structure. Nuclear fission Reactors, Astons mass spectrograph, Cyclotron and Betatron.

Photoelectric emission, Einstein`s photoelectric equation, Photo conductive and photo-voltaic cells. Compton effect.

Cathode ray Oscilloscope and its uses in amplitude, frequency and phase measurement. Soild state rectifier and one stage R–C amplifier.

Primary and secondary cosmic rays, Penetrating components of cosmic rays, Altitude and latitude variation of cosmic ray intensity, E.W Asymetry, Cosmic ray showers, Rossi curves, Outline of cascade theory, Origin of cosmic rays.

PRACTICAL PAPER

Time : 6 hrs. Full Marks :50

The course shall be include the following experiments.

1. Magnifying power of Telescope.
2. Magnifying power of Microscope.
3. Dip by–
   (i) Dip Circle
   (ii) Earth`s Inductor.

4. Wavelength by Newton`s rings.
5. Refractive index by spectrometer.
6. Wavelength of monochromatic light using Biprism.
7. Charactristics of a semi-conductor Diode.
8. Specific rotation by polarimeter.
9. Figure of merit of a suspended Coil galvanometer.
10. Measure of monochromatic light by plane transmission grating using Spectromet
11. Measurement of monochromatic light using optical bench.
12. Resolving power of telescope.
13. Calliberation of ammeter and voltmeter by potentiometer.
14. Compare the capacities of capacitors by De Saute`s Bridge.
15. B.G. Constant by decrement method.
16. Measurement of low and high resistance.
17. Figure of merit of ballistic galvanometer.
18. Design and study of single stage R.C. coupled amplifier.

B.Sc. Part-II

PHYSICS :

(GENERAL/ SUBSIDIARY)

The course shall consist of one Theory paper of 75 Marks. The pass marks will be 2 and the examination will be 3 hours duration. There will be One Practical paper of 2 marks. The pass marks will be 10 and the examination will be of 3 hours duration.

The following will be the detailed Courses–

Paper-II

THEORY

Time –3 Hours Full Marks :75

10 questions to be set, 5 to be answered. Question number one will be objective (15 Questions) and it will be Compulsory. 2 questions will be set from Group-A from Group-B and 3 from Group-C Atleast one question from each group is to be answered. All question will be of equal marks.

Group-A

ELECTROSTATICS AND MAGNETISM: 2(1+1) Question

Boundary Condition at the surface of separation of two dielectrics, Electric doublets, Dipole moment, Dielectric polarisation, Electrical images. Problems involving conducting plane and thin conducting, spherical shell only.

Magnetic shell, Langevin`s and Weiss theory of dia, Para and Ferromagnetism, Curie`s law, Production and measurement of strong magnetic fields, Magnetic circuits and electromagnets.

Group-B

CURRENT ELECTRICITY, MODERN PHYSICS: 4 Questions

Thermodynamical treatment of see back, Peltier and Thomson effect and their applications. Moving coil a periodic and ballistic galvanometer, Growth and decay of currents in electric Circuit. Oscillatory discharge of condenser.

A.C. and A.C. Circuits–Use of Vectors and Complex Quantities in A.C. Circuits Theory (LR, CR and LCR circuits). De Sauty`s bridge, Anderson`s bridge, Carey Foster`s bridge.

Measurement of charge by Millikan`s method and specific charge of an. electron by Thomson`s method, Natural radio-activity, Rutherford- Soddy`s Theory of radio-active decay, Geiger Muller Counter, Discovery of Neutron. Isotopes, Artificial, radio activity, Elementary ideas about nucleus and its structure. Nuclear fission Reactors, Aston`s mass spectrograph.

Photoelectric emission, Einsetin`s photo electric equation, Photo- conductive and photo-voltaic cell. Compton effect.

Cathode ray, Oscilloscope and its uses in amplitude, frequency and phase measurement. Solid state rectifier. One stage R-C amplifier. Principal of amplitude modulation and demodulation. Radio receiver through block diagram.

Group-C

OPTICS : 3 Questions

Fermat`s principle, Newton`s ring, Michelson`s Interferrometer, Fresnel`s diffraction at straight edge Fraunhoffer`s diffraction, single slit, double slit, Plane transmission grating, Resolving power of Telescope and mircoscope. Polarization, Production of plane, Circulary and elliptically polarized lights. Nicol`s prism, Quarter wave plate, half shade polarimeter, Babinet`s Compensator.

Bohr`s theory of Hydrogen spectra. Principal of Laser action, Ruby Laser. Maxwell`s equation, Equation of plane, electromagnetic waves and its solution.

PRACTICAL PAPER

Time : Hrs. Full Marks : 25

The course shall include the following experiments–

1. Magnifying power of Telescope
2. Angle of Dip by Circle.
3. Wave length by Newton`s rings.
4. Refractive index by spectrometer.
5. Wave length by plane transmission grating.
6. Measurement of low resistance.
7. Measurement of high resistance.
8. Figure of merit of moving coil galvanometer.
9. Measure angle of prism by spectrometer.
10. Angle of dip by earth inductor.
11. Resolving power of telescope.
12. Magnifying power of microscope.
13. Calliberation of ammeter and volt-meter by potentiometer.
14. Study the characteristics of given semiconductor diode.
15. Compare the capacities of capacitors by De Saurte`s Bridge.

B.Sc. Physics
Part-III
(Honours)

The Course shall consist of three Theory papers V, VI and VII each of 100 marks. The pass marks in the three theory papers taken together will be 135 and the examination in each will be of 3 hours duration. There will be Two practical papers VIII A and VIII B each of 50 marks and 6 hours duration. The pass marks taken together will be 45.
The following will be the detailed Courses-

Paper-V

THEORY

Time : 3 Hours Full Marks :75

10 questions to be set, 5 to be answered. Question number one will be objective (20 Questions) and it will be Compulsory. 3 questions will be set from each group A, B and C. Atleast one question from each group is to be answered. All questions will be of equal marks.

Group-A

MATHEMATICAL PHYSICS: 3 Questions

Curvilinear Coordinates, Cartesian, Spherical, Polar and Cylindrical Coordinates. Orthogonal transformation of coordinates, Scalar, Vector, Scalar and vector fields. Divergence and curl. Line surface and volume integrals, Theorem of Gauss, Stoke and Green. Tensor and its elementary properties. Partial differential equations and its solution by separation of variables, Laplace's equation and its solution. Wave equation and its solution, Poisson's equation and its solution. Function of complex variable, Cauchy-Rieman equation. Zeros and poles, Taylor and Laurenlz Theorems, Cauchy's integral Theorem, Residue Theorem Integration of complex functions.

Group-B

CLASSICAL MECHANICS: 3 Question

Hamilton's principle. Euler-Lagrange's equation, Principle of least action. Conservation theorems and Symmetry properties, Application of Hamiltonian, Dynamic to simple problem-Charged particle in an electromagnetic field (non-relativistic cases), Laws of motion of rigid body, Moment of inertia and Products of inertia. Eulerian angle. Eulef's equation of Motion of a rigid body. Gryroscopic motion, Motion of symmetrical top canonical transformation. Example of Canonical transformation. Contract transformation, Hamilton-Jacobi equation. Action angle variations.

Group-C

QUANTUM MECHANICS : 3 Question

Inadequacy of classical mechanics, Dual nature of matter and radiation. De Broglie's. Concept of state. The correspondence principle. Postulates of Quantum mechanics. Eigen functions and eigen values of Hamilton operators. Uncertainty relations.

Schrodinger wave equation and its physical meaning, its application to problems of free particle, Transmission of particle through potential step. One dimensional square well particle in a box. Linear harmonic oscillator. Rigid rotator. Hydrogen atom. Commutation rules of orbital angular momentum. Their eigen functions, eigen values. Spin Half angular momentum. Paul's spin matrices, Papuli spin operators. Symmetric and anti symmetric wave functions, Pauli's exclusion principle.

Paper-VI
THEORY

Time : 3 Hours **Full Marks :75**

10 questions to be set, 5 be answered. Question number one will be objective (20 Questions) and it will be Compulsory. 4 questions will be set from Group-A, 2 from Group-B and 3 from Group-C Atleast one question from each group is to be answered. All questions will be of equal marks.

Group-A

STATISTICAL PHYSICS: 3 Questions

The fundamental assumption of statistical mechanics. Probability distribution and entropy, Partition function and its Conversion to the thermodynamic functions, Sackur-Tetrode equation and Gibb's paradox.

Elements of ensemble theory and Liouville's Theorem. Canonical ensemble and .thermodynamics. Energy fluctuations in the canonical ensemble. Grand Canonical ensemble and thermodynamics Density and energy fluctuation in the grand Canonical ensemble, Simple application of ensemble theories to perfect gas.

Boltzmann distribution, Fermi-Dirac distribution, Bose-Einstein Distribution and their Simple application, Radial distribution function and its relation to thermodynamics functions. A brief.introduction to first and second order phase transformation. Critical exponent, Lsing model in Zeroth approximation, Introduction to Fluctuations. The probability of thermodynamics fluctuations.

Group-B

ELECTRONICS: **3 Questions**

Thermionic-Rechardson's equation and its experimental verification. Child-Langmuir equation, Schottky effect. Semi conductor devices. p-n junction and zenor diode. BIT and FET transistors. opto-electrical devices. Photo devices, LDR photo voltaic cell, photo transistor.

CIRCUIT THEORY:

Coupled LCR Circuits, Super position theorem, Thevenin and Reciprocity Theorems, Maximum power transfer theorem. One part and two part network (only h-parameter) T and Pi equivalence of two part network, Ladder network and constant K filters (low, high and band pass) Attenuators.

Group-C

SOLID STATE ELECTRONIC CIRCUIT: 3 Questions

Equivalent Circuit of BJT and FET, Half wave and full-wave rectifiers. Power supply with specific reference to smoothing Circuits and voltage stabilization by cold Cathode valve and zenor diode. A .F Amplifiers (R.C Coupled amplifier) Feedback amplifiers, Pushpull power amplifier, Simple Circuits for oscillation. L.C. (Hartley and colpitts) Oscillator, R.C oscillator, Astable Multivibrator, Principle of amplitude modulation, amplitude modulator average and envelop detection, radio receiver, super hetrodyne receivers, Simple idea of transmitters (with block diagram) CRO and its application. Logic Circuits AND, OR, NAND, NOR operation with the help of simple logic gates. Types of Computers and their basic Components, Input Output devices, Concept of hardware and software. BITS and BYTES Computer Programming of some simple mathematical problem in BASIC and FORTRAN Languages.

Paper-VII

THEORY

Time :3 Hours Full Marks:75

10 questions to be set, 5 to be answered. Question number one will be objective (20. Questions) and it will be Compulsory. 3 questions will be set from each group A and C. Atleast one question from each group is to be answered. All questions will be of equal marks.

Group-A

PLASMA AND CLASSICAL ELECTRODYNAMICS: 3 Ques.

Microscopic and Macroscopic properties of Plasma. Plasma oscillation Debye's potential. Wave propagation in isotropic plasma Ionospheric reflection Pinch effect, Alfven wave, Shaha's theory of ionisation. Retarded and advanced potential, Field due to an oscillating current, Element Oscillating Dipole, Lienard-Wichart Potentials. Potential and field due to uniformly moving charge. Convarience of Maxwell equation under Lorentz transformation, Transformation equation for electromagnetic fields.

Group-B

SOLD STATE PHYSICS: 3 Questions

Elements of crystallography, Bravais lattice, miller indices, Seven crystal system simple; crystal structure of Nacl, $CaCl_2$ and diamond Interaction of X-

rays, Neutrons and Electrons with Diffraction of X-rays from a perfect Crystal, Bragg" s law, Reciprocal lattice, Ewald Construction and Brillouin Zones.

Crystall binding, ionic, metallic, Covalent and vander waals binding Vanderwaals—London interaction and Cohesive energy of inter gas crystals, madelung energy and Madelung constant.

Free electrons theory of metals. Heat Capacity of electron gas, Electrical Conductivity of metals. Boltzmann-Transport equation Sommerfeld theory of electrical conductivity. Band Theory of solid.

Bloch's theorem, Kronig-Penny model, Distinction between metal Semi Conductor and Insulator, Intrinsic and Extrinsic semi Conductors Transistors, p-n Junction, Rectifier, Hall-Effect.

Group-C

ATOMIC AND NUCLEAR PHYSICS: 3 Questions

Origin of atomic spectra, Bohr's theory and Bohr-Sommerfield theory of hydrogen atom, Spectra of alkali and alkaline, earth metals. Selection rules, Excitation potential. Fine Structure, Stern gerlach experiment, Vector model of atom, Zeeman effect and Paschen Back effect of single valence atom. Moseley's law, Origin of X-rays spectra.

Rotational Vibrational spectra of diatomic molecules, Rotation Vibration and electronic bands, Introduction to NMR, ESR, Laser spectroscopy. General Properties of nuclear mass. Charge spin, static magnetic moment, size and stability, Nuclear models, liquid drop model and mass formulae. The shell model, Classical theory of Rutherford Scattering.

Paper-VIII (A)

PRACTICAL

Time : 6 Hours Full Marks : 50

The course shall -be include the following experiments-

1. Junction Diode Characteristics.
2. Zener Diode Characteristics.
3. FET Characteristics
4. BJT Characteristics
5. BJT Characteristics (Common emitter)
6. VJT Characteristics
7. Frequency response of R-C amplifier
8. Effect of Negative Feedback of R-C amplifier
9. Properties of Hartley oscillator
10. Study of logic gates (AND, NAND, OR, NOR)
11. Verify the child's Langmuir law.
12. Study the load Characteristics of rectifier.
13. Study the plate modulated wave.
14. Multivibrator and study of its wave form.
15. Design and study of power supply.

B.Sc. Part-III

Paper-VIIIB

PRACTICAL

Time : 6 Hours Full Marks :50

The course shall be include the following experiments-

1. Verification of Brewster's law
2. Verfication of Fresnels law of reflection and refraction of Polarised light.
3. Analysis of elliptically Polarised light a Babinets Compensator:
4. Inductance of coil by Anderson's Bridge
5. Mutual Inductance by Carey-Foster Bridge
6. Frequency characteristic of Low pass filter.
7. e/m by Braun's tube and high pass filter.
8. e/m by Helical method.
9. Planck's constant by photo-cell method.
10. Power factor of A.C Fan by-(i) Three Ammeter method (ii) Three Voltmeter method.
11. e/m By Milliken's oil drop method.
12. Phase shift measurement using oscilloscope.
13. Measurement of band gap of given semi conductor.
14. A comparative study of series and parallel resonant circuits and
    (a) Measurement of 'Q' of the circuit
    (b) Measurement of 'L' C and R
15. Study of Resonance in series L,C,R Circuit

B.Sc. PHYSICS

Part-III

(GENERAL)

The course shall consist .of one Theory paper of 75 marks. The pass marks will be 23 and the examination will be of 3 hours duration. There will be One Practical paper of 25 marks. The pass marks will be 10 and the examination will be of 3 hours duration.

The following will be the detailed Courses—

Paper-III

THEORY

Time :3 Hours Full Marks:75

10 questions to be set 5 to be answered. Question number one will be objective (15 Questions) and it will be Compulsory. 2 questions will be set from Group-A. 4 from Group-B and 3 from Group-C Atleast one question from each group is to be answered. All questions will be of equal marks.

Group-A

QUANTUM MECHANICS 2 Questions

Need of Quantum machanics. Dual nature of matter and radiation, Debroglie's relation, Uncertainty principle. Postulates of Quantum Mechanics. Schrodinger wave equation and its application to the problems-

(i) Particle in Box

(ii) Particle in one dimensional square well.

(iii) Transmission across a potential barrier.

(iv) Linear harmonic oscillator.

Group-B

SOLID STATE PHYSICS : 4 Questions

Crystal Structure, Bravais lattice, miller indices, Simple crystal structure of Nacl, $CaCl_2$, Crystal binding, ionic, metallic, Covalent and Vander Waal's binding.

London interaction and Cohesive energy inert gas Crystal modelung energy and Madelung constant.

FREE ELECTRON:

Theory of metals, Heat Capacity of electron gas, Electrical Conductivity of metals. Band Theory of solid, Bloch's theorem. Distinction between metal, Semi Conductor and Insulator; Intrinsic and Extrinsic semi Conductors, Transistor and p-n Junction rectifier. Electrical Polarisation and displacement in materials. Local electric field in an atom. Dielectric Constant and polarisation. Langevin Debye equation.

THERMIONICS:

Rechardson's equation and its experimental verfication. Child- Langmuir equation, Schottky's effect, Semi conductor devices-p-n Junction and Zener diode, BJT and FET transistors, opto electrical devices. Photo devices, LDR photo voltaic cell, Photo transistor. CIRCUIT THEORY :

Coupled LCR Circuits, Super position theorem, Maximum power transfer theorem. One part and two part networks (only h-parameter), T and Pi equivalence of two part network. Ladder network.

Group-C

SOLID STATE ELECTRONIC CIRCUITS: 3 Questions

Equivalence Circuit of BJT and FET, Halfwave and full-wave rectifiers. Power supply with special reference to smoothing Circuits and Voltage stablization by cold Cathod valve and Zener diode. A F Amplifiers (R.C) Feedback amplifiers, Push pull power amplifier. R.C. oscillator; Astable Multivibrator. Solid state amplitude modulator. Logic Circuits AND. OR, NAND, NQR operation with the help of simple logic gates.

Types of Computers and it basic Components. Input and Output devices. Concept of hardware and software.

B.Sc. Part-III

PRACTICAL PAPER

Time : 3 Hrs

Full Marks : 25

The course shall include the following examents.

1. Junction Diode Characteristics.
2. Zenor Diode Characteristics.
3. FET Characteristics
4. BJT Characteristics (Common-base)
5. BJT Characteristics. (Common-emitter)
6. Frequency response of R-C Coupled amplifer
7. Study of logic gates (AND. OR, NOR)
8. e/m by Helical method.

B.Sc. ZOOLOGY (PART-I)
SUBSIDIARY/GENERAL ZOOLOGY
Paper-I (Theory)

Time : 3 Hours Full Marks :75

Five Questions are to be set from each group. Students shall have to answer five questions attempting at least two from any group.

Group-A : Nonchordate

1. Bionomics, General characters, Classification (upto orders) of the following Phyla: Protozoa, Porifera, Coelenterata, Platyheiminthes, Aschelminthe, Anneleda, Arthropoda, Mollusca, Echinodermata and Hemichordata.
2. Detailed study of the Structure and Life-history of the following types–
   (a) Protozoa Paramecium, Leishmania
   (b) Porifera Sycon
   (c) Cnidaria Obelia
   (d) Platyhelminthes Fasciola
   (e) Aschelminthes Ascaris
   (f) Annelida Pheretima
   (g) Arthropoda Palaemon
   (h) Mollusca Pila
   (i) Echidodermata Asterias
   (j) Hemichordata Balanoglossus

Group-B CELL BIOLOGY, GENETICS AND EVOLUTION

1. Cell Biology and Genetics :
   (a) Gametogenesis, Fertilization and Parthenogenesis
   (b) Ultra structure and functions of the following cell organelles– Plasma membrane, Endoplasmic reticulum, Mitochondria, Golgi body, Ribosomes, Chromosome, Lysosome.
   (c) Structure and function of DNA.
   (d) Gene Mutation
   (e) Linkage and Crossing over
2. Evolution:
   (a) Sources of hereditary variation and their role in evolution.
   (b) Dawewin`s theory of Natural selection and Neo-Darwinism.
   (c) Isolating mechanisms and their role in evolution.

PRACTICAL
SUBSIDIARY/GENERAL

Full Marks :25

Time: 3 Hours 06

1. Dissection :
   Pheretima : Reproductive system, Nervous system.
   Palaemon : Alimentary canel, Nervous system.
   Pila : Alimentary canal, Nervous system, Organs of Palliall Complex.

2. Mounting : (Permanent stained Preparation) 04
   Septal nephridia, Ovary and Setae of Pheretima.
   Statocyst of Prawn;
   Radula and Osphradium of Pila. 06
3. Spotting:
   (a) Museum specimen 2 Nos.
   (b) Slides 3. Nos.
   (c) Evolution 1.Nos.
4. Practical records. 04
5. Viva-Voce 05

B.Sc. Honours Part-I

Zoology

THEORY

Paper-I (A)

(NON-CHORDATE)

Time : 3 Hours Full Marks : 75

In all ten questions are to be set, out of which number i and 2 consists of objective (1×15 marks) and short answer (3×5) questions respectively and both shall span over the whole syllabus in the paper. Students would be required to answer five questions out of which question number 1 and 2 shall be compulsory.

1. Bionomics–General characters and Classification (upto orders) of the following Phyla. Protozoa, Porifera, Cnidaria, Platyhelminthes, Annelida, Arthropoda, Mollusca, Echinodermata and Hermichordata.
2. Detailed study of the following types:
   (a) Protozoa–Paramecium. Leishmania donovani, Entamoeba histolytica, Polystomella (Elphidium), Trypanosoma, Vorticella.
   (b) Porifera–Canal system, Skeleton and Reproduction, affinities of the phylum.
   (c) Cnidaria–Obelia, Aurelia, Coral reef formation
   (d) Ctenophora–General organization of Hormiphora, affinities of the phylum.
   (e) Platyhelminthes–Fasciola hepatica and Taenia solium.
   (f) Aschelminthes–Ascaris lumbricoides, Wuchereria bancrofti.
   (g) Annelida–Pheretima posthuma, Hirudo.
   (h) Arthropoda–Palaemon, Peripatus, Sacculina, Larval forms of Crustaces
   (i) Mollusca–Unio, Pila, Sepia, Torsion and detorsion in Gastropoda.
   (j) Echinodermata–Asterias,
   (k) Herichordata–Balanoglossus.

Hemi

Paper-II A

(ECOLOGY, ANIMAL BEHAVIOUR AND BIOMETRY)

Time : 3 Hours Full Marks :75

1. **ECOLOGY :**
   1. Concept of Biosphere (Lithosphere, Hydrosphere and Atmosphere).
   2. Ecosystem–Definition, Structure and function of Pond Ecosystem.

3. Major Ecosystems of the world–Structure (abiotic and biotic) function including Energy flow in the following–
   (a) Freshwater
   (b) Grass land
   (c) Desert &
   (d) Forest Ecosystem
4. Biogeochemical cycles (Carbon, Nitrogen, Oxygen & Sulphur).
5. Community structure & its ecological succession.
6. Pollution and its hazards; Green house effect, Ozone depletion.
7. Wild–life conservation.

II. ANIMAL BEHAVIOUR:

1. Scope of Ethology, Innate and learned behaviour.
2. Social behaviour in insects.
3. Parental care in fishes and Amphibia.
4. Brooding, nesting and migratory behaviour in birds.
5. Concept of Biological clock.

III. BIOMETRY :

1. Normal distribution.
2. Mean, Mode and Median
3. Standard deviation
4. Standard error of Mean, Median and Standard deviation.
5. Student t–test, Testing the significance of (i) the mean of random sample from a normal population (ii) and the difference between sample means.
6. Chi Square teat
   (a) Goodness of fit
   (b) Test of independence.

PRACTICAL
(Paper-IB & IIB)

Time: 4 Hours — Full Marks : 50

1. Dissection : — 5

   Pheretima and Leech : General Anatomy, Alimentary canal, Reproductive, Excretory and Nervous system.

   Palaemon : Alimentary canal, Nervous system.

   Unio, Pila and Sepia : Nervous system, organs of Pallial complex of Pila.

2. **Permanent stained preparations of the followings :** 05 x 2 = 10

   Paramecium, Gemmules, spicules, Obelia colony, Nephridia andovary of Pheretima, Jaw of leech, statocyst of Prawn, Osphradiaum, Radulla and gill of Pila, Gill of Unio, Glochidium larvae, larvae of Crustacea and Echinoderms, Pedicillaria.

3. **Spotting(Each of two marks)** — 14

   (i) Museum specimen — 2 Nos.

(ii) Slides — 4 Nos.

(iii) Specimen relating to animal behaviour or parental care. — 1 No

4. Ecology — 06

(i) Analysis of spoil/pond biota.

(ii) Determination of dissolved oxygen in different water samples.

(iii) Community structure of Grassland.

(iv) Moisture content of soil sample

5. Biometery — 05

Calculation of the arithmetic mean and standard deviation of the samples provided.

6. Record and field work — 5

7. Viva-Voce — 5

B.Sc. Part-II
Zology
SUBSIDIARY/GENERALL COURSE
Paper-IIA
(THEORY)

Time : 3 Hours Full Marks : 75

Five Questions are to be from each group. Students shall have to answer five question attemptimg at least two from any group.

GROUP-A

CHORDATA :

1. Bionomics, General Characters and Classification (up to orders only) of living chordata of the following groups; Protochordata, Cyclostomata, Pisces, Amphibia, Reptilia, Aves and Mammalia.
2. Study of the following types–
   (i) Urochordata-Herdmania (including reterogressive metamor phosis).
   (ii) Cephalochordata-Amphioxus.
   (iii) Fishes-Scoliodon-Type study : difference with that of a Bony fish.
   (iv) Reptillia-Biting & feeding mechanism of Snakes.
   (v) Aves-Columba, Flight adaptations, elementary ideas of bird migration & Sanctuaries of India
   (vi) Mammals-Characters, Distribution and affinities of Prototheria & Metatheria.
3. Comparative study of the following in Vertebrates : Integument, Heart, Aort Arches and Brain.

Group-B

1. **EMBRYOLOGY :**
   (i) Types of Vertebrate eggs and their early cleavage.
   (ii) Development of Amphioxus (Up to the formation of Coelom) and chick to 3 germ layers.
   (iii) Placenta in Mammals : their development, types and functions.
2. BIOCHEMISTRY,PHYSIOLOGYAND ENDOCRINOLOGY:
   (i) Structure and classification of Protein, Carbohydrate & fats
   (ii) Physiology of Digestion, Excretion and Respiration in mammals
   (iii) Histophysiology of the following Endocrine glands in Mammals- Islets o Langerhans, Testes, Ovary, Thyroid, Adrenal & Pituitary.

B.Sc. Part-II
SUBSIDIARY/GENERAL ZOOLOGY
PRACTICAL
Paper-IIB

Time : 3 Hours Full Marks : 25

1. Dissection :
   Scoliodon : Afferent and Efferent Branchial arteries, Cranial nerves (V, VII, & X) Internal ear, eye muscles & their nerves supply. Urinogenital syste —04
   Columba : Flight muscles, Arterial and Venous system. 03
2. Mounting : — 03

Permanent/temporary stained preparation of the following-
Scales of fishes, Ampulla of Lorenzini, pecten and filoplume feather of birds 06

3. Spotting :
   Museum specimen – 1 No.
   Bones – 3 Nos.
   (Limb, Girdle, Skull, Vertebrae of Vertebrates) 2×2=04
4. Slides : 2 Nos (Endocrinology & Embryology)
   (iv) Identification of permanent slides of the various developmental stage of Frog and Chick.
   (v) Identification and comments upon the histological structure of various Endocrine glands of Vertebrates. 04
5. Practical Records 04
6. Viva-Voce

B.Sc. Honours (Part-II)
Zoology
Paper-III A
(Theory)

Full Marks : 75

Time : 3 Hours

In all ten questions are to be set of which number 1 and 2 consists of objective (1×15 marks) and short answer (3×5) questions respectively and both shall span over the whole syllabus in the paper. Students would be required to answer five questions out of which question number 1 and 2 shall be compulsory.

CHORDATA:

1. Origin and Evolution of Chordates.
2. Bionomics, General character and clasification of the living chordataes (up to orders) of the following groups: Urochordates, Cephalochordata, Cyclostomata, Pisces, Amphibia, Reptilia, Aves and Mammalia
3. Study of the following types–
   (a) Urochordata : General organization and life cycle of Herdmania and Salpa.
   (b) Cephalochordata : Amphioxus
   (c) Cyclostomata : Petromyzon.
   (d) **Fishes :**
      (i) Labeo or any bony fish, scoliodon
      (ii) Distribution, : General organization and affinities of dipnoi.
   (e) Amphibia :
      (i) Origin and evolution of Amphibia (ii) Neoteny.
   (f) Reptilia :
      (i) Any lizard (ii) Biting and feeding Meachanisms in snakes.
   (g) Aves :
      (i) Columba (ii) Origin of birds
      (iii) Flight Adaptations
   (h) Mammals :
      (i) Characters, distribution and affinities of Prototheria and Metatheria
      (ii) General organization of Primates.

B.Sc. Honours (Part-II)
Paper-IVA
(THEORY)
COMPARATIVE VERTEBRATE ANATOMY AND EMBRYOLOGY

Time : 3 Hours Full Marks : 75

In all ten question are to be set out of which number 1 and 2 consists of ojective (1×15 marks) and short answer (3×5) questions respectively and both shall span over the whole syllabus in the paper. Students would be required to answer five questions out of which question number 1 and 2 shall be compulsory.

1. COMPARATIVE ANATOMY :
   Study of following organ system in major Vertebrate groups
   (i) Integument : Its derivatives and function.
   (ii) Gastrointestinal tract.
   (iii) Respiratory system.
   (iv) Heart, Aortic arches.
   (v) Brain.
   (vi) Evolution and fate of kidney, urinogenital ducts, gonads
2. EMBRYYOLOGY :
   (vi) Fertilization :
   (vii) Types of Vertebrate eggs early cleavage.
   (viii) Development of Amphioxus (upto the formation of coelom)
   (ix) Development of chick (upto 3 germinal layers).
   (x) Development and function of extra-embryonic membranes in chick.
   (xi) Placenta in mammals-its development, types and function.
   (xii) Organogenesis of Heart, Brain and Eye in Chick embryo.

B.SC. PART-II (HONOURS)
PRACTICAL
PAPER-III & IV B

Time : 3 Hours Full Marks : 25

1. Dissecton : 10
   (i) Scoliodon and any Bony fish :Afferent and efferent branchial vessels, cranial nerves (V, VII, IX, X) Eye muscles and their nerve supply, internal ear, accessory respiratory organs
   (ii) Frog-Cranial nerves (V, VII, IX, X)
   (iii) Lizard-Arterial and Venous system.
   (iv) Pigeon-Arteriall and Venous system, air sacs, flight muscles (with the origin and insertion of tendons).
   (v) mammals-Neck nerves, Urino-gential organs.
2. Mounting : 05
   Velum and Oral hood of Amphioxus; Ampulla of Lorenzini, respiratory membrane of air breathing structures, scales of fishes. Pecten and feathers, Mounting of chick embryo (24 and 48).
3. Permanent staned preparation of paraffin sections provided. 05
4. Spotting : 2×10=20

(i) Museum specimen – 2 Nos
(ii) Slides -Histology & Embrology – chick embryo slides – 4 Nos
(iii) Bones
Limbs –1 No.
Girdles – 1No
Skull – 1 No
vertebrae of –
Frog, Varanus, Fowl & Rabit 1 No

5. Record and Field Work 05
6. Viva-voce 05

B.Sc. (Part-III)

ZoologyGeneral

Paper-III A

(Theory)

Time ; 3 Hours Full Marks : 75

Five questions are to be set from each group, Students shall have to answer five questions attempting at least two from any group.

Group-A : ECOLOGY

1. Concept of Biosphere,
2. Definition, structure and functions of a typical ecosystem.
3. Major Ecosystems of the world and their features.
4. Abiotic and Biotic factors.
5. Biogeochemical Cycles of Oxygen, Nitrogen and carbon
6. Energy Flow in ecosystems.

ANIMAL BEHAVIOUR:

(i) Scope of Ethology; Innate and Learned Behaviour.

(ii) Parental care in fishes and Amphibians.

(iii) Social Behaviour in insects.

(iv) Migratory Behaviour in birds & fishes.

Group-B: PALAEOZOOLOGY AND ZOOGEOGRAPHY

(i) Different Geological eras of the world, their climatic conditions and fauna.

(ii) Zoogeographic realms of the World and their boundaries.

(iii) Biogeographical distribution of animals in Oriental, Ethiopian and Australian regions.

(iv) Fossils and their mode of formation.

ECONOMIC ZOOLOGY:

(i) Seri culture, Lac culture and Pisci culture.

(ii) Preliminary idea of the common pests of paddy& Wheat, their control,

(iii) Vectors of Kalazar, Malaria, Filaria,-their Prevention and control.

PRACTICAL

Paper-III B (General)

ECOLOGY, ANIMAL BEHAVIOUR, PALAEOZOOLOGY, ZOOGEOGRAPHY & ECONOMIC ZOOLOGY

Time : 3 Hours Full Marks:25

1. Quantitative estimation of dissolved O_2 in water with the help of Winkler's volumetric methods. 05
2. Determination of pH of different water/Soil samples. 02
3. Moisture content of soil & identification and comment on the organism present in water/soil samples, 03
04. Identification and comment on the specimen (spotting) on 06
   (i) Palaeozoology-Fossils.
   (ii) Economic Zoology-Silk Yarn, Larva. Pupa, Adults of Silk Worm: Lac Sticks, Lac insect, Fishing gears. Museum specimens showing parental care; Mouth parts of male and female Culex, Anopheles, Sandfly and their different developmental stage.
5. Practical Records 04
6. Viva-voce 05

B.Sc. Honours (Part-III)

paper-V

(THEORY)

Time : 3 Hours Full Marks : 100

In all 10 questions are to be set out of which number 1 and 2 shall consist of Objective (1x20 Marks) and short answer (4x5) questions respectively and both shall span over the whole syllabus in the paper. Students would be required to answer five questions out of which question number 1 and 2 shall be compulsory.

BIOCHEMISTRY:

1. Structure and Classification of Protein, carbohydrate and Fats.
2. Structure and Classification of Amino Acid.
3. Metabolism of Carbohydrate: Glycogensis, Glycolysis and Kreb's cycle
4. Beta-oxidation of fatty acids.
5. Vitamins-Types and functions
6. Physiology (Mammals)
   (i) Physiology of digestion
   (ii) Physiology of respiration (ventilation of lungs and transport of gases).

(iii) Physiology of excretion and Osmoregulation.
(iv) Physiology of testicular and ovarian cycle,
(v) Histology of the various Endocrine glands of Mammal
(vi) Chemical nature and Physiological role of the Hormones secreted by Adenophypophysis, Neurohypophysis, Adrenal, Thyroid, Islet of Langerhans and Gonads.

B.Sc. Honours (Part-III)

Paper-VI

(THEORY)

Time : 3 Hours Full Marks: 100

In all 10 questions are to be set out of which number 1 and 2 shall consist of Objective (1x20 Marks) and short answer (4x5) questions respectively and both shall span over the whole syllabus in the paper. Students would be required to answer five questions out of which question number 1 and 2 shall be compulsory,

1. CELL BIOLOGY

(i) Ultra structure and function of the following cell organelles: Plasma membrane, Endoplasmic reticulum, Mitochondria, Golgi Complex, Ribosome, Chromosomes, Lysosomes, Nucleolus.
(ii) Gametognesis Fertilization and Parthenogenesis,
(iii) Elementary idea of Immunology : Lymphoid tissues and organs, Innate and Acquired immune response.

2. GENETICS

(i) Linkage and crossing over. Structure and replication of DNA. Transcription and Translation,
(ii) Chromosomal aberrations, the Genetic and Cytological manifestation and significance,
(iii) Gene Mutation andd Molecular Mechanism of its origin.
(iv) Extra nuclear genetic system (v) Sex determination and sex linked inheritance.

3. ECONOMIC ZOOLOGY

(i) Lac Culture
(ii) Seri Culture
(iii) Api. Culture
(iv) Pisci Culture
(v) Elementary idea of the common pests of paddy, wheat, sugarcane and vegetables and their control.

(vi) vectors of Kalazar, Malaria and Filaria, their biology, mode ot infection, prevention and control.

(vii) Wild-life conservation.

Paper-VII

EVOLUTION, ZOOGEOGRAPHY & PALEOZOOLOGY

Time : 3 Hours Full Marks : 100

In all 10 questions are to be set out of which number 1 and 2 shall consist of Objective (1x20 Marks) and short answer (4x5) questions respectively and both shall span over the whole syllabus in the paper. Students would be required to answer five questions out of which question number 1 and 2 shall be compulsory.

1. EVOLUTION :

(i) Sources of hereditary variation and their role in evolution.

(ii) Principles of evolution : Lamarkism, Neo-Lamarkism, Darwinism & Neo Darwinism.

(iii) Isolating mechanism and their role in evolution.

(iv) Hardy-Wienberg law and genetic equilibrium.

(v) Fossil history of horse & Man.

(vi) Micro, Macro and Mega evolution.

2. ZOOGEOGRAPHY & PALEOZOOLOGY

(i) Zoogeographical realms of the world, their boundaries and climatic peculiarities.

(ii) Characteristic & Peculiar fauna of Oriental, Ethiopian and Australian regions.

(iii) Characteristic of Island fauna.

(iv) Theories & Principles pertaining to animal distribution,

(v) Different geological of the world, their duration and climatic conditions.

(vi) Faunistic peculiarities of Paleozoic, Mesozoic and Cenozoic eras,

(vii) Fossil : their mode of formation & age determination.

Paper-VIII

PRACTICAL

BIOCHEMISTRY, PHYSIOLOGY & ENDOCRINOLOGY

Time :8 Hours Full Marks :100

FIRST SITTING

1. BIOCHEMISTRY : 10

(i) Benedict's test for reducing sugar.

(ii) Molisch's test

(iii) Iodine test for starch and glycogen.

(iv) Ninhydrin reaction for glycine/tyrosine/trypotophan.

(v) Millon s reaction for glycine/ tyrosine/phenylalanine.

2. **Physiology :** 7 x 2 = 14

Experiments to be performed in frog, bird/ mammal. (Two experiments)

(i) Enumeration of total RBC.

(ii) Estimation of hemoglobin (gm/lOOml) in blood.

(iii) Determination of ESR of blood.

(iv) Determination of bleeding and clotting time.

(v) Determination of O_2 uptake by terrestrial animal,

(vi) Simple heart-beat and muscle curve by drum method.

3. Dissection and display of any four of the following endocrine glands in a mammal-gonad, thyroid, adrenal, Pancreas, Spleen, Thymus, Pituitary.

4. Identification and comment upon the histological slides (five in number) ofthe following : Pituitary, Adrenal, Ovary, Testes, Islets of Langerhans, Thymus, Thyroid. Parathyroid and Vaginal smears, Bone, cartilage, ear, eye, spleen.

SECOND SITTING — 70

A. CELL BIOLOGY : 12

1. Vital staining of secretory granules in salivary glands of Cockroach and Mitochondria in the buccal epithelium.

B. GENETICS : 10

1. Aceto carmine stained squash preparation of the onion root tipand tests of grasshopper to demonstrate stage of mitotic divisions respectively.

2. Aceto carmine preparation of the giant chromosomes of the Chironomus/ Drosophila larvae.

C. EVOLUTION AND PLEONTOLOGY : 4x2=8

1. Serial homology as exhibites by the appendages of prawn.

2. Homology and Analogy as exhibited by the wings of birds, bat and insect.

4. Study of Fossils.

5. Identification and comment upon the specimens/ slides on-

Economic Zoology - 3 Nos; and 10

Cytology - 2 Nos 10

6. Practical Record 10

7. Viva-Voce 10

VEER KUNWAR SINGH UNIVERSITY, ARA

COURSES OF STUDY

for three years B.Sc. (Vocational) Hons Course

in

BIOTECHNOLOGY

(Based on UGC vocational program-me in Biotechnology and approved by Bihar Govt) implemented from the session 2014-15

Syllabus commitee

(Constituted by university letter no exam 209 dt 28.08.15)

1. Prof. (Dr) Rajesh Kumar, Co-ordinator,
   Head, P.G.Dept. of Bot
   V.K.S.University, Ara
2. Prof. (Dr) Suresh Pd. Srivastava,
   Head, P.G. Dept. of Zool.
   V.K.S.University, Ara
3. Prof. (Dr) Mithilesh Kr Pandey
   Dept. of Botany
   Maharaja Colllege Ara
4. Dr. Binod Kr Sinha,
   Associate Professor
   Dept of Bot
   Maharaja College Ara

6. Out line of Syllabus of the Course :

The syllabus of the vocational (Hons) Course in Biotechnology shall be as follows :

6.1. Honours Papers :

a) There shall be 21 Honours papers in all distributed in the three years of study as follwos:

Year	Course Title	Total Marks	Remarks
Ist Year	1. Biochemistry	100 = (80+20)	Theory Paper
	2. Mathematics & Practical Computers	100	Theory Paper
	3. Cell Biology — Thakur shyamjee	100	Theory Paper
	4. Genetics — Chandan sir	100	Theory Paper
	5. Microbiology — Ajeet sir	100	Theory Paper
	6. Biochemical Techniques	75	Practical Paper
	7. Microbiological Techniques	75	Practical Paper
	8. Ist Summer Job Training followed by Project Work	50	Job Training
2nd Year	1. Bio-Physics	100	Theory Paper
	2. Molecular Biology	100	Theory Paper
	3.Immunology	100	Theory Paper
	4. Animal Cell Cultures	100	Theory Paper
	5. Recombinant DNA Technology	100	Theory Paper
	6. Methods in Molecular & Cellular Biology	75	Practical Paper
	7. Immunological Methods	75	Practical Paper
	8. 2nd Summer Job Training followed by Project Work	50	Job Training
3rd Year	1. Animal Cell Biology (11)	100	Theory Paper
	2. Plant Bio-technology (12)	100	Theory Paper
	3. Environmental Biochemistry (13)	100	Theory Paper
	4. Culture Methods	100	Practical Paper
	5. Project Report	100	Project Report
Total	21 Papers	1900	Theory Paper-13 Practical Papers-5 Job Training & Project Report-3

(21

diary Papers :

A candidate admitted to B.Sc. (Vocational) Hons Course in Biotechnology l be required to offer two subsidiary subjects from out to the following:

i) Either Botany or Zoology

ii) Chemistry

Each subsidiary subject will consist of two papers, each of 100 marks pa- per-1 of the each subsidiary subject shall be offered and be taught in the first year of teh course; while Paper-II be taught in the2nd year.

Compulsory :

A candidate admitted to B.Sc. (Vocational) Hons Course in Biotechnology shall be required to offer and be examined in one compulsory paper of Entrepreneurship Development in the 3rd year of study. The paper will consist of 100 marks.

Syllabus of optional subsidiary subjects

Syllabus of two optional subsidary papers (Chemistry, Botany or Zoology) in Degree part I and part II will be similar to the syllabus o B.Sc. subsidiary syllabus of Part I & Part II of V.K.S.University, Ara.

Courses of Study
3 yrs. B.Sc. (Vocational) Hons course in
BIOTECHNOLOGY
V.K.S.University, Ara

Hons Part - I

There shall be five theory of 100 marks; two practical papers of 75 marks and Job training followed by project works of 50 marks in the first year of examination

Paper - I

Time 3hrs. Maximum Marks 80

In all 8 questions are to be set as follows :-

Q 1. Compulsory question multiple Choice question covering the entire syllabus	10 X 1.5= 15 Marks
Q 2. Compulsory Question 4 Short answer questions covering the entire syllabus	4 X 5 = 20 Marks
Q 3-8. Long answered questions covering the entire syllabus; three to be answered	3 X 15 = 45 Marks
	Total= 80 Marks
Two Internal Assesment of ten marks each	2 X 10 = 20 Marks
	Total= 100 Marks

15-20 days 20

BIOCHEMISTRY

Unit 1 : Introduction to Biochemistry;
Amino acids & proteins : Structure and function, structure and properties of Amino acids, Types of proteins and their classifcation, Forces stablizing protein structure and shape. Different level of structural organigation of proteins, protein purification and renatur ation of proteins : Fibrous and glolular proteins.

Carbohydrates : Structure, function and properties of monosaccharides, Diasaccharides and polysaccharides, Homo & Hetro polysaccharides, Mucopolysaccharides, Bacterial cell wall, Glycoproteins and their biological function.

Unit II Lipids : Structure and function, classification, nomenclature and properties of fatty acids, essential fatty acids, phospholipids, glycolipids, cerebrosides, cholestrol.

Nucleic acid : Sturcture and functions : physical and chemical properties of Nucleic acids, Nucleosides, Nucleotides, purines, pyrimidines, Biologically important nucleotides, Double helical model of DNA structure and forces responsible for A, B & Z DNA, denaturation and renaturation of DNA.

Unit III Enzymes : Introduction, classification & nomenclature of enzymes, role of enzymes in biosynthetic and degradative cellular functions, mechanism and mode of action of enzymes, inhibition and regulation of enzyme action, enzyme kinetics, In vitro activity of purified enzymes and their applications in industry. Various uses of enzymes in food processing, medicines, dignostics and production of new com pounds. Enzymes as research tools- ELISA methods, modification of biological compounds with the help of enzyme.

Unit IV Carbohydrate Metabolism : Reactions, energetics and regulation, Glycolysis Fate of pyruvate under arobic and anaerobic conditions. Pentose phosphate pathway and its significance, TCA cycle, Electron transport Chain, Oxidative phosphorylation. Gluconeogenesis, Glycogenolysis and glycogen synthesis, B-oxidation of fatty acids.

Paper - 2

Time 3hrs Maximum Marks 80

In all 8 questions are to be set as follows :

Q1.	Compulsory questions multiple choice questions covering the entire syllabus	10 X 1.5 = 15 Marks
Q2.	Compulsory questions 4 Short answer questions covering the entire syllabus	4 X 5 = 20 Marks
Q3.	to 8 long answered questions in two groups covering the entire syllabus, three to be answered at least one must be from each group	3 X 15 = 45 Marks
		Total = 80 Marks
	Two Internal Assessment of ten marks each	2 X 10 = 20 Marks
		Total = 100 Marks

Group A

MATHEMATICS :

Unit 1 - The set theory; properties of subsets, Linear and geometric functions. Limits and derivatives of functions. The binomial theorem, Logarithm, solution of Linear Equations.

Unit 2 - Differentiation & integration; matrices probability classical & axiomatic defination of probabity, probability calculation, method of sampling, confidence level, Measurement of central tendencies and deviations.

Group B

Practical Computers :

Unit III - General introduction to computers and its function; different components of computers; Basic design of computers.
Classification of computers; digital and analogue computers, Mini, Micro, Main frame & super computers Programming Logic & Design techniques- Algorithm Flow charts and Pseudocodes.

Unit IV- Computers in online monitoring and automation. Internet, Platform of internets, H++p, URL, TCP/IP protocol, Ip adress
Application of computers in coordination of solute concentration. pH and temperature etc of a fermenter in operation.
Demonstration of the above utilities (along with above lectures)

Paper- 3

Time 3hrs Maximum Marks 80

In all 8 questions are to be set as follows :

Q1.	Compulsory questions multiple choice questions covering the entire syllabus	10 X 1.5 = 15 Marks
Q2.	Compulsory questions 4 Short answer questions covering the entire syllabus	4 X 5 = 20 Marks
Q3. to 8	long answered questions covering the entire syllabus, three to be answered.	3 X 15 = 45 Marks
		Total = 80 Marks
	Two Internal Assessment of ten marks each	2 X 10 = 20 Marks
		Total = 100 Marks

CELL BIOLOGY

Unit 1 - Introduction to modern tools and techniques of cell biology optical, SEM, TEM, An introduction to cell biology, cell as baisic unit of living systems, The cell theory, modern cell biology, Procellular evolution, artificial creation of cells.

Unit2 - Diversity of cell size and shape : structure of prokaryotic cells (bacteria, Virus, Cyanobacteria, mycoplasma, eukaryotic microbes, plant and animal cells.) A detailed classification of cell types within an organism, cell, tissue, organ and organism as different levels of organization of otherwise genetically similar cells, Biochemical com position of cells (Proteins, lipids, carbohydrate, nucleic acid and the metabiolic pool)

Unit 3 - Oragnization of cell : Cell wall, cell membrane, ultrastructure and function of cell memberane, cytosol cell recognition and membrane transport, structure & function of memberane bound cell organelles nucleus (nuclear membrane, nucleous nucleoplasm) Golgibodies (structure, function including role in portein synthesis), Endoplamic reticulum structure function including role in protein segregation, mitochondria chloroplast, lysosome, peroxisome, vacuoles, and microbodies, non membrane bound cell organelles, ribosome, cytoskeleton and cell motality microtubules intermediate filaments and microfilaments.

Unit IV - Cell growth and division : Cell cycle, Kinds of cell division, amitosis, mitosis, meiosis, crossing over, significance of cell

division. Cell locomotion (amoeboid flagellar, ciliar) muscle and nerve cells, cell senescence and death, cell differentiation in plant & animals.

Cancer : Carcinogenesis, agents promoting carcinogenesis, characterstics and molcular basis of cancer.

Paper-4

Time 3hrs Maximum Marks 80

In all 8 questions are to be set as follows :

Q1. Compulsory questions multiple choice questions covering the entire syllabus	10 X 1.5 = 15 Marks
Q2. Compulsory questions 4 Short answer questions covering the entire syllabus	4 X 5 = 20 Marks
Q3. to 8 long answered questions covering the entire syllabus, three to be answered.	3 X 15 = 45 Marks
	Total = 80 Marks
Two Internal Assessment of ten marks each	2 X 10 = 20 Marks
	Total = 100 Marks

GENETICS

Unit 1 - Historical development in the field of genetics, organism suitable for genetic experimentation and their genetic significance.
Mendelian genetics : Mendel's experimental design, monohybrid, di-hybrid and tri-hybrid crosses. Laws of segregation and principle of independent assortment, verification of segregates by test and back crosses. Chromosomal theory of inheritance, Allelic interaction, concept of dominance, recessiveness, incomplete dominance, co-dominance, Semi-dominance, pleiotrophy, multiple allel, pseudo allele essential and lethal genes, penetrance and expressivity.

Unit II - Non allelic interactions : Interaction producing new phenotype complemtary genes, epistatis, (dominant & recessive) duplicate genes and inbibitory genes.
Genetic organization of prokaryotic, eukaryogic and viral genome. Structure and characteristics of bacterial and eukaryotic chromosome, chromosome morphology, chemical composition, concept of euchromatin and heterochromatin, packaging of DNA molecule into chromosome, chromosome banding pattern, karyotype, giant chromosome, one gene one polypeptide hypothesis, concept of

cistron, exons, introns, genetic code, gene function.

Unit III - Mutation : Definition and type and causes of mutation, chemical and physical mutagens, induced mutations in plants and animals and microbes for economic welfare of human being. Variation in chromosome structures, chromosomal aberration in human beings, abnormalities - Aneuploidy and Euploidy Sex determination in plants and animals, sex linkage, mechanism environmental factor, Barr bodies, Sex linked gene expression, sex linked inheritence.

Unit IV - Basic microbial genetics, conjugation, transduction, transformation, isolation of auxotrophs, replica plating techniques,
Genetic linkage, crossing over and chromosome mapping.
Extra chromosomal inheritance, population genetics : Hardy-weinberg equilibrium, gene and genotype frequencies.

Paper-5

Time 3hrs Maximum Marks 80

In all 8 questions are to be set as follows :

Q1.	Compulsory questions multiple choice questions covering the entire syllabus	10 X 1.5 = 15 Marks
Q2.	Compulsory questions 4 Short answer questions covering the entire syllabus	4 X 5 = 20 Marks
Q3. to 8	long answered questions covering the entire syllabus, three to be answered.	3 X 15 = 45 Marks
		Total = 80 Marks
	Two Internal Assessment of ten marks each	2 X 10 = 20 Marks
		Total = 100 Marks

MICROBIOLOGY

Unit 1 - Fundamentals, History, development and scope of microbiology.
Classification of micro-organisms : Microbial taxonomy, criteria used including molecular approaches, classification of bacteria, nutritional classification.
Morphology and cell structure of major groups of microorganisms eg. Bacteria type, cell structure, microbial cell surface (gram positive gram negative, ultra structure of flagella, cyanobacteria, protozoa, viruses, Archaebacteria, Rickttsias, PPLOs. - ?

Unit 2 - The concept of sterilization, methods of sterilization (Dry heat, wet heat, radiation, chemical and filteration etc.) cultivation and maintenance of microorganism, nutrilional categories of micro

Unit 3 - organism, methods of isolation, purification and preservation.
Microbial growth ; Growth curve, measurement of growth and factors affecting growth of bacteria.
Microbial metabiolism : Respiration, photosynthesis,
Bacterial Reproduction : Transformation, Transduction and conjugation, endospore and sporulation in bacterai.

Unit 4 - Control of Microorganisms: By physical, chemical and chemotheraputic agent.
Pathogenic microorganism : Defence mechanism against microorganisms (Non specific defence only)
N2 - Fixing microbes in agriculture.
Water microbiology : Bacterial pollutants of water, coliform and non coliforms, sewage composition and its disposal
Food microbiology : Important microorganism in food microbiolgy, moulds, yeast, bacteria, preservation of various types of foods, termentation products of bacteria,
Significance of bacteria.

Paper-6

Time 6 hrs Maximum Marks 75

BIOCHEMICAL TECHNIQUES

1. Qualitative tests for carbohydrates, lipids and proteins.
2. Quantitative estimation of sugars in given solution
3. Quantitative estimation of sugars in biological sample
4. Extraction and seperation of lipids
5. Estimation of Proteins
6. Estimation of DNA/RNA
7. Isolation and purification of proteins
8. Assay of enzyme activity
9. Kinetic studies on enzyme
10. Chromatographic methods for seperation of carbohydrates, lipids, and proteins

Paper-7

Time 6 hrs

Maximum Marks 75

MICROBIOLOGICAL TECHNIQUES

1. Cleaning of glasswares
2. Preparation of media, cotton plugging and sterilization
3. Personal hygiene - Microbes from hands, tooth scum, and other body parts.
4. Isolation of micro organisms from air, water and soil samples, dilution and pour plating, colony pruification.
5. Enumeration of micro organisms. Total V5 viable counts.
6. Staining methods : Simple staining, Gram staining, other staining method, metabolie characterization (e.g IM V$_2$C test)
7. Isolation of bacteria and their identification
8. Growth curve of microorganism.
9. Antibiotic sensivity of microbes, use of antibiotic discs.
10. Testing of water quality
11. Test for antibiodies against given bacteria
12. One step growth of bacteriophage.
13. Culture from body fluids (stool, urine, blood).
14. Alcoholic and mixed acid fermentation.

Paper-8

Maximum Marks 50

PROJECT WORK

The students will have to undergo on the job traing in clinic (Hospital) a fermentation plant or bakery. They have to submit its report. A certificate would be issued by the department from the institition providing the training.

14/7/15