3 Yr. Degree Course
(Minor)
based on NEP-2020
BOTANY

(Effective from Session 2024-25)

(Batch: 2024-2027)

SAMBALPUR UNIVERSITY

JYOTI-VIHAR, BURLA, SAMBALPUR, ODISHA-768019

COURSE AT A GLANCE (NEP-UG)

SUBJECT: *BOTANY* *ACADEMIC SESSION:* **2024-27**

CORE-I COURSE

Course Number	Semester	Course Title	Type of Paper P-Practical NP-Non-practical	Credit Hour	Maximum Weightage of Marks
Paper-I	I	Microbiology and Phycology	P	4	100
Paper-II		Analytical Technique in Plant Science	P	4	100
Paper-III	II	Cell Biology	P	4	100
Paper-IV		Mycology and Phytopathology	P	4	100
Paper-V	III	Archegoniate	P	4	100
Paper-VI		Anatomy of Angiosperms & Economic Botany	P	4	100
Paper-VII		Genetics	P	4	100
Paper-VIII	IV	Basic Molecular Biological	P	4	100
Paper-IX		Plant Ecology & Phytogeography	P	4	100
Paper-X		Plant Systemic	P	4	100
Paper-XI	V	Reproductive Biology of Angiosperm	P	4	100
Paper-XII		Basic Plant Physiology	P	4	100
Paper-XIII		Basic Plant Biotechnology	P	4	100
Paper-XIV	VI	Basic Plant Metabolism	P	4	100
Paper-XV				4	100
Paper-XVI	VII			4	100
Paper-XVII				4	100
Paper-XVIII				4	100
Paper-XIX				4	100
Paper-XX	VIII			4	100
Paper-XXI				4	100
Paper-XXII				4	100
Paper-XXIII				4	100

CORE-II/CORE-III COURSE

Course Number	Semester Core-II/ Core-III	Course Title	Type of Paper P-Practical NP-Non-practical	Credit Hour	Maximum Weightage of Marks
Paper-I	I/II	Microbiology and Phycology	P	4	100
Paper-II	III/IV	Cell biology	P	4	100
Paper-III	V/VI	Basic Plant Physiology	P	4	100
Paper-IV	VII		P	4	100
Paper-V	VIII		P	4	100

CORE COURSE II/III

Minor (Paper-I) Semester I/II

MICROBIOLOGY AND PHYCOLOGY

Course Objectives:

To introduce the diverse group of microorganisms and their habitat relationship
To learn the discovery, nature and multiplication of virus particles.
To know the characteristics, growth and physiology of bacteria and their role in agriculture, health and industry.
To learn the general characteristics and ecological distribution of bacteria, algae and Cyanobacteria and their immense importance to the mankind.
To have knowledge about the habitats, distribution and diversity of algae in the soil, freshwater and marine environments

Course Outcomes:

The students learn about the diverse nature of microbes and their interaction with other organisms
The students certainly get the opportunities to learn the basics of the nature and impact of viruses.
The students shall be able to understand the potential of various microbes and the approaches to use them for human welfare
The students would be able to identify the important microbes including bacteria, Cyanobacteria, and algae available in local environments and understand their beneficial roles.
The students shall learn about the immense potential the algal resources and understand the methods of cultivation and use of algae. Unit-I:
Learning Outcome: The learners are able to identify diverse group of microorganisms, general features of viruses and their economic importance.
The microbial world, microbial nutrition, growth and metabolism.
Viruses: Discovery, nature, physicochemical and biological characteristics; classification (Baltimore), general structure with special reference to viroid's and prions; replication (a general account), DNA virus (T-phage), lytic and lysogenic cycle; RNA virus (TMV). Economic importance of viruses. Vaccine production, role in research, medicine and diagnostics. Viral plant diseases- symptoms, effect and control
Unit–II:
Learning Outcome: The students understand the growth, physiology and economic importance of bacteria and Cyanobacteria. Bacteria: - Discovery, general characteristics, types- Archaebacterial, Eubacteria, Mycoplasma and Spheroplasts, Cell structure, inclusions, nutrition, reproduction- vegetative, asexual and recombination (conjugation, transformation transduction). Economic importance of bacteria with reference to their role in agriculture, medicine and industry.

Cyanobacteria: - Ecology, occurrence, cell structure, heterocyst, reproduction, economic importance; role in biotechnology. Morphology and life-cycle of No stock. General characteristics of prochlorophyceae, Evolutionary significance of Prochloron.

Unit–III: Learning Outcome: The students able to grasp the general characteristics, ecological distribution and economic importance of algae and Chlorophyte.

Algae:- General characteristics; Ecology and distribution; range of thallus organization; Cell structure and components; cell wall, pigments, reserve food (of only groups represented in the syllabus), flagella; methods of reproduction. Classification; criteria, system of Fritsch, and evolutionary classification of Lee (only up to groups); Role of algae in the environment, agriculture, biotechnology and industry.□ □ Chlorophyta:- General characteristics, occurrence, range of thallus organization, cell structure and reproduction. Morphology and life-cycles of Chlamydomonas, Volvox, Oedogonium and Coleochaete.

Unit-IV:

Learning Outcome: The students will able to understand the general characteristics, ecological distribution and economic importance of algae and Cyanobacteria.

Charophyta:- General characteristics; occurrence, morphology, cell structure and lifecycle of Chara; evolutionary significance

Xanthophyta:- General characteristics; occurrence, morphology and life-cycle of Vaucheria.

Phaeophyta:- Characteristics, occurrence, cell structure and reproduction. Morphology and life-cycles of Ectocarpus and Fucus.

Rhodophyta:-General characteristics, occurrence, cell structure and reproduction. Morphology and life-cycle of Polysiphonia.

Practicals:

9. Electron micrographs/Models of viruses–T-Phage and TMV, Line drawings/Photographs of Lytic and Lysogenic Cycle.

10. Types of Bacteria to be observed from temporary/permanent slides/photographs.

11. Examination of bacteria from bacterial culture by Gram ‘staining method.

12. Electron micrographs of bacteria, binary fission, endospore, conjugation, root Nodule (live materials and photographs).

13. Bacterial growth measurement by turbidometry.

14. Hemocytometry

15. Colony counting using colony counter

16. Phycology: - Study of vegetative and reproductive structures of Nostoc, Chlamydomonas (electron micrographs), Volvox, Oedogonium, Coleochaete, Chara, Vaucheria, Ectocarpus, Fucus and Polysiphonia, Procholoron, Diatoms through, temporary preparations and permanent slides

Textbooks:

- *Singh, V., Pandey, P.C., and Jain, D.K. (2017). Microbiology and Phycology, Rastogi Publication, Meerut.*
- *Pandey BP(2022).Botany for B.Sc. Students (Archigoniates & Plant Architecture),S. Chand publication, New Delhi*
- *Dubey RC & Maheshwari DK (2021) A text book of Microbiology, S. Chand publication, New Delhi*
- *Pandey BP(2023).Botany for B.Sc.Students SemesterI,NEP2020;S.Chand publication, New Delhi*

Reference Books:

- *Lee,R.E.(2008). Phycology, Cambridge University Press,Cambridge.4th edition.*
- *Prescott, L.M., Harley J.P., Klein D. A. (2010). Microbiology, McGraw-Hill, India. 8thedition.*
- *Kumar,H.D.(1999).Introductory Phycology . Affiliated East-West Press, Delhi.*
- *Campbell,N.A.,ReeceJ.B.,UrryL.A.,CainM.L.,WassermanS.A.MinorskyP.V.,Jackson R.B. (2008). Biology, Pearson Benjamin Cummings, USA. 8th edition.*
- *Pelczar, M.J., Chan, E.C.S., Krieg ,N.R.(2011) Microbiology, 8th edition, Tata McGraw- Hill Co, New Delhi.*
- *Willey , Sherwood and Christopher. Laboratory exercises in Microbiology. McGraw-Hill, India. 9th edition.*
- *Vasistha B.R. (2017)Botany for Degree student, Algae,S. Chand Publication, New Delhi.*
- *Mishra B.K.(2018)Microbiology and Phycology, Kalyani Publishers,New Delhi.*

Minor (Paper-II) Semester III/IV

CELL BIOLOGY

Course Objectives:

To understand the basic components of prokaryotic and eukaryotic cells and the role of various macromolecules in the cells.

Understand how the formation of cytoskeleton.

To have an understanding on nucleic acids as the genetic material;

To learn the basic mechanism of replication of nucleic acids.

Understand how cells undergo mitosis & meiosis.

Course Outcomes

Students will understand the structures and purposes of basic components of prokaryotic and eukaryotic cells, especially macromolecules, membranes, and organelles.

Students will understand the components of cell wall & cytoskeleton

Students will understand how these cellular components are used to generate and utilize energy in cells.

Students will apply their knowledge of cell biology to selected examples of changes or losses in cell function. These can include responses to environmental or physiological changes.

 Students will understand the cellular components underlying mitotic and meiotic cell division.

Unit-I

: Learning Outcomes: Students will understand the orgin, growth and basic components of cell, cell wall & cytoskeleton.

The Cell: Cell as a unit of structure and function; Characteristics of prokaryotic and eukaryotic cells; Origin of eukaryotic cell (Endosymbiotic theory).Unique features of plant cells

Plasmodesmata: Structure, role in movement of molecules & macromolecules, comparison with gap junctions.

Plant Cell wall: Chemistry, structure and function. Cytoskeleton: The concept, structure and roles of microtubules, microfilaments and intermediary filament.

Unit–II: Learning Outcomes: Students will recognize composition of Plasma Membrane and origin, structure, function of cell organelles.

 Plasma Membrane: Overview of membrane structure and function; fluid mosaic model; Chemical composition of membranes; Membrane transport – Passive, active and facilitated transport, endocytosis and exocytosis.

 Cell organelles: Endoplasmic Reticulum, Golgi apparatus, Lysosomes & Plant Vacuole.

Unit-III: Learning Outcomes: Students will realize the importance of photosynthesis and cellular respiration

Cell organelles: Chloroplast, Mitochondria and Peroxisomes: Structural organization & Function.

Biogenesis & semiautonomous nature of mitochondria and chloroplast.

Nucleus: Structure-nuclear envelope, nuclear pore complex, nuclear lamina & Function

Unit-IV: Learning Outcomes: Students will understand the cellular units (DNA&RNA) underlying mitotic and meiotic cell division

Nucleolus: Structure and function of nucleolus, Chromatin organization, its packaging role of nuclear matrix in chromosome organization and function, matrix binding proteins

Nucleic acids: Structure of nitrogenous bases; Structure and function of nucleotides; Types of nucleic acids; Structure of A, B, Z types of DNA; Types of RNA

Cell division: Eukaryotic cell cycle, different stages of mitosis and meiosis. Cell cycle, Regulation of cell cycle. Practical:

1. Study of plant cell structure with the help of epidermal peel mount of Onion/Rhoeo discolour

2. 2. Demonstration of the phenomenon of protoplasmic streaming in Hydrilla leaf.

3. Counting the cells per unit volume with the help of hemOcytometer.(Yeast/pollen grains).

4. Study the phenomenon of plasmolysis and deplasmolysis.

5. Study of different stages of mitosis and meiosis using acetocarmine and acetoorcine method from Onion root tip and bud respectively.

6. To find out the mitotic index.

TextBooks: Rastogi,V. B. (2016).Introductory Cytology, Kedar Nath & RamNath, Meerut

Verma PS & Agarwal VK(2022)Cell Biology(Cytology,Biomolecules and Molecular Biology) S Chand Publication ,New Delhi.

Gupta,P. K.(2017). Biomolecules and Cell Biology,Rastogi Publication, Meerut.

Kumar S.(2023).Cell biology,Pragati prakashan, Meerut

Reference Books: Sahoo,K.(2017) Biomolecules and Cell Biology, Kalyani Publishers ,New Delhi.

Tymoczko, J.L., Berg, J.M. and Stryer, L. (2012) Biochemistry: A short course, 2nded., W.H. Freeman

Nelson, D.L. and Cox, M.M.(2008) Lehninger Principles of Biochemistry,5th Edition, W.H. Freeman and Company.

Cooper, G.M. and Hausman, R.E. 2009 The Cell: A Molecular Approach. 5th edition. ASM Press & Sunderland, Washington, D.C.; Sinauer Associates, MA.

Kumar HD,MolecularBiology2edVikas Publication

Becker, W.M., Kleinsmith, L.J., Hardin. J. and Bertoni, G. P. 2009 The World of the Cell. 7th edition. Pearson Benjamin Cummings Publishing, San Francisco

Minor (Paper-III) Semester V/VI

BASIC PLANT PHYSIOLOGY

Course Objectives

 About the mechanism and physiological activities in plants.

 On nutrient uptake and translocation to different plant parts.

 On the nature and physiological roles of various plant hormones on plant growth and development.

 On the physiological requirements for plant morphogenesis and flowering

 On the role of light responsive pigments in plant morphogenesis. Course Outcomes

 The governing principles behind various physiological processes in plants.

About various uptake and transport mechanisms (water and solutes) in plants and the factors governing these processes.

The role of various plant hormones, signaling compounds ,and stress responses.

The skills to manipulate the plant hormones in plants for desired morphological and physiological responses.

The climatic and physiological requirements for molecular signalling of plants for growth, differentiation, maturity. Unit-I:

Learning Outcome: The learners shall have the knowledge on importance of water for basic physiological processes of plants.

Structure and properties of water; PH and buffers; cellular buffering systems; Cell water Potential and its components, plasmolysis and imbibition, soil water potential.

Water absorption by roots, aquaporins, path way of water movement, symplast, apoplast, trans-membrane pathways.

Ascent of sap–cohesion-tension theory. root pressure; water movement to leaves.

Transpiration: Processes; mechanism of stomatal movement; factors affecting transpiration; guttation.

Translocation in the phloem: experimental evidence in support of phloem as the site of sugar translocation. Pressure–flow model; phloem loading and unloading; source– sink relationship.

Unit-II:

Learning Outcome: The students shall know about the nutrient uptakes and hormonal regulation of plant growth and metabolism.

 Mineral nutrition: essential and beneficial elements, macro and micronutrients, mineral deficiency symptoms, chelating agents.

 Nutrient Uptake: Transport of ions across cell membrane, passive absorption, electrochemical gradient, facilitated diffusion, active absorption, role of ATP, carrier systems, proton ATPase pump and ion flux, uniport, co-transport, Symport and antiport.

 Plant growth regulators: Auxin: Biosynthesis, transport, distribution and function

 Gibberellins: Biosynthesis, transport, distribution and function

 Cytokini: Biosynthesis, transport, distribution and function

 Abscisic acid: Biosynthesis, transport, distribution and function

 Ethylene: Biosynthesis, transport, distribution and function

Unit-III:

Learning Outcome: The students shall know about photosynthesis and storage of metabolites by plants.

 Photosynthesis: General concept; photosynthetic apparatus; photosynthetic pigments and photo systems; Red drop and Emerson's enhancement effect.

 Primary photochemical reactions: photon, exciton and electron transfer

. Non-cyclic electron flow: role of tyrosine and phaeophyt in, quinine cycle, oxygen evolving complex and water splitting .Cyclic electron flow :process and function ;role of ferredox in-quinone reductase

 C3, C4 and CAM pathways of carbon fixation. Photorespiration Synthesis and Catabolism of Sucrose and Starch.

Unit-IV:

Learning Outcome: The learners shall have the skill to understand the photo morphogenesis.

 Physiology of flowering: Photoperiodism, flowering stimulus, floral meristems, external and internal factors of flower evocation; florigen concept; ABC model of floral organ identity; chemical signals for floral evocation.

 Seed dormancy: causes, effects, breaking of seed dormancy.

 Senescence: Types and causes, biochemical basis

 Phytochrome: Discovery, chemical nature, role of phytochrome in photo- morphogenesis, low energy responses (LER) and high irradiance responses (HIR), mode of action.

Practical:

1. Determination of osmotic potential of plant cell sap by plasmolytic method. 2. Determination of water potential of given tissue(potato tuber) by weight method. 3. Study of the effect of wind velocity and light on the rate of transpiration in excised twig/leaf. 4. Calculation of stomatal index and stomatal frequency from the two surfaces of leaves of a mesophyte and xerophyte. 5. To calculate the area of an open stoma and percentage of leaf area open through stomata in a mesophyte and xerophyte (both surfaces). 6. To study the phenomenon of seed germination (effect of light). 7. To study the induction of amylase activity in germinating barley grains. 8. To demonstrate suction due to transpiration. 9. Measurement of relation between transpiration and transpiring surface 10. Measurement of cuticular resistance to transpiration. 11. Measurement of primary photochemical reactions by fluorescence. Text Books:

Pandey and Sinha (2011).Plant Physiology, Vikash Publishing House, New Delhi Jain VK FundamentalofPlantphysiology,20thed.Schand publication, New Delhi

Reference Books:

Sinha, R.K.(2015). Modern Plant Physiology, Narosa Publishing House, New Delhi.

- *Hopkins, W.G. and Huner, A. (2008). Introduction to Plant Physiology. John Wiley and Sons. U.S.A. 4th edition.*
- *Taiz, L., Zeiger, E., MØller, I.M. and Murphy, A(2015).Plant Physiology and Development. Sinauer Associates Inc. USA. 6th edition.*
- *BajracharyaD.(1999).ExperimentsinPlantPhysiology-ALaboratoryManual.Narosa Publishing House, New Delhi.*
- *Salisbury, F. B. and Ross, C. W. Plant Physiology Wadsworth Publishing Company, California*
- *Sahoo, A.C. (2018).Outlines of Plant Physiology Kalyani Publishers, New Delhi.*