UNIVERSITY OF NORTH BENGAL

PROPOSED COURSE STRUCTURE

FOUR YEAR UNDERGRADUATE PROGRAM (FYUGP) WITH

SINGLE MAJOR and SINGLE MINOR

BOTANY

UNDER THE NEW CURRICULUM AND CREDIT FRAMEWORK, 2022

W.E.F. 2024–2025

COURSE STRUCTURE FOR 1st Year

Year	Semester	Course type	Course code	Course name	Credits	Credit distribution	
						Theory	Practical
I	1	Major	BOTAMAJ101	Origin of Life and Plant Diversity	4	3	1
		Major	BOTAMAJ102	Morphology and Anatomy	4	3	1
		Minor	BOTAMIN101	Introduction to Life and Plant Diversity	4	3	1
	2	Major	BOTAMAJ203	Biomolecules and Cell Biology	4	3	1
		Major	BOTAMAJ204	Microbiology	4	3	1
		Minor	BOTAMIN202	Cell Biology	4	3	1

***NUMBER OF TEACHING HOURS/WEEK**

THEORY: 1 credit = 1 Lecture/week = 1 hour/week

PRACTICAL: 1 credit = 1 Class/week = 2 hour/week

SEMESTER - I

Course Type: MAJOR
Course Code: BOTAMAJ101
Course Name: Origin of Life and Plant Diversity

Credits: 4 (Theory-3, Practical-1)
Full Marks: 80 (Theory-60, Practical-20)

Brief Course Description:

The course deals with the Origin and Evolution of life and imparts basic knowledge about plants and related life forms. It thoroughly establishes the relationship of plants with other kingdoms of life. Also, it emphasizes the huge diversity of known plant life, along with an idea of the fossil record and geological time scale.

Prerequisite(s) and/or Note(s):

(1) High School Biology.
(2) Note(s): Syllabus may be modified after and not during the term itself, depending on the circumstances. However, students will be evaluated only on the basis of topics covered in the course.

Course Objectives:

Knowledge acquired:

(1) Origin and evolution of Life
(2) Introduction to plant and other life forms
(3) Different groups of plants.

Skills gained:

(1) Handling microscopy, staining and mounting of plant specimens, and,
(2) Methods of collection, identification and preservation of plant specimens.

Competency Developed:

(1) Schematic knowledge of collection and subsequent plant specimens.
(2) Proper arrangement of preserved plant specimens.
(3) Choosing suitable staining and mounting protocols for study of plant specimens.

THEORY

Total lectures: 45

Unit-1: Origin of Life **(8 lectures)**

Origin of life: Oparin's hypothesis, Haldane's hypothesis, Miller-Urey experiment, Panspermia, origin of cells and the first organisms: the concepts of prebiotic soup and coacervates.

Unit-2: Evolution **(7 lectures)**

Fossil records; Geological time scale – major events in each era; Evidences of evolution; theories of evolution - Lamarck, Wallace, Charles Darwin, Hugo De Vries. Neo-Darwinism – major postulates - isolation, mutation, genetic drift, and speciation; the role of extinction in evolution.

Unit-3: Classification of Life Forms **(10 lectures)**

Diversity of life: Prokaryotes and Eukaryotes; unicellularity and multicellularity; Two kingdom classification (Carolus Linnaeus, 1735); phylogenetic classification (August W Eichler, 1878); Three kingdom classification (Ernst Haeckel, 1866); Four kingdom classification (H F Copeland, 1938); Five kingdom classification (R H Whittaker, 1969); Six kingdom classification (Thomas Cavalier-Smith, 1998); Seven kingdom classification (M A Ruggiero, 2015); Three domains (Carl Woese, 1990) – criteria for classification, general character.

Unit-4: Introduction to Plant Kingdom **(10 lectures)**

General features of plants; Basic knowledge of thallophytes, archegoniates and spermatophytes; Basic structure and function of plant organs: roots, stem and leaves, vascular bundle; Introduction to mesophytes, hydrophytes and xerophytes; Concept of alternation of generations; the colonization of land by plants; origin of embryophytes and flowering plants.

Unit-5: Plant Diversity **(10 lectures)**

Introduction to ICN and the status of algae and fungi; Diversity of plants: study of the salient features and economic importance of algae, fungi, bryophytes, pteridophytes, gymnosperms and angiosperms; Encyclopaedia of Life.

PRACTICAL

Total classes: 15

1. Study of Light microscope: simple and compound.
2. Preparation of specimens for light microscopy – Collection, fixation and preservation of plant specimens; Whole mounts and sections – hand sectioning.
3. Study of prokaryotic and eukaryotic cells.
4. Demonstration of basic staining techniques of plant tissues.

5. Study and demonstration of mounting techniques.
6. Collection and identification of plant specimens from diverse groups.
7. Morphological variations in roots, stem and leaves (or equivalent organs) across different plant groups.
8. Study of conducting elements in different plant groups through photographs / permanent slides.
9. Study of reproductive structures in different plant groups through photographs / permanent slides.

Suggested Readings

1. Brian K. Hall and Benedikt Hallgrímsson, 2013. Strickberger's Evolution (Fifth Edition). Jones and Bartlett Publishers.
2. Eldon D Enger, Frederick C Ross, David B Bailey, 2011. Concepts in Biology (Fourteenth Edition). Tata McGraw Hill.
3. Gerald Audesirk, Teresa Audesirk, Bruce E Byers, 2019. Biology: Life on earth. (Twelfth Edition). Pearson.
4. James D Mauseth, 2019. Botany: An Introduction to Plant Biology. Jones & Bartlett.
5. Kenneth A Mason, Jonathan B Losos, Tod Duncan, 2017. Biology (Twelfth Edition). McGraw Hill.
6. Lisa A Urry, Michael L Cain, Steven A Wasserman, Peter V Minorsky, Rebecca B Orr, 2021. Campbell Biology (Twelfth Edition). Pearson.
7. Michael G Simpson, 2019. Plant Systematics (Third Edition). Academic Press.
8. Peter Raven, George Johnson, Kenneth Mason, Jonathan Losos and Tod Duncan, 2023. Biology (Thirteenth Edition). McGraw Hill.
9. Prasad M K, Krishna Prasad M, 2000. Outlines of Microtechnique. Emkay Publishers, New Delhi.
10. Scott Freeman, Kim Quillin, Lizabeth Allison, Michael Black, Greg Podgorski, Emily Taylor, and Jeff Carmichael, 2019. Biological Science. Pearson.
11. Sylvia S Mader and Michael Windelspecht, 2022. Biology (Fourteenth Edition). McGraw Hill.
12. Timothy Walker, 2012. Plants: A Very Short Introduction. Oxford.

SEMESTER - I

Course Type: MAJOR
Course Code: BOTAMAJ102
Course Name: Morphology and Anatomy

Credits: 4 (Theory-3, Practical-1)
Full Marks: 80 (Theory-60, Practical-20)

Brief Course Description:

The course deals with the morphology, and anatomy, of plants. It emphasizes the structural organization of vegetative and reproductive organs, their functions, the origin and distribution of plant tissues, and the process of secondary growth.

Prerequisite(s) and/or Note(s):

(1) High school Biology.
(2) Note(s): Syllabus changes yearly and may be modified during the term itself, depending on the circumstances. However, students will be evaluated only on the basis of topics covered in the course.

Course Objectives:

Knowledge acquired:
(1) Structure and function of different plant organs.
(2) Concept of origin of different apical meristems.
(3) Concept of secondary growth and its types.

Skills gained:
(1) Practical identification of plant parts and their modifications.
(2) Understanding of plant tissue systems and secondary growth.

Competency Developed:
(1) Structural and functional differences between dicot and monocot.
(2) Structure and functional differences between the three plant tissue systems.
(3) Interdisciplinary application of plant morphology and anatomy.

THEORY

Total lectures: 45

Unit-1: Morphology (12 lectures)

Structure, function and types of root, stem and leaf; Concept of Flower as a Modified Shoot; types of flower, inflorescence, Cohesion and Adhesion; Ovule - Types; Placentation; Fruits and Seeds - Types and Dispersal.

Unit-2: Cellular Organization and Tissue System (14 Lectures)

Structures, functions, and modifications of plant cells and tissues - simple and complex (no phylogeny); Structure of dicot and monocot root, stem, and leaf; Epidermal tissue system - Structural organization and function; epidermal outgrowths – trichomes - types and functions, root hairs, stomata – types and classification, hydathodes. Ground Tissue System - Structural organization and function, endodermis and exodermis. Vascular Tissue System - Xylem and phloem - structure and function. Mechanical tissues – structure and functions.

Unit-3: Apical Meristems (6 Lectures)

Structure and Organization of shoot apex (Apical cell theory, Histogen theory, Tunica Corpus theory, Cytohistological zonation); Structure and Organization of root apex (Apical cell theory, Histogen theory, Korper-Kappe theory), structure and function of root cap and quiescent center.

Unit-4: Secondary Growth and Wood (10 lectures)

Structure, function and seasonal activity of cambium; secondary growth in root and stem, anomalous secondary growth; different types of wood (Sap wood and heart wood, ring and diffuse porous wood, early and late wood); tyloses and its importance.

Unit-5: Scope of Plant Morphology and Anatomy (3 lectures)

Applications in systematics, forensics, and pharmacognosy.

PRACTICAL

Total classes: 15

1. Study of cohesion and adhesion of floral parts through photograph/fresh specimens.
2. Study of aestivation through photographs/fresh specimens.
3. Study of different types of inflorescence and fruit types through photographs/fresh specimens.
4. Study of dicot and monocot stem, root and leaf by temporary slide preparation.
5. Study of apical meristems of root and shoot through photographs/permanent slides.

6. Study of normal and anomalous secondary growth through temporary slide preparations.

7. Study of xylem and phloem elements through temporary/permanent slides.

Suggested Readings

1. Kaplan, D., Specht, C.D. Kaplan's Principles of Plant Morphology. CRC Press.
2. Bell, A.D. Plant Form: An Illustrated Guide to Flowering Plant Morphology. Timber Press.
3. Dickison, W.C. (2000). Integrative Plant Anatomy. Harcourt Academic Press, USA.
4. Fahn, A. (1974). Plant Anatomy. Pergmon Press, USA.
5. Mauseth, J.D. (1988). Plant Anatomy. The Benjammin/Cummings Publisher, USA.
6. Evert, R.F. (2006) Esau's Plant Anatomy: Meristems, Cells, and Tissues of the Plant Body: Their Structure,Function and Development. John Wiley and Sons, Inc.

SEMESTER - I

Course Type: MINOR
Course Code: BOTAMIN101
Course Name: Introduction to Life and Plant Diversity

Credits: 4 (Theory-3, Practical-1)
Full Marks: 80 (Theory-60, Practical-20)

Brief Course Description:

This course deals with the Origin and Evolution of life and imparts basic knowledge about plants and related life forms. It thoroughly establishes the relationship of plants with other kingdoms of life. Also, it emphasizes the huge diversity of known plant life, along with an idea of the fossil record and geological time scale.

Prerequisite(s) and/or Note(s):

(1) High School Biology.
(2) Note(s): Syllabus may be modified after and not during the term itself, depending on the circumstances. However, students will be evaluated only on the basis of topics covered in the course.

Course Objectives:

Knowledge acquired:

(1) Origin and evolution of Life
(2) Introduction to plant and other life forms
(3) Different groups of plants.

Skills gained:

(1) Handling microscopy, staining and mounting of plant specimens, and,
(2) Methods of collection, identification and preservation of plant specimens.

Competency Developed:

(1) Schematic knowledge of collection and subsequent plant specimens.
(2) Proper arrangement of preserved plant specimens.
(3) Choosing suitable staining and mounting protocols for study of plant specimens.

THEORY

Total lectures: 45

Unit-1: Origin of life **(8 lectures)**

Origin of life: Oparin's hypothesis, Haldane's hypothesis, Miller-Urey experiment, origin of cells and the first organisms: the concepts of prebiotic soup and coacervates.

Unit-2: Evolution **(7 lectures)**

Geological time scale – major events in each era; Evidences of evolution; theories of evolution - Lamarck, Wallace, Charles Darwin, Hugo De Vries. Neo-Darwinism – major postulates - isolation, mutation, genetic drift, and speciation.

Unit-3: Diversity and classification of life forms **(10 lectures)**

Diversity of life: Prokaryotes and Eukaryotes; unicellularity and multicellularity; Two kingdom classification (Carolus Linnaeus, 1735); phylogenetic classification (August W Eichler, 1878); Three kingdom classification (Ernst Haeckel, 1866); Three domains (Carl Woese, 1990) – criteria for classification, general character.

Unit-4: Plant kingdom **(10 lectures)**

General features of plants; Basic knowledge of thallophytes, archegoniates and spermatophytes; Basic structure and function of plant organs: roots, stem and leaves, vascular bundle; Introduction to mesophytes, hydrophytes and xerophytes; Concept of alternation of generations; the colonization of land by plants.

Unit-5: Plant diversity **(10 lectures)**

Introduction to ICN and the status of algae and fungi; Diversity of plants: study of the salient features of major plant groups - algae, fungi, bryophytes, pteridophytes, gymnosperms and angiosperms.

PRACTICAL

Total classes: 15

1. Study of Light microscope: simple and compound.
2. Preparation of specimens for light microscopy – Collection, fixation and preservation of plant specimens; Whole mounts and sections – hand sectioning.
3. Study of prokaryotic and eukaryotic cells.

4. Demonstration of basic staining techniques of plant tissues.
5. Study and demonstration of mounting techniques.
6. Morphological variations in roots, stem and leaves (or equivalent organs) across different plant groups.
7. Study of reproductive structures in different plant groups through photographs / permanent slides.

Suggested Readings

1. Brian K. Hall and Benedikt Hallgrímsson, 2013. Strickberger's Evolution (Fifth Edition). Jones and Bartlett Publishers.
2. Eldon D Enger, Frederick C Ross, David B Bailey, 2011. Concepts in Biology (Fourteenth Edition). Tata McGraw Hill.
3. Gerald Audesirk, Teresa Audesirk, Bruce E Byers, 2019. Biology: Life on earth. (Twelfth Edition). Pearson.
4. James D Mauseth, 2019. Botany: An Introduction to Plant Biology. Jones & Bartlett.
5. Kenneth A Mason, Jonathan B Losos, Tod Duncan, 2017. Biology (Twelfth Edition). McGraw Hill.
6. Lisa A Urry, Michael L Cain, Steven A Wasserman, Peter V Minorsky, Rebecca B Orr, 2021. Campbell Biology (Twelfth Edition). Pearson.
7. Michael G Simpson, 2019. Plant Systematics (Third Edition). Academic Press.
8. Peter Raven, George Johnson, Kenneth Mason, Jonathan Losos and Tod Duncan, 2023. Biology (Thirteenth Edition). McGraw Hill.
9. Prasad M K, Krishna Prasad M, 2000. Outlines of Microtechnique. Emkay Publishers, New Delhi.
10. Scott Freeman, Kim Quillin, Lizabeth Allison, Michael Black, Greg Podgorski, Emily Taylor, and Jeff Carmichael, 2019. Biological Science. Pearson.
11. Sylvia S Mader and Michael Windelspecht, 2022. Biology (Fourteenth Edition). McGraw Hill.
12. Timothy Walker, 2012. Plants: A Very Short Introduction. Oxford.

SEMESTER - II

Course Type: MAJOR
Course Code: BOTAMAJ203
Course Name: Biomolecules and Cell Biology

Credits: 4 (Theory-3, Practical-1)
Full Marks: 80 (Theory-60, Practical-20)

Brief Course Description:

This course deals with topics in Biomolecules and Cell Biology. In particular, the course will cover the study of different biomolecules such as carbohydrates, proteins, and lipids. The cover will also provide information cell and its organalles.

Prerequisite(s) and/or Note(s):

(1) High School Biology.
(2) Note(s): Syllabus changes yearly and may be modified during the term itself, depending on the circumstances. However, students will be evaluated only on the basis of topics covered in the course.

Course Objectives:

Knowledge acquired:

(1) Clear idea about the structures and function of basic components of prokaryotic and eukaryotic cells, especially macromolecules, membranes, and organelles.
(2) Detailed knowledge of different types of biomolecules and the importance in cellular composition.

Skills gained:

(1) Qualitative analysis of macromolecules.
(2) Measurement of cell size.
(3) Techniques for studying chromosomes and cell division.

Competency Developed:

(1) Students learn to distinguish different biomolecules and can check their presence in different samples
(2) Student learn the structure and function of different parts of cell and its importance.
(3) Able to investigate protein, carbohydrate and lipid with their active role in cellular function.

THEORY

Total lectures: 45

Unit 1: Biomolecules **(15 lectures)**

Types and significance of chemical bonds; Carbohydrates-Nomenclature and classification with examples; Lipids - Definition and importance, classification; Fatty acids - structure and functions; Amino acids – Classification and examples; Proteins - peptide bond, properties and biological role of proteins, levels of protein structure; Properties and function of enzymes; Nucleic acids - Structure and types.

Unit 2: The Cell **(3 lectures)**

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

Unit 3: Cell Wall and Plasma Membrane **(4 lectures)**

Chemistry, structure and function of plant cell wall; Plasma membrane - Chemical composition and function, Fluid mosaic model; Membrane transport - Diffusion, Osmosis, Passive, active and Facilitated.

Unit 4: Cell Organelles **(18 lectures)**

Nucleus – Structure of nuclear envelope, nuclear pore complex, nuclear lamina, structure of chromatin, nucleolus; Cytoskeleton - Role and structure of microtubules, microfilaments and intermediate filament; Chloroplast, mitochondria and peroxisomes - Structural organization and functions; Endomembrane system; Endoplasmic reticulum - Structure, function and targeting and insertion of proteins in the ER; Golgi apparatus - Organization, function, and protein sorting and export from Golgi apparatus; Lysosomes - Structure and function.

Unit 5: Cell Division **(5 lectures)**

Mitosis and meiosis: Different stages and significance; Phases of eukaryotic cell cycle.

PRACTICAL

Total classes: 15

1. Qualitative tests for reducing sugars, non-reducing sugars, lipids and proteins.
2. Demonstration of the phenomenon of protoplasmic streaming in Hydrilla leaf.
3. Measurement of cell size by the technique of micrometry.
4. Counting the cells per unit volume with the help of haemocytometer (pollen/spore).
5. Study of cell and its organelles with the help of electron micrographs.
6. Study the phenomenon of plasmolysis and deplasmolysis.

7. Study the effect of organic solvents (ethanol/acetone) on membrane permeability through absorbance.
8. Study the effect of temperature on membrane permeability through absorbance.
9. Study of different stages of mitosis by squash technique.

Suggested Readings

1. Campbell MK (2012) Biochemistry, 7th edition, Published by Cengage Learning.

2. Campbell PN and Smith AD (2011) Biochemistry Illustrated, 4th edition, Published by Churchill Livingstone.

3. Tymoczko JL, Berg JM and Stryer L (2012) Biochemistry: A short course, 2nd edition, W.H.Freeman.

4. Berg JM, Tymoczko JL and Stryer L (2011) Biochemistry, W.H.Freeman and Company.

5. Nelson DL and Cox MM (2008) Lehninger Principles of Biochemistry, 5th edition, W.H. Freeman and Company.

6. Karp G (2010). Cell Biology, 6th edition, John Wiley & Sons, U.S.A.

7. Hardin J, Becker G, Skliensmith LJ (2012) 8th edition Becker's World of the Cell, Pearson Education Inc. U.S.A.

SEMESTER - II

Course Type: MAJOR
Course Code: BOTAMAJ204
Course Name: Microbiology

Credits: 4 (Theory-3, Practical-1)
Full Marks: 80 (Theory-60, Practical-20)

Brief Course Description:

This course deals with the history and scope of Microbiology along with the diversity of microbial world. It emphasizes the structural organization, growth, metabolism and reproduction of bacteria, viruses and other microbial forms. It also highlights the techniques practised in microbial laboratories and the application of microorganisms in agricultural and industrial sectors.

Prerequisite(s) and/or Note(s):

(1) High School Biology.
(2) Note(s): Syllabus may be modified after and not during the term itself, depending on the circumstances. However, students will be evaluated only on the basis of topics covered in the course.

Course Objectives:

Knowledge acquired:
(1) Diversity of microbial world.
(2) Introduction to the laboratory techniques in Microbiology.
(3) Agricultural and industrial application of microorganisms.

Skills gained:
(1) Media preparation, culturing and preservation of microbial cells.
(2) Basic sterilization techniques.

Competency Developed:
(1) Selection of suitable media for growth and reproduction for microbes.
(2) Choosing proper sterilization techniques.
(3) Collection and preservation of specific microorganisms.

THEORY

Total lectures: 45

Unit 1: Microbial Diversity (7 Lectures)

Introduction to microbial diversity; Hierarchical organization and positions of microbes in the living world: Distribution of microbes in soil, air, food and water. Significance of microbial diversity in nature. History and development of microbiology - Microbiologists and contributions of - Leeuwenhoek, Louis Pasteur, Robert Koch, Alexander Flemming.

Unit 2: Bacteria (12 Lectures)

Discovery, General characteristics; Types - Archaebacteria, Eubacteria, Wall less forms (Mycoplasma, Phytoplasma and Spheroplasts); Cell structure with special emphasis on cell wall, membrane, flagella, pili, endospore; nucleoid; Growth curve; Aerobic and anaerobic respiration, fermentation- lactic acid fermentation and alcoholic fermentation, Pasteur effect; Reproduction-vegetative, asexual and recombination (conjugation, transformation, and transduction). Economic importance of bacteria.

Unit. 3: Viruses (8 lectures)

General characteristics; classification (Baltimore), brief outline of ICTV system of classification; structure and multiplication of DNA virus (T-phage) and RNA virus (TMV, SARS-COV-2); viroids and prions - general characteristics and diseases; replication (general account), lytic cycle and lysogenic cycle; economic importance.

Unit. 4: Techniques in Microbiology (10 Lectures)

Brief description of culture media and their importance, microbial cultures. Pure culture and axenic cultures, subculturing. Basic knowledge of sterilization-autoclave, disinfection-laminar airflow, and preservation-slants. A brief account of ITCC, MTCC, and ATCC.

Unit 5: Applied Microbiology (8 Lectures)

Scope of Microbiology, Introduction to bioreactors, Basic structure & components; Role of microbes in industry (cheese, food, alcohol, wine, enzymes, organic acids); agriculture (PGPRs, biofertilizers); Bioremediation.

PRACTICAL

Total classes: 15

1. Electron micrographs of bacterial cell; Study of different types of Bacteria from temporary/permanent slides; Endospore, Binary fission, Conjugation.
2. Study of Viruses: Electron micrographs / Models - T-Bacteriophage and TMV; specimens/digital resources/ Line drawings of Lytic and Lysogenic Cycle.
3. Single staining using curd.
4. Gram staining to differentiate between Gram-positive and Gram-negative bacteria.
5. Demonstration of serial dilution technique for the isolation of pure culture of bacteria.
6. Study of *Rhizobium* from root nodules of a leguminous plant.
7. Study of bioreactors/fermenters, Laminar airflow, autoclave through photographs/video.

Suggested Readings:

1. Pelczar, M.J. (2001). Microbiology, 5th edition. New Delhi, Delhi, Tata McGrawHill Co.

2. Tortora, G.J., Funke, B.R., Case, C.L. (2016). Microbiology: An Introduction, Indian

3. Prescott, L.M., Harley J.P., Klein D. A. (2005). Microbiology, 6th edition: McGraw Hill, New Delhi.

4. Gupta, R., Chugh, G. (2022). Plants, Microbes and Diseases 1st Edition, I.K. International Pvt. Ltd., Delhi.

5. Subba Rao, N.S. (2000). Soil Microbiology, Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.

6. Talaro, K.P., Talaro, A. (2006). Foundations in Microbiology. McGraw Hill, New Delhi

SEMESTER - II

Course Type: MINOR
Course Code: BOTAMIN202
Course Name: Cell Biology

Credits: 4 (Theory-3, Practical-1)
Full Marks: 80 (Theory-60, Practical-20)

Brief Course Description:

This course deals with topics in Cell Biology. In particular, the course will cover the structural organization and functions of prokaryotic and eukaryotic cell, cellular organelles and cytoskeleton. It also gives an idea of cell division.

Prerequisite(s) and/or Note(s):

(1) High School Biology.
(2) Note(s): Syllabus changes yearly and may be modified during the term itself, depending on the circumstances. However, students will be evaluated only on the basis of topics covered in the course.

Course Objectives:

Knowledge acquired:

1) Clear idea about the structures and functions of basic components of prokaryotic and eukaryotic cells, especially cytoskeletons, membranes, and organelles.
(2) Detailed knowledge of cell cycle and cell division.

Skills gained:

(1) Measurement of cell size.
(2) Technique of Chromosome study.
(3) Characterize plasmolysis and deplasmolysis.

Competency Developed:

(1) Student learn the structure and function of different parts of cell and its importance.
(2) Distinguish between the stages of cell division.

THEORY

Total lectures: 45

Unit 1: The cell **(6 lectures)**

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

Unit 2: Cell wall and plasma membrane **(6 lectures)**

Chemistry, structure and function of plant cell wall; Plasma membrane - Chemical composition and function, Fluid mosaic model; Membrane transport - Diffusion, Osmosis, Passive, active and Facilitated diffusion.

Unit 3: Cell organelles **(14 lectures)**

Nucleus – Structure of nuclear envelope, nuclear pore complex, nuclear lamina, structure of chromatin, nucleolus; Chloroplast, mitochondria and peroxisomes - Structural organization and functions; Endoplasmic reticulum – Structure and function; Golgi apparatus – Organization and function; Lysosomes - Structure and function.

Unit 4: Cell division **(7 lectures)**

Mitosis and meiosis: Different stages and significance; Phases of eukaryotic cell cycle.

Unit 5: Cellular macromolecules **(12 lectures)**

Carbohydrates - Nomenclature and classification with examples; Lipids – classification with examples; Fatty acids - structure and functions; Amino acids – Classification and examples; Proteins - peptide bond, properties and biological role of proteins, levels of protein structure; Properties and function of enzymes; Nucleic acids - Structure and types.

PRACTICAL

Total classes: 15

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

2. Measurement of cell size by the technique of micrometry.

3. Study of cell and its organelles with the help of electron micrographs.

4. Study the phenomenon of plasmolysis and deplasmolysis.

5. Study of different stages of mitosis by squash technique.

6. Qualitative tests for reducing sugars, non-reducing sugars, lipids and proteins.

Suggested Readings

1. Campbell MK (2012) Biochemistry, 7th edition, Published by Cengage Learning.

2. Campbell PN and Smith AD (2011) Biochemistry Illustrated, 4th edition, Published by Churchill Livingstone.

3. Tymoczko JL, Berg JM and Stryer L (2012) Biochemistry: A short course, 2nd edition, W.H.Freeman.

4. Berg JM, Tymoczko JL and Stryer L (2011) Biochemistry, W.H.Freeman and Company.

5. Nelson DL and Cox MM (2008) Lehninger Principles of Biochemistry, 5th edition, W.H. Freeman and Company.

6. Karp G (2010). Cell Biology, 6th edition, John Wiley & Sons, U.S.A.

7. Hardin J, Becker G, Skliensmith LJ (2012) 8th edition Becker's World of the Cell, Pearson Education Inc. U.S.A.

QUESTION PATTERN & TOTAL MARKS DISTRIBUTION FOR MAJOR, & MINOR PAPERS

Theoretical Papers (Full Marks = 60)

Sl No.	Questions to be answered	Out of	Marks for each Question	Total Marks
1.	5	8	2	5 × **2** = 10
2.	5	8	6	5 × **6** = 30
3.	2	4	10	2 × **10** = 20

DURATION OF EXAMINATION FOR MAJOR, & MINOR PAPERS

Semester End Examination	Full Marks	Duration of Exams
Theoretical	60	2.5 Hours
Practical	20	3 Hours

 # Practical guidelines and question pattern will be communicated before the semester end examination as per the decision of UGBOS Botany.

UNIVERSITY OF NORTH BENGAL

PROPOSED COURSE STRUCTURE

FOUR YEAR UNDERGRADUATE PROGRAM (FYUGP) WITH

THREE DISCIPLINE SPECIFIC MULTIDISCIPLINARY COURSE

BOTANY

UNDER THE NEW CURRICULUM AND CREDIT FRAMEWORK, 2022

W.E.F. 2024–2025

COURSE STRUCTURE FOR 1st Year

Year	Semester	Course type	Course code	Course name	Credits	Credit distribution	
						Theory	Practical
I	1	DSC Subject A/ Subject B	BOTADSC101	Introduction to Life and Plant Diversity	4	3	1
		Minor	BOTAMIN101	Introduction to Life and Plant Diversity	4	3	1
	2	DSC Subject A/ Subject B	BOTADSC202	Cell Biology	4	3	1
		Minor	BOTAMIN202	Cell Biology	4	3	1

***NUMBER OF TEACHING HOURS/WEEK**

THEORY: 1 credit = 1 Lecture/week = 1 hour/week

PRACTICAL: 1 credit = 1 Class/week = 2 hour/week

SEMESTER - I

Course Type: DSC A/B
Course Code: BOTADSC101
Course Name: Introduction to Life and Plant Diversity

Credits: 4 (Theory-3, Practical-1)
Full Marks: 80 (Theory-60, Practical-20)

Brief Course Description:

This course deals with the Origin and Evolution of life and imparts basic knowledge about plants and related life forms. It thoroughly establishes the relationship of plants with other kingdoms of life. Also, it emphasizes the huge diversity of known plant life, along with an idea of the fossil record and geological time scale.

Prerequisite(s) and/or Note(s):

(1) High School Biology.
(2) Note(s): Syllabus may be modified after and not during the term itself, depending on the circumstances. However, students will be evaluated only on the basis of topics covered in the course.

Course Objectives:

Knowledge acquired:

(1) Origin and evolution of Life
(2) Introduction to plant and other life forms
(3) Different groups of plants.

Skills gained:

(1) Handling microscopy, staining and mounting of plant specimens, and,
(2) Methods of collection, identification and preservation of plant specimens.

Competency Developed:

(1) Schematic knowledge of collection and subsequent plant specimens.
(2) Proper arrangement of preserved plant specimens.
(3) Choosing suitable staining and mounting protocols for study of plant specimens.

THEORY

Total lectures: 45

Unit-1: Origin of life **(8 lectures)**

Origin of life: Oparin's hypothesis, Haldane's hypothesis, Miller-Urey experiment, origin of cells and the first organisms: the concepts of prebiotic soup and coacervates.

Unit-2: Evolution **(7 lectures)**

Geological time scale – major events in each era; Evidences of evolution; theories of evolution - Lamarck, Wallace, Charles Darwin, Hugo De Vries. Neo-Darwinism – major postulates - isolation, mutation, genetic drift, and speciation.

Unit-3: Diversity and classification of life forms **(10 lectures)**

Diversity of life: Prokaryotes and Eukaryotes; unicellularity and multicellularity; Two kingdom classification (Carolus Linnaeus, 1735); phylogenetic classification (August W Eichler, 1878); Three kingdom classification (Ernst Haeckel, 1866); Three domains (Carl Woese, 1990) – criteria for classification, general character.

Unit-4: Plant kingdom **(10 lectures)**

General features of plants; Basic knowledge of thallophytes, archegoniates and spermatophytes; Basic structure and function of plant organs: roots, stem and leaves, vascular bundle; Introduction to mesophytes, hydrophytes and xerophytes; Concept of alternation of generations; the colonization of land by plants.

Unit-5: Plant diversity **(10 lectures)**

Introduction to ICN and the status of algae and fungi; Diversity of plants: study of the salient features of major plant groups - algae, fungi, bryophytes, pteridophytes, gymnosperms and angiosperms.

PRACTICAL

Total classes: 15

1. Study of Light microscope: simple and compound.
2. Preparation of specimens for light microscopy – Collection, fixation and preservation of plant specimens; Whole mounts and sections – hand sectioning.
3. Study of prokaryotic and eukaryotic cells.

4. Demonstration of basic staining techniques of plant tissues.
5. Study and demonstration of mounting techniques.
6. Morphological variations in roots, stem and leaves (or equivalent organs) across different plant groups.
7. Study of reproductive structures in different plant groups through photographs / permanent slides.

Suggested Readings

1. Brian K. Hall and Benedikt Hallgrímsson, 2013. Strickberger's Evolution (Fifth Edition). Jones and Bartlett Publishers.
2. Eldon D Enger, Frederick C Ross, David B Bailey, 2011. Concepts in Biology (Fourteenth Edition). Tata McGraw Hill.
3. Gerald Audesirk, Teresa Audesirk, Bruce E Byers, 2019. Biology: Life on earth. (Twelfth Edition). Pearson.
4. James D Mauseth, 2019. Botany: An Introduction to Plant Biology. Jones & Bartlett.
5. Kenneth A Mason, Jonathan B Losos, Tod Duncan, 2017. Biology (Twelfth Edition). McGraw Hill.
6. Lisa A Urry, Michael L Cain, Steven A Wasserman, Peter V Minorsky, Rebecca B Orr, 2021. Campbell Biology (Twelfth Edition). Pearson.
7. Michael G Simpson, 2019. Plant Systematics (Third Edition). Academic Press.
8. Peter Raven, George Johnson, Kenneth Mason, Jonathan Losos and Tod Duncan, 2023. Biology (Thirteenth Edition). McGraw Hill.
9. Prasad M K, Krishna Prasad M, 2000. Outlines of Microtechnique. Emkay Publishers, New Delhi.
10. Scott Freeman, Kim Quillin, Lizabeth Allison, Michael Black, Greg Podgorski, Emily Taylor, and Jeff Carmichael, 2019. Biological Science. Pearson.
11. Sylvia S Mader and Michael Windelspecht, 2022. Biology (Fourteenth Edition). McGraw Hill.
12. Timothy Walker, 2012. Plants: A Very Short Introduction. Oxford.

SEMESTER - I

Course Type: MINOR
Course Code: BOTAMIN101
Course Name: Introduction to Life and Plant Diversity

Credits: 4 (Theory-3, Practical-1)
Full Marks: 80 (Theory-60, Practical-20)

Brief Course Description:

This course deals with the Origin and Evolution of life and imparts basic knowledge about plants and related life forms. It thoroughly establishes the relationship of plants with other kingdoms of life. Also, it emphasizes the huge diversity of known plant life, along with an idea of the fossil record and geological time scale.

Prerequisite(s) and/or Note(s):

(1) High School Biology.
(2) Note(s): Syllabus may be modified after and not during the term itself, depending on the circumstances. However, students will be evaluated only on the basis of topics covered in the course.

Course Objectives:

Knowledge acquired:

(1) Origin and evolution of Life
(2) Introduction to plant and other life forms
(3) Different groups of plants.

Skills gained:

(1) Handling microscopy, staining and mounting of plant specimens, and,
(2) Methods of collection, identification and preservation of plant specimens.

Competency Developed:

(1) Schematic knowledge of collection and subsequent plant specimens.
(2) Proper arrangement of preserved plant specimens.
(3) Choosing suitable staining and mounting protocols for study of plant specimens.

THEORY

Total lectures: 45

Unit-1: Origin of life **(8 lectures)**

Origin of life: Oparin's hypothesis, Haldane's hypothesis, Miller-Urey experiment, origin of cells and the first organisms: the concepts of prebiotic soup and coacervates.

Unit-2: Evolution **(7 lectures)**

Geological time scale – major events in each era; Evidences of evolution; theories of evolution - Lamarck, Wallace, Charles Darwin, Hugo De Vries. Neo-Darwinism – major postulates - isolation, mutation, genetic drift, and speciation.

Unit-3: Diversity and classification of life forms **(10 lectures)**

Diversity of life: Prokaryotes and Eukaryotes; unicellularity and multicellularity; Two kingdom classification (Carolus Linnaeus, 1735); phylogenetic classification (August W Eichler, 1878); Three kingdom classification (Ernst Haeckel, 1866); Three domains (Carl Woese, 1990) – criteria for classification, general character.

Unit-4: Plant kingdom **(10 lectures)**

General features of plants; Basic knowledge of thallophytes, archegoniates and spermatophytes; Basic structure and function of plant organs: roots, stem and leaves, vascular bundle; Introduction to mesophytes, hydrophytes and xerophytes; Concept of alternation of generations; the colonization of land by plants.

Unit-5: Plant diversity **(10 lectures)**

Introduction to ICN and the status of algae and fungi; Diversity of plants: study of the salient features of major plant groups - algae, fungi, bryophytes, pteridophytes, gymnosperms and angiosperms.

PRACTICAL

Total classes: 15

8. Study of Light microscope: simple and compound.
9. Preparation of specimens for light microscopy – Collection, fixation and preservation of plant specimens; Whole mounts and sections – hand sectioning.
10. Study of prokaryotic and eukaryotic cells.

11. Demonstration of basic staining techniques of plant tissues.
12. Study and demonstration of mounting techniques.
13. Morphological variations in roots, stem and leaves (or equivalent organs) across different plant groups.
14. Study of reproductive structures in different plant groups through photographs / permanent slides.

Suggested Readings

13. Brian K. Hall and Benedikt Hallgrímsson, 2013. Strickberger's Evolution (Fifth Edition). Jones and Bartlett Publishers.
14. Eldon D Enger, Frederick C Ross, David B Bailey, 2011. Concepts in Biology (Fourteenth Edition). Tata McGraw Hill.
15. Gerald Audesirk, Teresa Audesirk, Bruce E Byers, 2019. Biology: Life on earth. (Twelfth Edition). Pearson.
16. James D Mauseth, 2019. Botany: An Introduction to Plant Biology. Jones & Bartlett.
17. Kenneth A Mason, Jonathan B Losos, Tod Duncan, 2017. Biology (Twelfth Edition). McGraw Hill.
18. Lisa A Urry, Michael L Cain, Steven A Wasserman, Peter V Minorsky, Rebecca B Orr, 2021. Campbell Biology (Twelfth Edition). Pearson.
19. Michael G Simpson, 2019. Plant Systematics (Third Edition). Academic Press.
20. Peter Raven, George Johnson, Kenneth Mason, Jonathan Losos and Tod Duncan, 2023. Biology (Thirteenth Edition). McGraw Hill.
21. Prasad M K, Krishna Prasad M, 2000. Outlines of Microtechnique. Emkay Publishers, New Delhi.
22. Scott Freeman, Kim Quillin, Lizabeth Allison, Michael Black, Greg Podgorski, Emily Taylor, and Jeff Carmichael, 2019. Biological Science. Pearson.
23. Sylvia S Mader and Michael Windelspecht, 2022. Biology (Fourteenth Edition). McGraw Hill.
24. Timothy Walker, 2012. Plants: A Very Short Introduction. Oxford.

SEMESTER - II

Course Type: DSC A/B
Course Code: BOTADSC202
Course Name: Cell Biology

Credits: 4 (Theory-3, Practical-1)
Full Marks: 80 (Theory-60, Practical-20)

Brief Course Description:

This course deals with topics in Cell Biology. In particular, the course will cover the structural organization and functions of prokaryotic and eukaryotic cell, cellular organelles and cytoskeleton. It also gives an idea of cell division.

Prerequisite(s) and/or Note(s):

(1) High School Biology.
(2) Note(s): Syllabus changes yearly and may be modified during the term itself, depending on the circumstances. However, students will be evaluated only on the basis of topics covered in the course.

Course Objectives:

Knowledge acquired:

1) Clear idea about the structures and functions of basic components of prokaryotic and eukaryotic cells, especially cytoskeletons, membranes, and organelles.
(2) Detailed knowledge of cell cycle and cell division.

Skills gained:

(1) Measurement of cell size.
(2) Technique of Chromosome study.
(3) Characterize plasmolysis and deplasmolysis.

Competency Developed:

(1) Student learn the structure and function of different parts of cell and its importance.
(2) Distinguish between the stages of cell division.

THEORY

Total lectures: 45

Unit 1: The cell **(6 lectures)**

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

Unit 2: Cell wall and plasma membrane **(6 lectures)**

Chemistry, structure and function of plant cell wall; Plasma membrane - Chemical composition and function, Fluid mosaic model; Membrane transport - Diffusion, Osmosis, Passive, active and Facilitated diffusion.

Unit 3: Cell organelles **(14 lectures)**

Nucleus – Structure of nuclear envelope, nuclear pore complex, nuclear lamina, structure of chromatin, nucleolus; Chloroplast, mitochondria and peroxisomes - Structural organization and functions; Endoplasmic reticulum – Structure and function; Golgi apparatus – Organization and function; Lysosomes - Structure and function.

Unit 4: Cell division **(7 lectures)**

Mitosis and meiosis: Different stages and significance; Phases of eukaryotic cell cycle.

Unit 5: Cellular macromolecules **(12 lectures)**

Carbohydrates - Nomenclature and classification with examples; Lipids – classification with examples; Fatty acids - structure and functions; Amino acids – Classification and examples; Proteins - peptide bond, properties and biological role of proteins, levels of protein structure; Properties and function of enzymes; Nucleic acids - Structure and types.

PRACTICAL

Total classes: 15

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

2. Measurement of cell size by the technique of micrometry.

3. Study of cell and its organelles with the help of electron micrographs.

4. Study the phenomenon of plasmolysis and deplasmolysis.

5. Study of different stages of mitosis by squash technique.

6. Qualitative tests for reducing sugars, non-reducing sugars, lipids and proteins.

Suggested Readings

1. Campbell MK (2012) Biochemistry, 7th edition, Published by Cengage Learning.

2. Campbell PN and Smith AD (2011) Biochemistry Illustrated, 4th edition, Published by Churchill Livingstone.

3. Tymoczko JL, Berg JM and Stryer L (2012) Biochemistry: A short course, 2nd edition, W.H.Freeman.

4. Berg JM, Tymoczko JL and Stryer L (2011) Biochemistry, W.H.Freeman and Company.

5. Nelson DL and Cox MM (2008) Lehninger Principles of Biochemistry, 5th edition, W.H. Freeman and Company.

6. Karp G (2010). Cell Biology, 6th edition, John Wiley & Sons, U.S.A.

7. Hardin J, Becker G, Skliensmith LJ (2012) 8th edition Becker's World of the Cell, Pearson Education Inc. U.S.A.

SEMESTER - II

Course Type: MINOR
Course Code: BOTAMIN202
Course Name: Cell Biology

Credits: 4 (Theory-3, Practical-1)
Full Marks: 80 (Theory-60, Practical-20)

Brief Course Description:

This course deals with topics in Cell Biology. In particular, the course will cover the structural organization and functions of prokaryotic and eukaryotic cell, cellular organelles and cytoskeleton. It also gives an idea of cell division.

Prerequisite(s) and/or Note(s):

(1) High School Biology.
(2) Note(s): Syllabus changes yearly and may be modified during the term itself, depending on the circumstances. However, students will be evaluated only on the basis of topics covered in the course.

Course Objectives:

Knowledge acquired:

1) Clear idea about the structures and functions of basic components of prokaryotic and eukaryotic cells, especially cytoskeletons, membranes, and organelles.
(2) Detailed knowledge of cell cycle and cell division.

Skills gained:

(1) Measurement of cell size.
(2) Technique of Chromosome study.
(3) Characterize plasmolysis and deplasmolysis.

Competency Developed:

(1) Student learn the structure and function of different parts of cell and its importance.
(2) Distinguish between the stages of cell division.

THEORY

Total lectures: 45

Unit 1: The cell **(6 lectures)**

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

Unit 2: Cell wall and plasma membrane **(6 lectures)**

Chemistry, structure and function of plant cell wall; Plasma membrane - Chemical composition and function, Fluid mosaic model; Membrane transport - Diffusion, Osmosis, Passive, active and Facilitated diffusion.

Unit 3: Cell organelles **(14 lectures)**

Nucleus – Structure of nuclear envelope, nuclear pore complex, nuclear lamina, structure of chromatin, nucleolus; Chloroplast, mitochondria and peroxisomes - Structural organization and functions; Endoplasmic reticulum – Structure and function; Golgi apparatus – Organization and function; Lysosomes - Structure and function.

Unit 4: Cell division **(7 lectures)**

Mitosis and meiosis: Different stages and significance; Phases of eukaryotic cell cycle.

Unit 5: Cellular macromolecules **(12 lectures)**

Carbohydrates - Nomenclature and classification with examples; Lipids – classification with examples; Fatty acids - structure and functions; Amino acids – Classification and examples; Proteins - peptide bond, properties and biological role of proteins, levels of protein structure; Properties and function of enzymes; Nucleic acids - Structure and types.

PRACTICAL

Total classes: 15

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

2. Measurement of cell size by the technique of micrometry.

3. Study of cell and its organelles with the help of electron micrographs.

4. Study the phenomenon of plasmolysis and deplasmolysis.

5. Study of different stages of mitosis by squash technique.

6. Qualitative tests for reducing sugars, non-reducing sugars, lipids and proteins.

Suggested Readings

1. Campbell MK (2012) Biochemistry, 7th edition, Published by Cengage Learning.

2. Campbell PN and Smith AD (2011) Biochemistry Illustrated, 4th edition, Published by Churchill Livingstone.

3. Tymoczko JL, Berg JM and Stryer L (2012) Biochemistry: A short course, 2nd edition, W.H.Freeman.

4. Berg JM, Tymoczko JL and Stryer L (2011) Biochemistry, W.H.Freeman and Company.

5. Nelson DL and Cox MM (2008) Lehninger Principles of Biochemistry, 5th edition, W.H. Freeman and Company.

6. Karp G (2010). Cell Biology, 6th edition, John Wiley & Sons, U.S.A.

7. Hardin J, Becker G, Skliensmith LJ (2012) 8th edition Becker's World of the Cell, Pearson Education Inc. U.S.A.

QUESTION PATTERN & TOTAL MARKS DISTRIBUTION FOR DSC Subject A/Subject B, & MINOR PAPERS

Theoretical Papers (Full Marks = 60)

Sl No.	Questions to be answered	Out of	Marks for each Question	Total Marks
1.	5	8	2	5 × **2** =10
2.	5	8	6	5 × **6** =30
3.	2	4	10	2 × **10** = 20

DURATION OF EXAMINATION FOR DSC Subject A/Subject B, & MINOR PAPERS

Semester End Examination	Full Marks	Duration of Exams
Theoretical	60	2.5 Hours
Practical	20	3 Hours

 # Practical guidelines and question pattern will be communicated before the semester end examination as per the decision of UGBOS Botany.