



S.K.C.G. (AUTONOMOUS) COLLEGE
PARALAKHEMUNDI,GAJAPATI-761200

COURSES OF STUDIES

Choice Based Credit System (CBCS)

M. Sc./P.G. - Life Science

2020-21 AND ONWARDS

DISTRIBUTION OF MARKS

End Semester Examination

Full Marks:80

SECTION-A

08 Short Answer Questions (SAQ) (50 words)
out of 12 Questions covering the entire Syllabus.

08x02 = 16 marks

SECTION-B

04 Short Answer Questions (SAQ) (100 words)
each Question with one alternative set unit wise.

04x04 = 16 marks

SECTION-C*

04 Long Answer Questions (LAQ) (500 words)
each Question with one alternative set unit wise.

04x12 = 48 marks

Total → 80 marks

SECTION – C*

Q.No.2- **Unit-I** LAQ (Answer any one Question)

01x12 = 12 marks

- a.
- b.

Q.No.3- **Unit-II** LAQ (Answer any one Question)

01x12 = 12 marks

- a.
- b.

Q.No.4- **Unit-III** LAQ (Answer any one Question)

01x12 = 12 marks

- a.
- b.

Q.No.5- **Unit-IV** LAQ (Answer any one Question)

01x12 = 12 marks

- a.
 - b.
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CBCS Course Structure of Master of Science in Life Science
(M.Sc. in Life Science) Total Credits: 80
 (Effective from Academic Session 2020-2021)

SEMESTER -I (Total Credits-20)						
Paper Code	Topics		Full mark	Mid-Sem	End-Sem	Credits
LSC 101	Biophysics and Biochemistry		100	20	80	4
LSC 102	Cell Biology & Microbiology.		100	20	80	4
LSC 103	Genetics and Evolution		100	20	80	4
LSC 104	Practical		100	-	-	4
LSC 105	Practical		100	-	-	4
SEMESTER -II (Total Credits-20)						
Paper Code	Topics		Full mark	Mid-Sem	End-Sem	Credits
LSC 206	Ecology & Biostatistics		100	20	80	4
LSC 207	Mol. Biology & Bio-Techniques		100	20	80	4
LSC 208	Biotechnology Basics		100	20	80	4
LSC 209	Practical		100	-	-	4
LSC 210	Practical		100	-	-	4
SEMESTER III (Total Credits-20) PLANT SCIENCE						
Paper Code	Topics		Full mark	Mid-Sem	End-Sem	Credits
LSC 311	Plant Morphology & Taxonomy		100	20	80	4
LSC 312	Plant Physiology.		100	20	80	4
LSC 313	Plant Metabolism		100	20	80	4
LSC 314	Practical		100	-	-	4
LSC 315	Practical		100	-	-	4
SEMESTER -III (Total Credits-20) ANIMAL SCIENCE						
Paper Code	Topics		Full mark	Mid-Sem	End-Sem	Credits
LSC 311	Biology of Non-Chordata		100	20	80	4
LSC 312	Biology of Chordata		100	20	80	4
LSC 313	Ethology & Developmental biology		100	20	80	4
LSC 314	Practical		100	-	-	4
LSC 315	Practical		100	-	-	4
SEMESTER -IV (Total Credits-20)						
Paper Code	Topics(Plant Science)	Topics(Animal Science)	Full mark	Mid-Sem	End-Sem	Credits
LSC 416	Plant Anatomy & Development Botany	Animal Physiology, Immunology & Taxonomy	100	20	80	4
LSC 417	Practical	Practical	100	-	-	4
LSC 418	Special Paper (Biotechnology/Biochemistry/Environmental Biology)		100	20	80	4
LSC 419	Practical		100	-	-	4
LSC 420	Project & Seminar		100	-	-	4

The course comprises of four Semesters with 80 Credits, to be completed in two years duration having two semesters in each year. Each Semester will consist of three theory papers and two practical papers. Each theory paper will carry 100marks (20 marks for Mid-Sem and 80 marks for End Sem Examination) and practical paper will carry 100marks each. The duration of examination for each theory paper shall be of 3 hours and for each practical paper of 6 hours.

1st & 2nd Semester will be common for all the students of the M.Sc. Life Sciences. In 3rd Semester students will be allowed to opt either for Plant or Animal Sciences stream according to his/her honours taken in UG. Similarly in the 4th Semester the student will take either a Plant Science or an Animal Science theory paper (according to his/her selected stream) and any one special paper theory and its related Practical, Project & Seminar to complete the course.

1ST AND 2ND SEMESTER : Courses are common to both the Plant and Animal Sciences.

3RD SEMESTER : Courses are separate for Plant and Animal science stream.

4TH SEMESTER : Courses cover only one theory paper each for Plant and Animal Science stream. The other two papers (one theory & one Practical+Project+Seminar) are special papers which are common to both the Plant and Animal Science Streams.

Both the Plant and Animal Science streams of the M.Sc. Life Sciences course will have examinations for a total of 2000 marks with 80 Credits, in four semesters, with a total of 500 marks(20 Credits) examination in each semester.

SEMESTER- I
PAPER-LSC 101
BIOPHYSICS AND BIOCHEMISTRY

Time: 3 Hours

Full Marks: 100 (20 + 80)

UNIT – I: BIOPHYSICS

1. Intermolecular forces: Dipoles, dielectric constants, Ionic bond, Hydrogen bonds & Vander Wall's force.
2. Colloidal system, properties of colloids, Ultra-filtration, Emulsion, Suspension & Adsorption.
3. Structure and Ionisation of water, Acid and bases, Relationship of pH and pK in a Buffer system.

UNIT – II: BIOPHYSICS

1. Laws of Thermodynamics in relation to living organisms. Concept of steady state, Gibb's Free energy, enthalpy, entropy and energy changes.
2. Membrane Ultra-structure, Composition and functions,
3. Membrane transport, Diffusion, Active transport.

UNIT – III: BIOMOLECULES

1. Structure of amino acids and proteins (primary, secondary, tertiary and quaternary structures) Domain & Motif concept of protein, Ramachandran plot.
2. Structure of polysaccharides, structure and significance of glycolipids, glycoproteins and Peptidoglycans. An outline concept and classification of lipids.
3. Nature, Properties and Classification of Enzymes and Co-enzymes. Mechanism of Enzyme action. Kinetics, Regulation of enzyme activity: Constitutive and regulatory enzymes.

UNIT - IV: BIOCHEMISTRY

1. Gluconeogenesis, Hexose Monophosphate shunt,
2. Fatty acid biosynthesis, Amino acid metabolism.
3. Electron transport in mitochondria and chloroplast. Oxidative phosphorylation & Photo-phosphorylation, proton pump. ATP Synthesis

SEMESTER-I
PAPER- LSC 102
CELL BIOLOGY AND MICROBIOLOGY

Time: 3 Hours

Full Marks: 100 (20 + 80)

UNIT – I: CELL BIOLOGY

1. Ultra structure of Cell, Structure and function of Mitochondria, Chloroplast, ER, Golgi body,
2. Centrosome and Lysosome, structure & function of Ribosomes.
3. Cell – Cell interaction, adhesion, Cell signaling.

UNIT – II: CELL BIOLOGY

1. Cytoskeleton : Micro tubule, Micro filaments, Intermediate filaments.
2. Cell cycle, cellular reproduction, Cell cycle check points,
3. Cell cycle control mechanism, cycling & CDK

UNIT – III: MICROBIOLOGY

1. Virus: Status, nature and classification, Reproduction in Virus; lysogeny and lytic cycle.
2. Bacteria– Molecular organisation, growth, nutrition, and reproduction in bacteria, Genetic Recombination: transformation, Conjugation & transduction.
3. Bacteriophage Genome, Outline of Eukaryotic phages.

UNIT – IV: MICROBES IN INDUSTRY

1. A brief outline survey of other Microbes
2. Protozoa, Mycoplasma, Slime molds, Actinomycetes, Yeasts and Cyanobacteria.
3. Use of Microbes in industry (fermentation, alcohol, antibiotics, vitamins, food production, organic acids, enzymes, steroid transformation, food preservation) and agriculture.

SEMESTER-I
PAPER- LSC 103
GENETICS AND EVOLUTION

Time : 3 Hours

Full Marks: 100 (20 + 80)

UNIT – I: GENETICS

1. Mendelism ; Probability and pedigree analysis; Incomplete dominance and codominance;
2. Multiple alleles, Lethal alleles, Epistasis, Pleiotropy, Recessive and Dominant traits, Penetrance and Expressivity,
3. Numericals , Problems, Polygenic inheritance: Neo-Mendelism

UNIT – I: GENETICS

1. Gene interaction, Linkage, Crossing over and Recombination.
2. Structural and numerical changes in chromosome (Aneuploidy & Euploidy)
3. Principles of population genetics and Hardy-Weinberg Law.

UNIT – III: EXTRA CHROMOSOMAL INHERITANCE, POPULATION GENETICS :

1. Chloroplast mutation: Variegation in Four o'clock plant;
2. Mitochondrial mutations in yeast; Maternal effects-shell coiling in snail;
3. Infective heredity- Kappa particles in *Paramecium*.

UNIT – IV: EVOLUTION

1. Fossils, Fossilisation and dating of fossils and some Indian fossils.
2. Patterns of evolution – Sequential evolution, convergent and Divergent evolution, Micro, Macro and Mega evolution. Molecular evolution, Synthetic theory of evolution
3. Theory of Natural selection; Continental drift and Species distribution, Speciation.

SEMESTER-I
PAPER-104 (PRACTICAL)
CELL BIOLOGY AND MICROBIOLOGY

Time : 6 Hours

Full Marks: 100

CELL BIOLOGY

1. Study of stages of mitosis and meiosis by squashing technique
2. Karyotype Analysis
3. Micrometry and measurement of Cell size

MICROBIOLOGY

1. Sterilization of glass ware
2. Preparation of culture media (LB)
3. Gram staining of bacteria
4. Streak plate culture of bacteria

SEMESTER-I
PAPER- LSC 105 (PRACTICAL)
(GENETICS AND EVOLUTION)

Time: 6 Hours

Full Marks: 100

GENETICS

1. Three point test cross
2. Study of Gene interaction (Concept Map and Problems)
3. Epistatic gene interactions (Complementary, Supplementary and Dominant-Recessive)
(9:7; 9:3:4, 9:7 & 15:1- To be elucidated and confirmed with help of coloured seeds)

EVOLUTION

1. Model/Photographs/Slides of Fossils and Missing Links
2. Study of Evolutionary Trees of selected species

SEMESTER-II
PAPER- LSC 206
ECOLOGY AND BIOSTATISTICS

Time: 3 Hours

Full Marks: 100 (20 + 80)

UNIT – I ECOLOGY:

1. Concept of Ecosystem (Emergent Properties, Biological levels of Organisation,
2. Structure, Classification of Ecosystems, Ecological energetics, Gaia hypothesis and Cybernetics).
3. Leibig's Law of Minimum and concept of limiting factors, Law of Tolerance.

UNIT – II COMMUNITY ECOLOGY & BIODIVERSITY:

1. Population Ecology (structure and dynamics).
2. Community Structure, Community dynamics, Ecological niche.
- 3, Biodiversity: Types/Levels, Conservation strategies.

UNIT – III ENVIRONMENTAL CONCERNS:

1. Environmental Pollution: sources & control (Air Pollution, Water Pollution, Land Pollution, Noise pollution)
2. Green house effect, Ozone depletion, Global warming, climate change, Waste Management & Bioremediation,
3. Environmental Management and Auditing, EIA, Environmental Education and awareness.

UNIT – IV- BIOSTATISTICS:

1. Probability distribution (Normal, Binomial & Poisson), Students 't' test Goodness of fit and association analysis by chi-square test.,
2. Analysis of variance ratio test (Two-way & Three-way).
3. Correlation and Regression analysis.

SEMESTER-II
PAPER- LSC 207
(MOLECULAR BIOLOGY & BIOTECHNIQUES)

Time : 3 Hours

Full Marks: 100 (20 + 80)

UNIT – I : MOLECULAR BIOLOGY-I

1. Nucleic acids : Components of DNA & RNA, Molecular models of DNA, Types of DNA, Types, Structure and functions of RNA.
2. Replication of Double stranded DNA; [Prokaryotic Rolling Circle and Θ model and Eukarotic]
3. Transcription and Reverse transcription

UNIT – II : MOLECULAR BIOLOGY-II

1. Gene Concept as recon, muton and cistron, split gene,
2. History, elucidation and properties of Genetic Code jumping gene, and over-lapping gene concepts.
3. Regulation of gene expression; Operon Concepts, Negative and Positive regulations

UNIT – III : MOLECULAR BIOLOGY-III

1. Constitution of Eukaryotic genome, C-Value paradox, sequence components i.e., repetitive and non repetitive DNA sequence.
2. In-vitro DNA hybridization and its applications.
4. Sequencing of nucleic acids

UNIT – IV : BIOTECHNIQUES

1. Microscopy –Principles and types : Fluorescence Microscopy ,TEM & SEM.
Centrifugation–General Principles and types of centrifugation
2. Chromatography –Principles and types of Chromatography (Paper, Thin layer and Gas)
3. Spectrophotometry– Principle & Instrumentation for colorimetry, Spectrophotometry
Electrophoresis–Elementary Principles and types

SEMESTER-II
PAPER- LSC 208
BIOTECHNOLOGY BASICS

Time: 3 Hours

Full Marks 100 (20+80)

UNIT - I: Biotechnology: Concept and History

1. Biotechnology: Old and Modern concepts, Interdisciplinary nature, Public perception of Biotechnology, Biotechnology and the Developing world.
2. Basic Tools of new Biotechnology: 1) Enzymes; Restriction enzymes; types and functions,
3. Extraction, Isolation and purification of RNA and genomic, organellar and plasmid DNA,

UNIT - II: Biotechnology Tools and Strategies

1. Amplification of DNA; PCR –Types and applications
2. Blotting techniques (Southern, Northern, Western, Dot and Slot)
3. Cell, tissue, organ and protoplast culture techniques

UNIT – III: Cloning Vectors and Strategies

1. Cloning Vectors: Types. Plasmid, Cosmid, Phagemid, Vector construction – P_{BR} 322,
2. Recombinant DNA (Genetic Engineering) technology
3. Gene transfer technologies: Direct and Agro-bacterium mediated,

UNIT – IV: Application of Biotechnology

1. Fermentation; Bioreactors, Antibiotics and enzyme technology
2. Hybridoma technology- Monoclonal antibodies, Transgenic Plants and Animals
3. Waste water and Sewage treatment, Bioremediation, Bio-safety, Bioethics

SEMESTER-II
PAPER- LSC 209 (PRACTICAL)
(ECOLOGY AND BIOSTATISTICS)

Time: 6 Hours

Full Marks: 100

ECOLOGY :

1. Species - Area curve
2. Frequency, Density and Abundance - Community study
3. Ecological anatomy (Selected Hydrophytes and xerophytes; models/photographs of selected animal species)

BIOSTATISTICS :

1. Central Tendency - Measurement of mean, mode & median.
2. Measurement of dispersion
3. Student t* test
4. Chi² test

SEMESTER-II
PAPER- LSC 210 (PRACTICAL)
BIOTECHNIQUES, MOL. BIOLOGY AND BIOTECHNOLOGY

Time: 6 Hours

Full Marks: 100

INSTRUMENTAL TECHNIQUES:

1. Spectrocolorimeter/Photo meter - Instrumentation and working principle
2. Centrifugation - Instrumentation and working principle
3. P^H Meter - Instrumentation and working principle
4. PCR- Instrumentation and working principle
5. Chromatography- Instrumentation and working principle

MOL. BIOLOGY AND BIOTECHNOLOGY :

1. Extraction and estimation of DNA & RNA
2. Estimation of protein content
3. Agarose Gel electrophoresis
4. Sample mixture Separation by Chromatography (Paper/TLC)

SEMESTER-III
PAPER- LSC 311 (PLANT SCIENCES)
PLANT MORPHOLOGY AND TAXONOMY

Time: 3 Hours

Full Marks: 100 (20 + 80)

UNIT – I: THALLOPHYTES

1. Outline classification of cryptogams up to order. Algae-Range of thallus structure and reproduction in Cyanophyta, Chlorophyta, Phaeophyta and Rhodophyta.
2. Fungi: Organisation of thallus structure and reproduction. Economic importance of Phycomycetes, Ascomycetes and Basidiomycetes. Degeneration of sexuality in Fungi.
3. Bryophytes – Salient features, Evolution of gametophyte and sporophyte Liverworts (Marchantiophyta). Hortworts (Anthocerotophyta),

UNIT – II: THALLOPHYTE AND TRACHEOOPHYTES (VASCULAR LAND PLANTS)

1. Evolution of sex organs in Bryophyta, Degeneration or Progressive Strilisation of Sporogenous tissues in Bryophyta.
2. Pteridophyta-Origin of land plants, Salient features, evolution of vascular tissues, Origin of Heterospory and its significance
3. Fillicales as the most advanced group of Pteridophyta.

UNIT – III: SALIENT FEATURES OF GYMNOSPERMS

1. Gymnosperms - Origin and outline classification upto order and Characteristic features, Cycadofillicales as intermediate group between Bryophytes and Pteridophytes,
2. Cycadals as relic of ancient Gymnosperms, Phylogenetic position of Ginkgoales. Angiospermic characters of Gnetales,
3. Palaeobotany-Geological era, process of fossilization. Fossil Gymnosperms of India.

UNIT – IV SALIENT FEATURES AND TAXONOMY OF ANGIOSPERMS

1. Angiosperms - Origin and evolution of angiosperms.
2. Different systems of classification upto order. International code of Nomenclature (ICN),
3. Range of floral structure, affinities and phylogeny of Monocot and Dicots with special reference to Glumiflorae, Liliflorae Scitaminae, Microspermae, Ranales, Malvales, Tubiflorae and Umbelliferae.

SEMESTER-III
PAPER- LSC 312 (PLANT SCIENCES)
PLANT PHYSIOLOGY

Time : 3 Hours

Full Marks: 100 (20 + 80)

UNIT - I: WATER RELATIONS

1. Water relations in plants: Concepts of water and solute potential;
2. Principles of Absorption of water,
3. Ascent of sap,

UNIT - II: TRANSPIRATION AND MINERAL NUTRITION

1. Transpiration: Stomatal movement mechanism,
2. Essential elements Minerals, hydroponics, absorption of elements, passive and active transport role of essential elements and deficiency symptoms,
3. Translocation of organic solutes in phloem.

UNIT -III: SIGNAL TRANSDUCTION & SENSORS

1. Phytochromes and their Photo and Biochemical properties
2. Photophysiology of light induced responses
3. Signal transduction: overview of signaling molecules, receptors, Sensors; Mechanism Signal transduction & regulatory systems

UNIT - IV: PHOTOSYNTHESIS

1. Photosynthesis- Principles of light absorption in chloroplast, Organisation of light absorbing systems, mechanism of electron flow,
2. C₃, C₄ and CAM pathway for carbon reduction.
3. Photorespiration.

SEMESTER-III
PAPER- LSC 313 (PLANT SCIENCES)
PLANT METABOLISM

Time: 3 Hours

Full Marks: 100 (20 + 80)

UNIT-I: CONCEPT OF METABOLISM

1. Introduction, Anabolic and Catabolic Pathways
2. Regulation of Metabolism, Role of Regulatory Enzymes,
3. Allosteric and Covalent modulation, Isozymes

UNIT - II: LIPID METABOLISM

1. Lipid metabolism : fatty acid biosynthesis, catabolism of lipids,
2. Oxidation of fatty acids.
3. Sulphur metabolism; uptake , transports & assimilation.

UNIT – III: NITROGEN METABOLISM:

1. Nitrogen metabolism - Bio-chemical metabolism of Nitrogen fixation in free living and Symbiotic associations
2. Nitrogen assimilation, Nitrogen cycle,
3. Mycorrhiza; Endo & Ecto mycorrhizal association,

UNIT - IV : RESPIRATION :

1. Respiration - Aerobic and Anaerobic respiration, Respiratory quotient,
2. Energetics of respiration; Electron Transport System,
3. Action un-couplers, Cyanide resistant respiration. HMP pathway.

SEMESTER-III
PAPER- LSC 314 (PRACTICAL)
(PLANT MORPHOLOGY AND TAXONOMY)

Time: 6 Hours

Full Marks: 100

MORPHOLOGY

1. Some Algal mixture separation.
2. Study and identification of some important Fungi.
3. Anatomical studies of Bryophyta
4. Anatomical studies of pterodophyta
5. Anatomical studies of Gymnosperm

[Slides/material W.M, Stages of life cycle of species from item 1 to 5 above]

TAXONOMY

Floral characters & Identification of families :

1. Graminae, Cyperaceae, Ranunculaceae,
2. Umbelliferae, Malvaceae, Apocynaceae

SEMESTER-III
PAPER- LSC 315 (PRACTICAL)
(PLANT PHYSIOLOGY AND METABOLISM)

Time : 6 Hours

Full Marks: 100

PHYSIOLOGY:

1. Osmotic potential - calculation using potato tuber & Rhoeo-discolor leaf.
2. Estimation of chlorophyll pigment in various leaf samples
3. Comparision of chlorophll and carotenoid content.
4. Stomatal Index / Stomatal frequency.

METABOLISM

Measuring Rate of Photosynthesis under different conditions by Wilmutt's Bubbler

1. Under different wavelengths of light (Blue, Red and Green)
2. Different concentrations of CO₂
3. Different Temperature
4. R.Q and ATP energy balance sheet; (only problems)

SEMESTER-III
PAPER- LSC 311 (ANIMAL SCIENCES)
BIOLOGY OF NON-CHORDATA

Time: 3 Hours

Full Marks: 100 (20 + 80)

Unit – I: Nonchordata

1. Locomotion in protozoa.
2. Reproduction in protozoa.
3. Parasitism in protozoa.
4. Reproduction in Porifera.
5. Polymorphism in Coelentrata.

Unit – I: Nonchordata

1. Structure and affinities of Ctenophora.
2. Structure and affinities of Archiannelida.
3. Helminth Parasites with special reference to man.
4. Metamerism in Annelida.

Unit – III : Nonchordata

1. Vision in insects.
2. Larval forms in Crustacea.
3. Respiration in Arthropoda.
4. Structure and affinities of peripetus.
5. Respiration in Mollusca.

Unit – IV : Nonchordata

1. Larval forms in Echinodermata.
2. Water vascular system in Echinodermata.
3. Structure and affinities of Hemichordata.
4. Structure and affinities of Lobophorates and Brochiopods.
5. Economic Zoology: Apiculture, Sericulture, Lac culture, Pearl culture.

SEMESTER-III
PAPER- LSC 312 (ANIMAL SCIENCES)
BIOLOGY OF CHORDATA

Time: 3 Hours

Full Marks: 100 (20 + 80)

Unit – I:

1. Origin of Chordata.
2. Inter relationship of Cephalochordata and Urochordata.
3. Structure and affinities of Cyclostomata.
4. Distribution, structure and affinity of Dipnoi.

Unit -II

1. Origin of Tetrapoda.
2. Parental care in fishes
3. Parental care in amphibia

Unit – III :

1. Structure & affinities of sphenodon
2. Mammal like reptiles
3. Flight adaptations and perching mechanism in birds.

Unit – III :

1. General account of prototheria and metatheria.
2. Dentition in mammals.
3. Adaptive radiation in mammals.
4. Comparative anatomy of Integument and Jaw-suspensorium in Vertebrates

SEMESTER-III
PAPER- LSC 313 (ANIMAL SCIENCES)
ETHOLOGY AND DEVELOPMENTAL BIOLOGY

Time: 3 Hours

Full Marks: 100(20 + 80)

Unit – I : Ethology

1. Instinct, Learning, types of learning, Neural mechanism of learning and learning in Vertebrates.
2. Orientation and navigation in animals.
3. Migration behaviour in fishes and birds.
4. Reproductive behaviour in vertebrates (Courtship and Mating).
5. Biological clocks.
6. Social behaviour in insects and primates.

Unit – II : DEVELOPMENTAL BIOLGOY

1. Molecular events during fertilization.
2. Cleavage.
3. Morphogenic movements and mechanism of gastrulation.
4. Concept of organizer and embryonic induction.

Unit – III : DEVELOPMENTAL BIOLGOY

1. Foetal membranes and their development,
2. Placentation
3. Oestrous and Menstrual cycle.

Unit – IV : DEVELOPMENTAL BIOLGOY

1. Infertility and Artificial insemination, Invitro fertilisation.
2. Birth control.
3. Regeneration, Apoptosis : Mechanism of PCD, genetic control.
4. Cytological & Morphological abnormalities of cancer cell.

SEMESTER-III
PAPER- LSC 314 (PRACTICAL-AS)
(NON-CHORDATA AND CHORDATA)

Time: 6Hours

Full Marks: 100

Non-Chordata:

1. Nervous system of Pila
2. Nervous system of Sepia
3. Nervous system of Prawn

Chordata:

1. Arterial system of Calotes
2. Venous system of Calotes
3. Brain of Toad

SEMESTER-III
PAPER- LSC 315 (PRACTICAL-AS)
(DEVELOPMENT BIOLOGY AND ANIMAL PHYSIOLOGY)

Time: 6 Hours

Full Marks: 100

Development Biology:

1. Study of Blastula, gastrula of Frog
2. Tadpole larva of Frog
3. Study of 18hrs, 20hrs, 24hrs, 33hrs, 36hrs, 42hrs, 48hrs chicken embryo

Animal Physiology:

1. Test for carbohydrate
2. Test for Protein
3. Test for Fat
4. Action of salivary amylase on starch

SEMESTER-IV
PAPER- LSC 416 (PLANT SCIENCE)
(PLANT ANATOMY AND DEVELOPMENTAL BOTANY)

Time: 3 Hours

Full Marks: 100 (20 + 80)

Unit – I: Secondary Growth

1. Secondary growth in Monocot and Dicot plants,
2. Adaptive and Non-adaptive anomalous secondary growth in Monocots and Dicots (Stem & Roots);
3. Mechanical Tissues: principles of arrangement of mechanical tissues.

Unit – II: Phytogeography & Developmental Biology

1. Phyto-Geographical distribution of plants,
2. Isolation and isolating mechanisms, Sympatric and allopathic populations.
3. Micro-sporogenesis, Mega-sporogenesis, Types of Embryo Sacs,

Unit – III: Developmental Biology

1. Fertilisation; Concept of Double Fertilisation & Triple Fusion;
2. Endosperm, Types and development, Apomixis, Development of Dicot and Monocot embryos. Polyembryony,
3. Structure and types of Seeds and Germination,

Unit – IV: Growth regulators

1. Physiology of flowering photoperiodism,
2. Senescence, Regulation of plant growth and Development – phytohormones,
3. Molecular mechanism of responses of plants to Auxins, Gibberellins, Cytokinins, ABA and Ethylene.

SEMESTER-IV
PAPER- LSC 417 (PLANT SCIENCES) PRACTICAL
(PLANT ANATOMY, DEVELOPMENTAL BOTANY)

Time: 6 Hours

Full Marks: 100

Plant Anatomy

1. Study abnormal secondary growth in-adaptive and Non-adaptive type Dicot Stem & Root (Slides)
2. Microscopic Preparations for the above groups
3. Study of abnormal secondary growth in-adaptive and non-adaptive types in Monocot stem and roots
4. Microscopic Preparations for the above groups

Developmental Botany

1. Embryological slides
2. Anatomy of Anther of different stages of microsporegenesis
3. Pollen germination by hanging drop method
4. Pollen wall morphology

SEMESTER-IV
PAPER- LSC 416 (ANIMAL SCIENCE)
(ANIMAL PHYSIOLOGY, IMMUNOLOGY AND TAXONOMY)

Time: 3 Hours

Full Marks: 100 (20 + 80)

Unit – I: Animal Physiology

1. Digestion and absorption of food.
2. Cardiac cycle and its regulation.
3. Breathing and gaseous exchange; Transportation of gases,
4. Muscle contraction.
5. Mechanism of Nerve impulse conduction, synaptic transmission.
6. Physiology of excretion.

Unit – II : Immunology

1. Types of Immunity: Innate, acquired, passive, active, Humeral and Cell mediated immunity, specificity and memory
2. Lymphoid Organs: Origin, development and function
3. Immunoglobulins: Structure, distribution and function
4. Major Histocompatibility Complexes and their role in Antigen-Antibody recognition
5. Some common Human Immune-deficiency diseases

Unit – III : Taxonomy

1. History of Taxonomy.
2. Principles of classification and procedures in Taxonomy.
3. Species concept.
4. Concepts of chemotaxonomy, cytotoxicity and Numerical Taxonomy.

Unit – IV : Taxonomy

1. Preservation and Identification of animals.
2. Ecology and physiology in taxonomy.
3. General Classification of Animal Kingdom.

SEMESTER-IV
PAPER- LSC 417 (ANIMAL SCIENCE) PRACTICAL
(ANIMAL PHYSIOLOGY IMMUNOLOGY AND TAXONOMY)

Time: 6 Hours

Full Marks: 100

Animal Physiology

1. Estimation of Hb%
2. RBC count of man/any vertebrate
3. WBC count of man
4. Preparation of Haemin crystals
5. Determination of blood type (Blood group)
6. Caesin content of milk
7. O₂ uptake by insect.
8. Determination of Haematocrit value of blood.

Immunology and Taxonomy

1. Blood grouping by Immunotechniques.
2. Percepin test
3. Single immune diffusion test
4. Taxonomical features & phylogenetic study of some selected species.

SEMESTER-IV
(SPECIAL PAPER)
PAPER- LSC 418
(A) ENVIRONMENTAL BIOLOGY

Time: 3 Hours

Full Marks: 100 (20 + 80)

Unit – I: Stress Physiology

1. Basic concepts of stress (Stress, Strain, Resistance, Tolerance and Avoidance, Incipient lethal level, Acclimation and acclimatization, Homeostasis.
2. Bioassays, Synergism and Antagonism.
3. Water deficit stress and adaptations of plants and animals to water deficit stress.
4. Ionising radiation, Types and sources of Ionising radiation in environment, effects and radiation standards.

Unit –II: Pollution

1. Pollution – Oil Pollution
2. Pollution due to agricultural activity and Eutrophication.
3. Pollution in Indian Rivers.

Unit – III: Production and Conservation Ecology

1. Primary Production and methods of measurement.
2. Secondary Production and Yield to man.
3. Ecological efficiencies and production in different regions of the world.
4. Natural habitat conservation in Orissa with special reference to Chilika, Bhitarkanika, Similipal, Mahendragiri.
5. Afforestation and forest management.
6. Wild life conservation.
7. Soil conservation.

Unit – IV : Environmental Management

1. Environmental monitoring and management.
2. Environment protection laws.
3. Environmental education and awareness.
4. Biological control of pests.
5. Sewage and solid waste management.
6. Treatment of effluents in distilleries and paper and pulp industries.

**SEMESTER-IV
(SPECIAL PAPER)
PAPER- LSC 418
(B) BIOTECHNOLOGY**

Time: 3 Hours

Full Marks: 100 (20 + 80)

UNIT – I: PRINCIPLES AND TOOLS BIOTECHNOLOGY:

1. Biotechnology-an interdisciplinary study, Techniques and tools: Restriction enzymes: Types and functions,
2. Cloning Vectors for recombinant DNA (Plasmids, Phages, Cosmids), gene Library (BAC, YAC and MAC),
3. Gene Cloning: Strategies, cloning in bacteria and eukaryotes;

UNIT – II: PRINCIPLES AND TOOLS BIOTECHNOLOGY:

1. Basic PCR, anchored PCR and asymmetric PCR; DNA Polymorphism (RAPD, RFLP, AFLP, SSR),
2. Sequencing of gene or a DNA segment: Maxim & Gilbert's, Sanger's method; gene synthesis mechanism;
3. General Idea about OMICs (Genomics, Transcriptomics, Proteomics and Metabolomics)

UNIT – III: APPLIED BIOTECHNOLOGY:

1. Scope of animal cell culture, advantages and disadvantages, the gas phase for tissue culture, culture media for animal cells and tissues, Transgenic animals; Stem Cells: Culture and applications
2. Culture media and plant cell culture : Culture media and their constituents (MS, B5 and White's media, cell culture; Somaclonal variation, production of haploids: anther culture, ovule culture, Transgenic Plants.
3. Protoplasts isolation, protoplast culture and application.

UNIT – IV: INDUSTRIAL AND ENVIRONMENTAL BIOTECHNOLOGY:

1. Engineering of macro molecules-basic outline of protein engineering, drug designing, Isolation and culturing of micro-organisms;
2. production of organic compounds by microbial fermentation: Bioreactors, Biotechnology in paper industry, pollution Control: Cleaner technologies, reducing environmental impact of industrial effluents, biosensors;
3. Renewable sources of energy, Green energy and Bio-fuel, use of biotech tools for biodiversity conservation.

SEMESTER-IV
(SPECIAL PAPER)
PAPER- LSC 418
(C) BIOCHEMISTRY

Time: 3 Hours

Full Marks: 100 (20 + 80)

Unit – I: Macromolecular structure and metabolism:

1. Physical properties, chemical structure, isolation and purification of proteins, molecular and biological heterogeneity of proteins, (with special reference to hormones and iso-enzymes, structural collagen) and contractile protein.
2. Classification and intracellular distribution of enzyme & proteins, metabolism of individual essential aminoacids.
3. Chemical structure and biological significance of polysaccharides, starch, glycogen, inulin, dextrin, cellulose, hemicellulose, lignin, mucopolysaccharides and glycoproteins) path of carbon in photosynthesis, glycogen metabolism, glyoxalic shunt, uronic acid pathway, gluconeogenesis,

Unit – II :

1. Fixation of carbon dioxide (in darkness) in plants, photorespiration in plants. Chemical structure and biological significance of phospholipids & glycolipids, lipoprotein and steroid metabolism (biosynthesis and degradation of phospholipids, sphingolipids and cholesterol).
2. A general account of plant alkaloids and pigments, photosynthetic pigments anthocyanins and anthoxanthine biosynthesis and metabolism of auxins in plant structure) and classification of vitamins and hormones in animals and their roles in metabolism.
3. The concept of free energy, high energy bonds and the key position of ATP, phosphorylation, mitochondria as a biological transducer mechanism of electron transport and oxidative phosphorylation;

UNIT -III

1. The mechanism of enzymatic analysis catalyzed reaction and the plausible models for reaction mechanism, substrate and product inhibition of enzyme action feed back modulation of the activity of kinetics of action.
2. Regulation of enzyme synthesis in microbial organisation and critical estimation of the regular operon model control enzyme synthesis in higher organisms.
3. Evolution of energy transforming mechanism, energy transduction in cell, characteristic features and types of transducer role of ATP in active transport.

Unit – IV:

1. Thermodynamic equilibrium and metabolic control regulation of glycolysis and TCA cycle, basterut and krahtress effects,
2. Regulation of glycogen metabolism control of lipid metabolism in a cell and in the body (animal) regulation of nucleic acid merabolism inborn errors of metabolism, antibody and interferon, their synthesis.
3. Molecular mechanism of hormone action with reference to epinephrine, insulin, thyroxine and plant auxins, biochemistry of senescence.

SEMESTER-IV
PAPER- LSC 419
(PRACTICAL)

TIME: 6 HRS

Full Marks: 100

BIOTECHNOLOGY

1. Preparation of Plant tissue culture media (M.S)
2. Sterilisation of culture-wares, Explant/tissue/organs etc
3. Inoculation and incubation and subculture
4. Isolation of Plasmid DNA
5. Isolation of Genomic (Plant/Animal) DNA
6. Electrophoretic separation of DNA (AGE-demonstration)

SEMESTER-IV
PAPER- LSC 420
(SEMINAR PRESENTATION AND PROJECT REPORT)

Full Marks: 100

A) SEMINAR PRESENTATION (40)

1. Students are required to participate in weekly seminar activities and present papers under guidance of a teacher.
2. The best presentation of each student will be evaluated by an external examiner on the date of exam.
3. Marks will be awarded on the basis of total performance in the whole semester by both External and Internal examiner.

B) PROJECT REPORT / FIELD STUDY REPORT (60)

1. Each student is required to take up a small research project under the guidance of a teacher, to be completed within a period of 4 weeks and the report be submitted at the time of examination.

Or

The student prepare a scientific review of any current topic in biotechnology/ molecular biology/Environmental issues, under the guidance of a teacher and the report be submitted for evaluation.

Or

The student prepare a field study report on distribution of plants/ animal or vegetation of floristic aspects of a locality visited and report be submitted for evaluation.