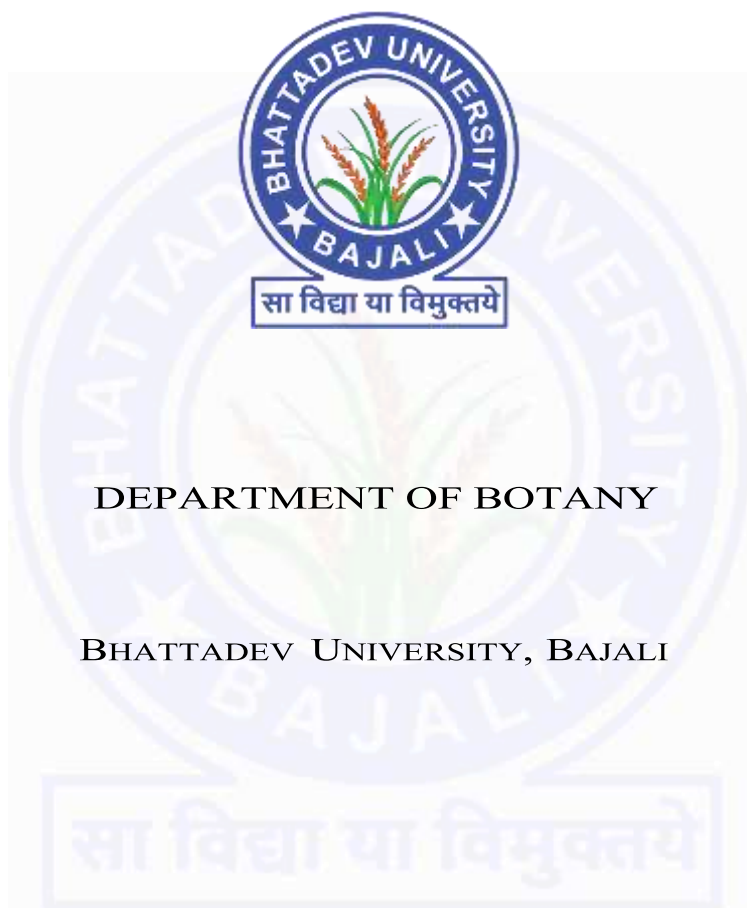

**PROPOSED FOUR YEAR UNDERGRADUATE PROGRAM (FYUGP)
SYLLABUS**

JULY, 2026



DEPARTMENT OF BOTANY

BHATTADEV UNIVERSITY, BAJALI

Major (Core) Courses

SEMESTER I
Course Code: BOT1101004CC
Course Name: Microbial and Algal Diversity
(L-2, T-1, P-1, C-4)

THEORY
(Lectures: 45)

Course Objectives:

1. To understand diversity and classification of microorganisms
2. To explain structure and replication of viruses and bacteria
3. To study characteristics and classification of fungi and algae
4. To examine life cycles and economic importance of microbes

Course Learning Outcomes:

On successful completion of this course, students will be able to

1. Describe major microbial groups and their classification
2. Explain viral and bacterial structure and reproduction
3. Identify key features of fungi and algae
4. Compare life cycles and ecological roles of microbes

Section I:

(L-8, T-4)

Introduction to Microbes: Hierarchical organization of microbes in living world; Kingdom concept; Three domains of life; Distribution of microorganisms in soil, air, water and food; Economic importance.

Viruses: Discovery, physiochemical and biological characteristics; general structure, with special reference to viroids and prions; Classification (Baltimore 1971), replication (general account), DNA virus (T-phage); Lytic and lysogenic cycle, RNA virus (TMV).

Section II:

(L-7, T-3)

Bacteria: Discovery, General characteristics; Types-archaeobacteria, eubacteria, wall-less forms (mycoplasma and spheroplasts); Cell structure; Nutritional types; Reproduction-vegetative, asexual and recombination (conjugation, transformation and transduction)

Introduction to fungi: General characteristics; Thallus organization; Cell wall composition; Nutrition; Classification (Anisworth, 1973).

Section III:

(L-7, T-4)

Study of major divisions of fungi: General characteristics of Chytridiomycota, Zygomycota, Ascomycota, Basidiomycota: asexual and sexual fruiting bodies; Brief account of *Mucor*, *Aspergillus*, *Penicillium* and *Agaricus* (Mycelial form). Economic importance of fungi.

Algae: General characteristics; Ecology and distribution; Evolutionary trend in thallus organization; Cell structure; Pigment system; Reserve food; Classification (Lee, 2008); Reproduction and Economic importance. Life Cycle of Chlorophyceae (*Volvox*, *Oedogonium*); Charophyceae (*Chara*); Bacillariophyceae (*Diatoms*); Phaeophyceae (*Ectocarpus*); Rhodophyceae (*Polysiphonia*); Cyanophyceae (*Nostoc*) and Xanthophyceae (*Vaucheria*).

Practical

(Lectures: 30)

1. EMs/Models of viruses – T-Phage and TMV, Line drawing/Photograph of Lytic and Lysogenic Cycle.
2. Gram staining of bacteria (For both Gram positive and Gram negative).
3. Types of Bacteria from temporary/permanent slides/photographs and by Gram staining technique; electron micrographs of bacterial reproduction, Binary Fission and Conjugation
4. Study of asexual stage from temporary mounts. Study of sexual stage from permanent slides/ cultured specimens/photographs of the following genera; *Mucor*, *Aspergillus*, *Penicillium*, *Puccinia* and *Agaricus*.
5. Study of diversity in thallus forms of algae: Cyanophyceae, Chlorophyceae, Xanthophyceae, Phaeophyceae and Rhodophyceae through temporary mounts, specimens or permanent slides.

Note: List of practical may be updated depending on the availability of resources.

Suggested Readings

1. Campbell, N.A. & Reece, J.B., 2008, Biology, 8th edition, Pearson Benjamin Cummings, San Francisco.
2. Pelczar, M.J., 2001, Microbiology, 5th Edition, Tata McGraw-Hill Co., New Delhi.
3. Tortora, G.J., Funke, B.R. & Case, C.L., 2010, Microbiology: An Introduction, 10th edition, Pearson Benjamin Cummings, U.S.A.
4. Wiley, J.M., Sherwood, L.M. & Woolverton, C.J., 2013, Prescott's Microbiology, 9th Edition, McGraw Hill International.
5. Kumar, H.D., 1999, Introductory Phycology, East-West Press, Delhi.
6. Lee, R.E., 2008, Phycology, 4th edition, Cambridge University Press, Cambridge.
7. Sharma, O.P., 2011, Diversity of Microbes & Cryptogams (Algae). Tata McGraw-Hill, New Delhi.
8. Vashishta, B.R., Sinha, A.K. and Singh, V.P (2010). Botany for degree students- Algae. S. Chand and Co. Ltd., New Delhi.

9. Agrios, G.N., 2011, Plant Pathology, 6th edition, Academic Press, U.K.
10. Alexopoulos, C.J., Mims, C.W. & Blackwell, M., 1996, Introductory Mycology, 4th edition, John Wiley & Sons (Asia) Singapore.
11. Sethi, I.K. & Walia, S.K., 2011, Text book of Fungi and Their Allies, Macmillan Pub. India Ltd.
12. Sharma, P.D., 2011, Plant Pathology, Rastogi Publication, Meerut, India.
13. Webster, J. & Weber, R., 2007, Introduction to Fungi, 3rd Edition, Cambridge Univ Press, Cambridge.

SEMESTER II

Course Code: BOT1201004CC

Course Name: Biomolecules and Cell Biology

(L-2, T-1, P-1, C-4)

THEORY

Course Objectives

1. To understand structure and function of major biomolecules
2. To explain principles of bioenergetics and enzyme activity
3. To study cell organization and membrane systems
4. To examine structure and function of cell organelles
5. To understand cell cycle and signalling mechanisms

Course Learning Outcomes

On successful completion of this course, students will be able to

1. Describe chemical properties of biomolecules and their biological roles
2. Explain energy transformations and enzyme kinetics
3. Compare prokaryotic and eukaryotic cell organization
4. Identify structure and function of cellular organelles

Section I:

(L-7, T-4)

Biomolecules

Types and significance of chemical bonds; Structure and properties of water; pH and buffers.

Carbohydrates: Nomenclature and classification; Monosaccharide and its derivatives; Disaccharide; Polysaccharides; Reducing and non-reducing sugar.

Lipids: Properties and function of lipids; Essential fatty acids; Triacylglycerol and Wax; Phospholipids.

Amino acids and Proteins: Structure and optical properties of amino acids; Peptide and polypeptide; Protein structure- primary, secondary, tertiary and quaternary; Protein denaturation and biological role of proteins.

Section II:

(L-6, T-3)

Nucleic acids: Nitrogenous bases; Structure and function of Nucleotides; Types of nucleic acids; Basic structure of dsDNA (with A, B and Z forms) and RNA.

Bioenergetics

Laws of thermodynamics, concept of free energy, endergonic and exergonic reactions, coupled reactions, redox reactions. ATP: structure, its role as an energy currency molecule.

Enzymes:

Structure of enzyme: holoenzyme, apoenzyme, cofactors, coenzymes and prosthetic group; Classification of enzymes; Features of active site, substrate specificity, mechanism of action (activation energy, lock and key hypothesis, induced - fit theory), Michaelis–Menten equation, enzyme inhibition and factors affecting enzyme activity.

Vitamins:

General characteristics of vitamins and hormones. Nomenclature and classification of vitamins and its significance.

Section III:**(L-7, T-4)*****The Cell***

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

Cell wall and plasma membrane

Chemistry, structure and function of Plant cell wall. Overview of membrane function; fluid mosaic model; Chemical composition of membranes; Membrane transport – Passive, active and facilitated transport, endocytosis and exocytosis.

Cell Organelles

Nucleus: Structure- nuclear envelope, nuclear pore complex, nuclear lamina, molecular organization of chromatin; Nucleolus- Nucleolar-organizing regions.

Cytoskeleton: Role and structure of microtubules, microfilaments and intermediary filament.

Chloroplast, mitochondria and peroxisomes: Structural organization; Function; Semiautonomous nature of mitochondria and chloroplast.

Ribosomes: Structure and types.

Section IV:**(L-10, T-4)**

Endomembrane system: Endoplasmic Reticulum – Structure, targeting and insertion of proteins in the ER, protein folding, processing; Smooth ER and lipid synthesis, export of proteins and lipids; Golgi Apparatus – organization, protein glycosylation, protein sorting and export from Golgi Apparatus; Lysosomes.

Nucleus: Structure, nuclear envelope and nuclear matrix; Nucleolus- nucleolar organizing region.

Cell Cycle and Cell Division

Phases of eukaryotic cell cycle; Cell cycle checkpoints; Cell division-mitosis and meiosis; Cell Signaling mechanism, signal transduction and signal protein; role of protein kinases.

Practical

(30 Hours)

1. Qualitative test for carbohydrates, reducing sugars & non-reducing sugars, lipid and proteins.
2. Cell structure with the help of epidermal peel mount of Onion/ *Rhoeo*.
3. Demonstration of the phenomenon of protoplasmic streaming in *Hydrilla/Vallisneria* leaf.
4. Counting the cells per unit volume with the help of haemocytometer (Yeast/pollen grains).
5. Cytochemical staining: DNA- Feulgen and cell wall in the epidermal peel of onion using Periodic Acid Schiff's (PAS) staining technique.
6. Study different stages of mitosis and meiosis.
7. Meiosis through temporary squash preparation.

Note: List of practical may be updated depending on the availability of resources.

Suggested Readings

1. 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
2. Berg, J.M., Tymoczko, J.L. and Stryer, L. (2011) Biochemistry, W.H. Freeman and Company
3. Campbell, M.K. (2012) Biochemistry, 7th ed., Published by Cengage Learning
4. Campbell, P.N. and Smith, A.D. (2011) Biochemistry Illustrated, 4th ed., Published by Churchill Livingstone

Cell Biology:

5. Cooper, G.M. and Hausman, R.E. (2009) The Cell: A Molecular Approach. 5th edition. ASM Press & Sunderland, Washington, D.C.; Sinauer Associates, MA.
6. Hardin, J., Becker, G., Skliensmith, L.J. (2012). Becker's World of the Cell, Pearson Education Inc. U.S.A. 8th edition.
7. Karp, G. (2010). Cell Biology, John Wiley & Sons, U.S.A. 6th edition.
8. Nelson, D.L. and Cox. M.M. (2008) Lehninger Principles of Biochemistry, 5th Edition., W.H. Freeman and Company
9. Tymoczko, J.L., Berg, J.M. and Stryer, L. (2012) Biochemistry: A short course, 2nd ed., W.H. Freeman
10. Voet, G and Voet, J.G. (2010). Biochemistry. 4th Edition, Wiley, Hoboken

Minor Courses

SEMESTER I
Course Code: BOT1101004MC
Course Name: Microbial and Algal Diversity
(L-2, T-1, P-1, C-4)

THEORY

Course Objectives:

1. To understand diversity and classification of microorganisms
2. To explain structure and replication of viruses and bacteria
3. To study characteristics and classification of fungi and algae
4. To examine life cycles and economic importance of microbes

Course Learning Outcomes:

On successful completion of this course, students will be able to

1. Describe major microbial groups and their classification
2. Explain viral and bacterial structure and reproduction
3. Identify key features of fungi and algae
4. Compare life cycles and ecological roles of microbes

Section I:

(L-8, T-3)

Introduction to Microbes: Hierarchical organization of microbes in living world; Kingdom concept; Three domains of life; Distribution of microorganisms in soil, air, water and food; Economic importance.

Viruses: Discovery, physiochemical and biological characteristics; general structure, with special reference to viroids and prions; Classification (Baltimore 1971), replication (general account), DNA virus (T-phage); Lytic and lysogenic cycle, RNA virus (TMV).

Section II:

(L-7, T-4)

Bacteria: Discovery, General characteristics; Types-archaebacteria, eubacteria, wall-less forms (mycoplasma and spheroplasts); Cell structure; Nutritional types; Reproduction-vegetative, asexual and recombination (conjugation, transformation and transduction)

Introduction to fungi: General characteristics; Thallus organization; Cell wall composition; Nutrition; Classification (Anisworth, 1973).

Section III:

(L-7, T-4)

Study of major divisions of fungi: General characteristics of Chytridiomycota, Zygomycota, Ascomycota, Basidiomycota: asexual and sexual fruiting bodies; Brief account of *Mucor*, *Aspergillus*, *Penicillium* and *Agaricus* (Mycelial form). Economic importance of fungi.

Section IV:

(L-8, T-4)

Algae: General characteristics; Ecology and distribution; Evolutionary trend in thallus organization; Cell structure; Pigment system; Reserve food; Classification (Lee, 2008); Reproduction and Economic importance. Life Cycle of Chlorophyceae (*Volvox*, *Oedogonium*); Charophyceae (*Chara*); Bacillariophyceae (*Diatoms*); Phaeophyceae (*Ectocarpus*); Rhodophyceae (*Polysiphonia*); Cyanophyceae (*Nostoc*) and Xanthophyceae (*Vaucheria*).

Practical

(30 Hours)

1. EMs/Models of viruses – T-Phage and TMV, Line drawing/Photograph of Lytic and Lysogenic Cycle.
2. Gram staining of bacteria (For both Gram positive and Gram negative).
3. Types of Bacteria from temporary/permanent slides/photographs and by Gram staining technique; electron micrographs of bacterial reproduction, Binary Fission and Conjugation
4. Study of asexual stage from temporary mounts. Study of sexual stage from permanent slides/ cultured specimens/photographs of the following genera; *Mucor*, *Aspergillus*, *Penicillium*, *Puccinia* and *Agaricus*.
5. Study of diversity in thallus forms of algae: Cyanophyceae, Chlorophyceae, Xanthophyceae, Phaeophyceae and Rhodophyceae through temporary mounts, specimens or permanent slides.

Note: List of practical may be updated depending on the availability of resources.

Suggested Readings

Viruses and Bacteria:

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13. Webster, J. & Weber, R., 2007, Introduction to Fungi, 3rd Edition, Cambridge Univ Press, Cambridge.

SEMESTER II

Course Code: BOT1201004MC

Course Name: Biomolecules and Cell Biology

(L-2, T-1, P-1, C-4)

THEORY

Course Objectives

1. To understand structure and function of major biomolecules
2. To explain principles of bioenergetics and enzyme activity
3. To study cell organization and membrane systems
4. To examine structure and function of cell organelles
5. To understand cell cycle and signalling mechanisms

Course Learning Outcomes

On successful completion of this course, students will be able to

1. Describe chemical properties of biomolecules and their biological roles
2. Explain energy transformations and enzyme kinetics
3. Compare prokaryotic and eukaryotic cell organization
4. Identify structure and function of cellular organelles

Section I:

(L-7, T-4)

Biomolecules

Types and significance of chemical bonds; Structure and properties of water; pH and buffers.

Carbohydrates: Nomenclature and classification; Monosaccharide and its derivatives; Disaccharide; Polysaccharides; Reducing and non-reducing sugar.

Lipids: Properties and function of lipids; Essential fatty acids; Triacylglycerol and Wax; Phospholipids.

Amino acids and Proteins: Structure and optical properties of amino acids; Peptide and polypeptide; Protein structure- primary, secondary, tertiary and quaternary; Protein denaturation and biological role of proteins.

Section II:

(L-6, T-3)

Nucleic acids: Nitrogenous bases; Structure and function of Nucleotides; Types of nucleic acids; Basic structure of dsDNA (with A, B and Z forms) and RNA.

Bioenergetics

Laws of thermodynamics, concept of free energy, endergonic and exergonic reactions, coupled reactions, redox reactions. ATP: structure, its role as an energy currency molecule.

Enzymes:

Structure of enzyme: holoenzyme, apoenzyme, cofactors, coenzymes and prosthetic group; Classification of enzymes; Features of active site, substrate specificity, mechanism of action (activation energy, lock and key hypothesis, induced - fit theory), Michaelis–Menten equation, enzyme inhibition and factors affecting enzyme activity.

Vitamins:

General characteristics of vitamins and hormones. Nomenclature and classification of vitamins and its significance.

Section III:**(L-7, T-4)*****The Cell***

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

Cell wall and plasma membrane

Chemistry, structure and function of Plant cell wall. Overview of membrane function; fluid mosaic model; Chemical composition of membranes; Membrane transport – Passive, active and facilitated transport, endocytosis and exocytosis.

Cell Organelles

Nucleus: Structure- nuclear envelope, nuclear pore complex, nuclear lamina, molecular organization of chromatin; Nucleolus- Nucleolar-organizing regions.

Cytoskeleton: Role and structure of microtubules, microfilaments and intermediary filament.

Chloroplast, mitochondria and peroxisomes: Structural organization; Function; Semiautonomous nature of mitochondria and chloroplast.

Ribosomes: Structure and types.

Section IV:**(L-10, T-4)**

Endomembrane system: Endoplasmic Reticulum – Structure, targeting and insertion of proteins in the ER, protein folding, processing; Smooth ER and lipid synthesis, export of proteins and lipids; Golgi Apparatus – organization, protein glycosylation, protein sorting and export from Golgi Apparatus; Lysosomes.

Nucleus: Structure, nuclear envelope and nuclear matrix; Nucleolus- nucleolar organizing region.

Cell Cycle and Cell Division

Phases of eukaryotic cell cycle; Cell cycle checkpoints; Cell division-mitosis and meiosis; Cell Signaling mechanism, signal transduction and signal protein; role of protein kinases.

Practical

(30 Hours)

1. Qualitative test for carbohydrates, reducing sugars & non-reducing sugars, lipid and proteins.
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4. Counting the cells per unit volume with the help of haemocytometer (Yeast/pollen grains).
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6. Study different stages of mitosis and meiosis.
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6. Hardin, J., Becker, G., Skliensmith, L.J. (2012). Becker's World of the Cell, Pearson Education Inc. U.S.A. 8th edition.
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8. Nelson, D.L. and Cox. M.M. (2008) Lehninger Principles of Biochemistry, 5th Edition., W.H. Freeman and Company
9. Tymoczko, J.L., Berg, J.M. and Stryer, L. (2012) Biochemistry: A short course, 2nd ed., W.H. Freeman
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