

FYUGP BSc(Botany) Course structure: 2026

Section 1: To be implemented from 2026 Newly Admitted FYUGP:

Semester -I			
Type	Course	Paper Code	Credit
Major	Major-1 (Plant and Microbial Diversity)	BOT-01-CC-10101	4
*Minor	Minor-1 (Plant and Microbial Diversity)	BOT-01-MC-10101	4
SEC	SEC-1 (Major oriented) *	BOT-01-SEC-10101	3
AEC	AEC-1 (Languages/Alt. English)	XXX-01-AEC-10101	4
MDC	MDC-1	XXX-01-MDC-10101	3
VAC	VAC-1	EVS-01-VAC-10101	2
			20
Semester-2			
	Course		Credit
Major	Major-2 (Cell Biology and Biomolecules)	BOT-01-CC-10201	4
*Minor	Minor-2 (Cell Biology and Biomolecules)	BOT-01-CC-10201	4
SEC	SEC-2 (Major oriented) *	BOT-01-SEC-10201	3
AEC	AEC-2 (English Communication)	XXX-01-AEC-10201	4
MDC	MDC-2	XXX-01-MDC-10201	3
VAC	VAC-2	EVS-01-VAC-10201	2
			20

***Here, the minor paper indicates the minor paper offered by the Department of Botany for the students other than Botany major.**

MAJOR CHANGE to be allowed after 2nd Semester. Changed Major to be started from the Day-1 of Third Semester.

Semester-3			
Type	Course	Paper Code	Credit
Major	Major-3 (Laboratory and Field Techniques in Plant Science)	BOT-01-CC-20303	4
Major	Major-4 (Plant Physiology)	BOT-01-CC-20304	4
*Minor	Minor-3 (Laboratory and Field Techniques in Plant Science)	BOT-01-MC-20303	4
SEC	SEC-3 #	XXX-01-SEC-20303	3
MDC	MDC-3	XXX-01-MDC-20303	3
VAC	VAC-3	XXX-01-VAC-20303	2
			20

Semester-4			
	Course		Credit
Major	Major-5 (Mycology and Phytopathology)	BOT-01-CC-20405	4
Major	Major-6 (Morphology and Anatomy of Angiosperms)	BOT-01-CC-20406	4
Major	Major-7 (Microbiology)	BOT-01-CC-20407	4
Major	Major-8 (Plant Resources and Economic Botany)	BOT-01-CC-20408	4
*Minor	Minor-4 (Plant Resources and Economic Botany)	BOT-01-MC-20404	4
			20

*Here, the minor paper indicates the minor paper offered by the Department of Botany for the students other than Botany major.

- *Summer Break in Between 4th and 5th Semester: Internship-4 (Credit added to 5th Semester)*
- *Those who miss the Internship in 4th-5th Summer Break, shall do the Internship after the 6th Semester (during 6th Semester Summer Break). In such cases, the 5th Semester result shall not be COMPLETE.*

Semester-5			
Type	Course	Paper Code	Credit
Major	Major-9 (Genetics)	BOT-01-CC-30509	4
	Major-10 (Plant Ecology, Phytogeography and Climate Change)	BOT-01-CC-30510	4
	Major-11 (Plant Systematics)	BOT-01-CC-30511	4
*Minor	Minor-5 (Plant Systematics)	BOT-01-MC-30505	4
Internship	Internship	During next summer vacation	4
			20
Semester-6			
	Course		Credit
Major	Major-12 (Molecular Biology)	BOT-01-CC-30612	4
	Major-13 (Reproductive Biology of Angiosperm)	BOT-01-CC-30613	4
	Major-14 (Plant Metabolism and Biochemistry)	BOT-01-CC-30614	4
	Major-15 (Applied Plant Biology)	BOT-01-CC-30615	4
*Minor	Minor-6 (Applied Plant Biology)	BOT-01-MC-30606	4
			20

*Here, the minor paper indicates the minor paper offered by the Department of Botany for

the students other than Botany major.

- Summer Break in Between 4th and 5th Semester: Internship-4 (Credit added to 5th Semester)
- Those who miss the Internship in 4th-5th Summer Break, shall do the Internship after the 6th Semester (during 6th Semester Summer Break). In such cases, the 5th Semester result shall not be COMPLETE.

***Here, the minor paper indicates the minor paper offered by the Department of Botany for the students other than Botany major.**

*SEC-1 and SEC-2 Should be Major Oriented/to supplement the Major. CCS will prescribe a Bucket of SECs against each Major, so that Hands-on and other Practices/Knowledge.

BSc WITH HONOURS

Semester-7			
	Course		Credit
Major	Major 16- Plant Breeding, Genomics and Bioinformatics	BOT-01-CC-40716	4
	Major-17 Conservation Ecology and Biodiversity Assessment	BOT-01-CC-40717	4
	Major 18: Plant diseases, diagnostic and management	BOT-01-CC-40718	4
	Major-19 Environmental Microbiology	BOT-01-CC-40719	4
	Research Component (RC-1) Research methodology		4
			20

Semester-8			
	Course		Credit
Major	Major-20 Molecular Genetics and Cell Signaling	BOT -01-CC-40820	4
	Major-21 Fungal Diversity, Genetics, and Applications	BOT -01-CC-40821	4
	Major-22 Exploring Cryptogams and Gymnosperms	BOT -01-CC-40822	4
	Major-23 Plant Growth and morphogenesis	BOT -01-CC-40822	4
			16

B.Sc. Botany Honours with Research Semester-

	Semester-8		
	Course		Credit
	Dissertation		16
			16

BOTANY

Programme Specific Outcomes (PSOs):

1. Graduates will exhibit advanced knowledge and expertise in specialized domains of Botanical sciences, including plant taxonomy, physiology, pathology and microbiology, genetics, and ecology.
2. Graduates will be able to design and conduct independent botanical research projects, including framing research questions, developing experimental designs, collecting and analysing data, and drawing scientifically valid conclusions.
3. Graduates will interpret and evaluate complex botanical datasets using statistical and computational approaches, and present their findings effectively through written documentation and oral communication.
4. Graduates will acquire proficiency in diverse laboratory techniques and methodologies commonly used in botanical research, such as microscopy, molecular biology procedures, tissue culture, chromatography, and spectroscopy.
5. Graduates will demonstrate skill in fieldwork practices, including plant specimen collection, preservation, and identification, and will possess taxonomic expertise for classification and recognition of plant species.
6. Graduates will develop strong analytical and critical thinking skills, enabling them to identify and address complex botanical problems, evaluate scientific literature, and propose innovative solutions to real-world challenges in plant sciences.

7. Graduates will effectively communicate botanical concepts and research outcomes to both specialized and general audiences through reports, scientific publications, conference presentations, and outreach initiatives.
8. Graduates will adhere to ethical principles and professional standards in all aspects of their work, ensuring research integrity, respect for intellectual property, and consideration of ethical issues in decision-making.
9. Graduates will collaborate productively with peers from varied disciplines, integrating botanical expertise with other scientific fields to tackle multidisciplinary challenges in environmental science, agriculture, biotechnology, and conservation.
10. Graduates will engage in lifelong learning and professional development, staying updated with advances in botanical sciences, participating in continuing education, and contributing to the field through scholarly work and professional networking.

Four-year Undergraduate Programme

Subject: Botany

Semester: First

Major- 1/Minor-1

Course Name: *Plant and Microbial Diversity*

(SUBJECT CODE: BOT -01-CC-10101/ BOT -01-MC-10101)

Existing Base Syllabus: UG CBCS Syllabus

Course Level: 100-199, and subsequent level as per NEP structure

THEORY [Total marks: 60] Credit: 03; Total No. of classes: 45			
Unit no.	Unit content	No. of classes	Marks
Unit 1	Origin of life: Theories and concepts of the Origin of Life, Kingdom concepts.	3	4

Unit 2	Bacteria and Viruses: Bacteria: General characteristics, cell structure, reproduction, transformation, transduction and conjugation; Archaeobacteria- an introduction. Viruses: characteristics, reproduction (Lytic and Lysogenic life cycles), RNA virus (TMV), DNA virus (Cauliflower Mosaic Virus).	8	10
Unit 3	Algae: General characteristics, cell structure, range of thallus structure and pigmentation, reproduction, and classification; a brief account on <i>Nostoc</i>, <i>Oedogonium</i>, <i>Chara</i> and <i>Ectocarpus</i>	6	10
Unit 4	Fungi & Lichens: General characteristics, distribution, reproduction, and classification (Anisworth, 1973); a brief account of <i>Mucor</i>, <i>Phytophthora</i> and <i>Agaricus</i>; Lichens: structure, types, and economic importance	7	12
Unit 5	Bryophytes and Pteridophytes: Bryophytes: General characteristics, classification, and evolutionary trends; a brief account on <i>Riccia</i>, <i>Marchantia</i> and <i>Polytrichum</i> Pteridophytes: General features, classification, reproduction, evolutionary trends (stellar evolution), and affinities; a brief account on <i>Lycopodium</i>, <i>Selaginella</i>, and <i>Pteris</i>	10	12
Unit 6	Gymnosperms and Angiosperms: Gymnosperms: General characteristics, classification, reproduction, heterospory and origin of seed habit; a brief account on <i>Cycas</i>, <i>Pinus</i> and <i>Gnetum</i> Angiosperms: General characteristics, Concept of artificial, natural and phylogenetic system of classification. Structure of flower and floral parts and inflorescence; Brief accounts on Lamiaceae, and Orchidaceae	11	12
PRACTICAL [Credit: 01]			
1. Study of structure of TMV and Bacteriophage (electron micrographs/models). 2. Study of morphology of <i>Nostoc</i>, <i>Oedogonium</i>, <i>Chara</i> and <i>Ectocarpus</i> (Temporary preparation of slides). 3. Study of <i>Mucor</i>, <i>Ascobolus</i>, <i>Agaricus</i>, <i>Phytophthora</i> (Temporary preparation of slides) 4. Study of vegetative and reproductive parts of <i>Riccia</i>, <i>Marchantia</i> and <i>Polytrichum</i> (preparation of slides). 5. Study of <i>Lycopodium</i>, <i>Selaginella</i> (morphology, strobilus, and spores), <i>Adiantum</i>/ <i>Pteris</i> (morphology).		30	40

6. Study of <i>Cycas/ Pinus</i> and <i>Gnetum</i> (morphology, leaf/ needle, megasporophyll and microsporophyll)		
7. Study of different types of inflorescences.		

Reading list:

1. Alexopoulos, C.J., Mims, C.W., Blackwell, M. (1996). Introductory Mycology, John Wiley & Sons (Asia) Singapore. 4th edition.
2. Bhatnagar SP, Moitra A (1996) Gymnosperms. New Delhi, Delhi: New Age International (P) Ltd Publishers.
3. Campbell NA, Reece JB (2008) Biology, 8th edition, Pearson Benjamin Cummings, San Francisco.
4. Evert RF, Eichhorn SE (2012) Raven Biology of Plants, 8th edition, New York, NY: W.H. Freeman and Company.
5. Ingrouille M, Eddie B (2006) Plants: Evolution and Diversity. Cambridge University Press.
6. Kumar HD (1999) Introductory Phycology, 2nd edition. Delhi, Delhi: Affiliated East-West. Press Pvt. Ltd.
7. Lee, R.E. (2008). Phycology, Cambridge University Press, Cambridge. 4th edition.
8. Parihar NS (1991) An Introduction to Embryophyta. Vol. II. Pteridophytes. Prayagraj: U.P.: Central Book Depot.
9. Pelczar MJ (2001) Microbiology, 5th edition. New Delhi, Delhi: Tata McGraw-Hill Co.
10. Puri P (1985) Bryophytes. New Delhi, Delhi, Atma Ram and Sons.
11. Raven, P.H., Johnson, G.B., Losos, J.B., Singer, S.R. (2005). Biology. Tata McGraw Hill, Delhi
12. Sethi IK, Walia SK (2018) Text book of Fungi and Their Allies. 2nd Edition, Med tech Publishers, Delhi.
13. Singh G (2019) Plant Systematics: An Integrated Approach. 4th edition. CRC Press, Taylor and Francis Group.
14. Singh V, Pandey PC, Jain DK (2001) A Text Book of Botany. Meerut, UP: Rastogi and Co.
15. Tortora GJ, Funke BR, Case CL (2007) Microbiology. San Francisco, U.S.A: Pearson Benjamin Cummings.
16. Vanderpoorten, A. & Goffinet, B. (2009) Introduction to Bryophytes. Cambridge University Press
17. Vashishta PC, Sinha AK, Kumar A (2010) Pteridophyta. New Delhi, Delhi: S. Chand & Co Ltd.
18. Webster J, Weber R (2007) Introduction to Fungi. Cambridge, Cambridge University Press.

Graduate Attributes

Course Objective:

This paper describes the origins of life and the evolutionary lines connecting viruses, bacteria, algae, fungi, and the diverse plant divisions from bryophytes to angiosperms. Central to this study is a practical, hands-on methodology that utilizes morphological features and laboratory techniques for the precise identification of microbial and botanical groups.

Course outcomes:

After completing this course, students will have the skills to:

1. Knowledge with the concept of different kingdoms and the theories behind how life began.
2. Understand the various biological kingdoms and the foundational theories regarding the origins of life.
3. Basic understanding of the characteristics, distribution, classification, reproduction, and current status of various microbial and plant communities.
4. Acquire a knowledge of the biological characteristics, geographic distribution, taxonomic classification, and reproductive strategies of diverse microbial and plant communities.
5. Good understanding of virus, algae, fungus, bryophyte, and pteridophyte cell structures, dicotyledonous and monocotyledonous leaf venation patterns, and inflorescence and fruit features.
6. Develop a broad understanding of the cellular structures of viruses, algae, fungi, bryophytes, and pteridophytes, along with the inflorescences, and floral structure of angiosperms.
7. Knowledge to identify various groups of organisms in the laboratory through morphological analysis.
8. Attain the technical proficiency required to identify diverse biological groups in a laboratory setting through systematic morphological analysis.

Theory Credit: 03

Practical Credit: 01

No. of Required Classes: 75 (Theory: 45; Practical: 30)

No. of Contact Classes: 75 (Theory: 45; Practical: 30)

No. of Non-Contact Classes: Nil

Particulars of Course Designer

BOS, Department of Botany

GOALPARA COLLEGE, GOALPARA-783101

Four-year Undergraduate Programme

Subject: Botany

Semester: Second

Major -2/Minor-2

Course Name: *Cell Biology and Biomolecules*

(SUBJECT CODE: BOT -01-CC-10201/BOT-01-MC-10201)

Existing Base Syllabus: UG CBCS Syllabus

Course Level: 100-199, and subsequent level as per NEP structure

THEORY [Total marks: 60] Credit: 03; Total No. of classes: 45			
Unit no.	Unit content	No. of classes	Marks

Unit 1	Introduction to cell: Cell Theory; General characteristics of prokaryotic and eukaryotic cells; origin of eukaryotes through the Endosymbiotic theory . cytoskeleton and its role in cellular organization. Phases of the cell cycle, mitosis, meiosis, and regulatory pathways.	8	12
Unit 2	Cell wall and plasma membrane: Physical and chemical structure of plant cell wall. plasma membrane structure; chemical composition; Fluid Mosaic Model; Transport Mechanism of membrane, Principles of active, passive, and facilitated movement across the membrane.	6	12
Unit 3	Cellular organelles: Structure and function of the nucleus, including the nuclear envelope, chromatin organization, and the nucleolus. Structure and function of Chloroplast, Mitochondria, Peroxisomes, Ribosome, Endoplasmic Reticulum, Golgi Apparatus, and Lysosomes	9	8
Unit 4	Carbohydrates and Lipids: Carbohydrates: Nomenclature and classification. Lipids: Definition and major classes of storage and structural lipids; Structure, properties and functions of Essential fatty acids.	9	8
Unit 5	Amino acids and Proteins: Structure and classification of amino acids; Levels of protein structure (primary, secondary, tertiary, and quaternary); Ramachandran Plot; Protein denaturation and renaturation and biological roles of proteins.	8	10
Unit 6	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.	5	10
PRACTICAL [Credit: 01]			

1. Qualitative tests for carbohydrates, reducing sugars, non-reducing sugars, lipids and proteins. 2. Study of plant cell structure with the help of epidermal peel mount of Onion/ <i>Rhoeo</i>/ <i>Crinum</i>. 3. Demonstration of the phenomenon of protoplasmic streaming in <i>Hydrilla</i> and <i>Vallisneria</i> leaf. 4. Counting the cells per unit volume with the help of haemocytometer. (Yeast/ pollen grains). 5. Cytochemical staining of: DNA- Feulgen and cell wall in the epidermal peel of onion using Periodic Schiff's (PAS) staining technique. 6. Study different stages of mitosis and meiosis through temporary slides.	30	40
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Reading list:

1. **Alberts B, Johnson A, Lewis J et al(2002) Molecular Biology of the Cell, Garland Science.**
2. Berg JM, Tymoczko JL and Stryer L (2011) Biochemistry, W.H. Freeman and Company.
3. Campbell MK (2012) Biochemistry, 7th Edition. Published by Cengage Learning
4. Campbell PN, Smith AD (2011) Biochemistry Illustrated, 4th Edition, Published by Churchill Livingstone.
5. Cooper GM, Hausman RE (2009) The Cell: A Molecular Approach. 5th edition. ASM Press & Sunderland, Washington, D.C.; Sinauer Associates, MA.
6. Hardin J, Becker G, Skliensmith LJ (2012) Becker's World of the Cell, Pearson Education Inc. U.S.A. 8th Edition.
7. Jain JL(2005) Fundamentals of Biochemistry. S Chand and Company Ltd.
8. Karp G (2010) Cell Biology, John Wiley & Sons, U.S.A. 6th Edition.
9. Nelson DL, Cox MM (2008) Lehninger Principles of Biochemistry, 5th Edition, W.H. Freeman and Company.
10. Power CB (2010) Cell Biology. Himalaya Publishing House.
11. Tymoczko JL, Berg JM and Stryer L (2012) Biochemistry: A short course, 2nd Edition, W.H. Freeman.
12. Verma PS, and Agarwal VK (2000) Cell biology Genetics Molecular Biology Evolution and Ecology. S Chand and Company.

Graduate Attributes

Course Objective:

This paper provides a comprehensive knowledge of the structure of biomolecules, the fundamental building blocks of living systems, their molecular properties, biological roles, and functional significance. Emphasis is given on the correlation between chemical structure and biological function, exemplifying how molecular architecture supports physiological processes. Moreover, the discussion incorporates practical dimensions through laboratory techniques and hands-on approaches, thereby integrating theoretical perceptions with experimental practice.

Course outcomes:

On successful completion of the course, students will be:

1. Able to get knowledge of the structure, classification, and physicochemical properties of biomolecules and enzymes.
2. Detail understanding of the structure, properties, and functions of cells and their components.
3. Develop practical skills in studying cell properties, cell membranes, DNA staining techniques, and plant cell microscopy.
4. Able to identify various biomolecules in the laboratory through qualitative tests.

Theory Credit: 03

Practical Credit: 01

No. of Required Classes: 75 (Theory: 45; Practical: 30)

No. of Contact Classes: 75 (Theory: 45; Practical: 30)

No. of Non-Contact Classes: Nil

Particulars of Course Designer

BOS, Department of Botany

GOALAPRA COLLEGE, GOALPARA-783101

Four-year Undergraduate Programme

Subject: Botany

Semester: Third

Major -3/Minor-3

Course Name: *Laboratory and Field Techniques in Plant Science*
(SUBJECT CODE: BOT -01-CC-10303/BOT-01-MC-10303)

Existing Base Syllabus: UG CBCS Syllabus

Course Level: 200-299, and subsequent level as per NEP structure

THEORY [Total marks: 60] Credit: 03; Total No. of classes: 45			
Unit no.	Unit content	No. of classes	Marks
Unit 1	Laboratory safety and good practices: General laboratory safety: dos and don'ts, lab safety measures, code of conduct in laboratory, safe handling of chemicals, glass apparatus, instruments, electrical appliances; First aid practices (acid spills, burns and other injuries), safety symbols, classes/ grades of chemicals, Laboratory waste management: radioactive, hazardous chemicals and biological wastes.	8	8
Unit 2	Handling and maintenance of instruments: Weighing balance, pipettes and micropipettes, magnetic stirrer, autoclave, laminar airflow, pH and conductivity meter (calibration and use), Incubator (static and shaker), Lux meter, hemocytometer, micrometer, spectrophotometer, Agarose gel electrophoresis unit, SDS PAGE unit, centrifuge, distillation unit.	8	12
Unit 3	Measurements and calculations: Units of measurements, conversion from one unit to another, Weighing, calculations: scientific notations, powers, logarithm and fractions; measurement of volumes of liquids.	4	8
Unit 4	Solutions and Buffers: Preparation of solutions: stock solution, standard solution. Types of solutions: Normal, Molar, Molal, Percentage, ppm, ppb. Dilution and dilution factors, Acids, Bases, adjustment of pH, Buffers - phosphate, Tris- HCl and Citrate buffer.	6	8
Unit 5	Microscopy and Culture Techniques: Microscopes: working principles and types (Light and Electron microscopes), sample and slide preparation: fixation, staining, mounting, preservation(for light and electron microscopy). Basic culture media (NA, NB, PDA, MS), selective and differential media, Culture techniques: plating (streak, spread & pour), serial dilution.	8	12
Unit 6	Biostatistics: computing and field skills: Data types - primary and secondary, methods of data collection, sample and sampling methods - merits and demerits; technical and biological replicates; Tabulation and presentation of data, Descriptive statistics - Mean, Median, Mode, Variance, Standard Deviation, Standard error, Coefficient of Variation,	11	12

	MS-Word, PowerPoint, Excel, concept on biological databases. Collection, Identification, Preparation and Preservation of Herbarium and Museum specimens.		
PRACTICAL [Credit: 01]			
Preparation of solutions- molar, molal, normal, percentage, stock solution and dilution Measurement of pH of solutions using pH meter/ pH strip and preparation of buffers (Phosphate /citrate buffer) Working with instruments - Centrifuge, autoclave, laminar air flow, hot air oven, incubator, light microscope, spectrophotometer/colorimeter, Slide preparation and staining of plant materials. Determination of cell/spore size using micrometer. Preparation of PDA/NA medium for growth and maintenance of fungal/bacterial cultures. Calculation of mean, mode, median, standard deviation using data set. Drawing of tables, graphs and to carry out statistical calculation using Microsoft Excel. Preparation of herbarium specimen: Collection, processing, mounting, and labelling of plant specimen.	30	40	

Reading list:

1. Bisen PS (2014) Laboratory Protocols in Applied Life Sciences, 1st Edition. CRC Press.
2. Danniel WW (1987) Biostatistics. New York, NY: John Wiley Sons.
3. Evert RF, Eichhorn SE, Perry JB (2012) Laboratory Topics in Botany. W.H. Freeman and Company.
4. Jones AM, Reed R, Weyers J (2016) Practical Skills in Biology, 6th Edition, Pearson
5. Mann SP (2016) Introductory Statistics, 9th edition. Hoboken NJ, John Wiley and Sons Inc.
6. Mesh MS, Kebede-Westhead E (2012) Essential Laboratory Skills for Biosciences. John Wiley & Sons, Ltd.
7. Mu P, Plummer DT (2001) Introduction to practical biochemistry. Tata McGraw- Hill Education.
8. Zar ZH (2010) Biostatistical Analysis, 5th Edition, Pearson Prentice Hall, New Jersey, USA.

Graduate Attributes

Course Objective:

This paper will provide basic knowledge and understanding of good laboratory practices, laboratory waste management, understanding hazards and risks to ensure a safe

laboratory environment, measurements, units, and common mathematical calculations, sampling and data collection, and instrument operation and maintenance.

Course outcomes:

On successful completion of the course, students will be:

1. Able to follow laboratory safety guidelines, ensuring proper handling of chemicals, instruments, and effective waste disposal practices.
2. Able to operate and maintain laboratory equipment such as balances, pipettes, autoclaves, incubators, spectrophotometers, and electrophoresis systems.
3. Able to carry out accurate measurements, unit conversions, and scientific calculations involving notations, logarithms, and fractional values.
4. Able to prepare stock, standard, and specialized solutions with precision; regulate pH levels and apply commonly used laboratory buffers.
5. Able to utilize light and electron microscopy principles, prepare slides correctly, and perform microbial culture methods with diverse media.
6. Able to gather, organize, and interpret biological data using descriptive statistics and digital tools; curate herbarium and museum specimens effectively.

Theory Credit: 03

Practical Credit: 01

No. of Required Classes: 75 (Theory: 45; Practical: 30)

No. of Contact Classes: 75 (Theory: 45; Practical: 30)

No. of Non-Contact Classes: Nil

Particulars of Course Designer

BOS, Department of Botany

GOALPARA COLLEGE, GOALPARA

Four-year Undergraduate Programme

Subject: Botany

Semester: Third

Major 4

Course Name: *Plant Physiology*

SUBJECT CODE: BOT-01-CC-20304

Existing Base Syllabus: UG CBCS Syllabus
Course Level: 300-399, and subsequent level as per NEP structure

THEORY [Total marks: 60] Credit: 03; Total No. of classes: 45			
Unit no.	Unit content	No. of classes	Marks
Unit 1	Plant-Water relations: Water Potential and its components, Water absorption by roots: aquaporins; Water movement pathway: symplast, apoplast, transmembrane pathway; Ascent of sap – Cohesion-tension theory. Root pressure, guttation; Transpiration, its significance and affecting factors, anti-transpirants, mechanism of stomatal movement.	5	8
Unit 2	Mineral nutrition and nutrient uptake: Criteria for essentiality of mineral elements, macro- and micronutrients, formulation of nutrient solutions for plant growth experiments, functions of essential elements, mineral deficiency symptoms, role of chelating agents, ion antagonism and toxicity. Soil as a nutrient reservoir; Ion transport across membranes: Passive and active absorption, role of electrochemical gradients, facilitated diffusion, carrier systems, proton ATPase pump and ion flux, mechanisms of uniport, symport, antiport, and co-transport.	10	10
Unit 3	Translocation in Phloem: Phloem as site of organic solute translocation and experimental evidences; composition of phloem sap; mechanism of solute transport, Pressure-Flow model and Munch's hypothesis, Phloem loading and unloading, Source-sink relationships, factors affecting phloem translocation.	4	8
Unit 4	Plant Growth Regulators: Discovery, chemical characteristics (basic structural features), bioassay methods, and physiological roles of Auxins, Gibberellins, Cytokinins, Absciscic acid, Ethylene, Brassinosteroids, and Jasmonic acid; Synthetic plant growth regulators (PGR); application of PGRs in agriculture and horticulture..	10	14

Unit 5	Physiology of flowering and seed dormancy: Photoperiodism: Short-day plants (SDPs) and long-day plants (LDPs), flowering induction, concept of florigen; Vernalization; Photoreceptors: Phytochrome, cryptochrome, and phototropin; Discovery, chemical properties, mechanisms of action, roles in photomorphogenesis, low energy responses (LER) and high irradiance responses (HIR); Seed dormancy: Importance, causes of dormancy, and methods to overcome dormancy.	8	12
Unit 6	Unit 6: Plant stress physiology: Abiotic and biotic stress: Plant responses to drought, waterlogging, salinity, heavy metals, freezing, heat stress, and pathogen invasion. Oxidative stress: Formation of reactive oxygen species (ROS); Impact of ROS on metabolic processes; Mechanisms of ROS detoxification in plants; Stress alleviation strategies (enzymatic and non-enzymatic).	8	8
PRACTICAL [Credit: 01]			
	1. Determination of osmotic potential of plant cell sap by the method of plasmolysis. 2. Determination of water potential of given tissue (e.g., potato tuber) by weight method. 3. Study of the effect of sunlight on the rate of transpiration in excised twig/leaf. 4. Calculation of stomatal index and stomatal frequency from the two surfaces of leaves of mesophyte/ xerophyte. 5. Effect of carbon dioxide concentration on the rate of photosynthesis. 6. To study the effect of different concentrations of IAA on Gram/Pea/Moong root (IAA Bioassay). 7. Determination of seed germination percentage in different physical conditions (Demonstration) 8. Demonstration of water stress through PEG application or water withdrawal in germinating seeds or growing plants. 9. Demonstration of water stress through PEG application or water withdrawal in germinating seeds or growing plants.	30	40

Reading list:

1. Bajracharya D (1999) Experiments in Plant Physiology-A Laboratory Manual. Narosa Publishing House, New Delhi.
2. Bhatla SC, Lal MA (2018) Plant Physiology, Development and Metabolism. Springer Nature Singapore Pte Ltd.

3. Devlin RM (2017) Outline of Plant Physiology. Medtech: Scientific International Pvt. Ltd.
4. Devlin RM, Witham FH, Blaydes DF (2017) Devlin's Exercises in Plant Physiology. Medtech: Scientific international Pvt. Ltd.
5. Hopkins WG, Huner A (2008) Introduction to Plant Physiology (4th edition). John Wiley and Sons. U.S.A.
6. Kochhar SL, Gujral SK (2021) Plant Physiology: Theory and Applications (2nd edition). Cambridge University Press.
7. Malik CP, Srivastava (2015) Text Book of Plant Physiology. Kalyani Publishers, New Delhi.
8. Salisbury FB, Ross CW (2004) Plant Physiology (4th edition). Cengage Learning India Pvt. Ltd., New Delhi, India.
9. Taiz L, Zeiger E, MØller IM, Murphy A (2015) Plant Physiology and Development (6th edition). Sinauer Associates Inc. USA.

Graduate Attributes

Course Objective:

Students will acquire knowledge of plant–water relations and be able to explain the vital role of water in diverse physiological processes of plants through the study of this paper. The paper will also highlight the importance of mineral elements in plant physiology and the various mechanisms employed by plants for mineral absorption. It will further provide a basic understanding of the pathways and processes involved in the transport of organic solutes produced within plants. In addition, this paper will explain the functions and modes of action of different plant growth regulators together with the physiology of flowering and seed dormancy. Moreover, the paper will discuss the range of abiotic and biotic stresses encountered by plants in their surroundings and the stress adaptation strategies adopted by plants to overcome the harmful effects of stress.

Course outcomes:

1. Knowledge on the fundamental aspects of plant–water relations including water potential, absorption, transport pathways, ascent of sap, transpiration, and stomatal regulation.
2. Knowledge on the essential mineral nutrients, mechanisms of uptake, deficiency indicators, and processes of ion transport in plants.
3. Knowledge on the phloem anatomy, composition, and mechanisms of solute translocation with emphasis on source–sink interactions.
4. Knowledge on the origin, chemical properties, bioassay techniques, physiological functions, and agricultural uses of natural and synthetic plant growth regulators.
5. Knowledge the physiological control of flowering and seed dormancy, including photoperiodism, vernalization, photoreceptors, and dormancy-breaking approaches.
6. Knowledge on plant adaptations to abiotic and biotic stresses, oxidative stress, and the mechanisms involved in detoxification and stress mitigation.

Theory Credit: 03
Practical Credit: 01
No. of Required Classes: 75 (Theory: 45; Practical: 30)
No. of Contact Classes: 75 (Theory: 45; Practical: 30)
No. of Non-Contact Classes: Nil
Particulars of Course Designer
BOS, Department of Botany
GOALAPRA COLLEGE, GOALPARA-783101

Four-year Undergraduate Programme
Subject: Botany

Semester: Fourth
Major 5
Course Name: Mycology and Phytopathology
SUBJECT CODE: BOT-01-CC-20405
Existing Base Syllabus: UG CBCS Syllabus
Course Level: 200-299, and subsequent level as per NEP structure

THEORY [Total marks: 60] Credit: 03; Total No. of classes: 45			
Unit no.	Unit content	No. of classes	Marks
Unit 1	Introduction to Fungi: General structures of fungi; hyphal structures; cell and cell wall composition; nutritional modes; origin of fungi; classification system (Alexopoulos, 1962 & Ainsworth, 1973); general characteristics of Myxomycota and Eumycota; symbiotic fungi (lichens and mycorrhiza); structural organization and types.	10	10
Unit 2	Lower Fungi: Mastigomycotina and Zygomycotina: defining characteristics; reproductive features; heterothallism; life cycle studies with reference to <i>Synchytrium</i> , <i>Phytophthora</i> , and <i>Mucor</i> .	6	8
Unit 3	Higher Fungi: Ascomycotina and Basidiomycotina: distinguishing features; reproduction; diversity of fruiting bodies; life cycle studies with reference to <i>Aspergillus</i> , <i>Peziza</i> , <i>Puccinia</i> , and <i>Agaricus</i> .	6	12
Unit 4	Fungi Imperfecti: Deuteromycotina: General features; thallus organization; reproduction; heterokaryosis and parasexuality; classification with special reference <i>Alternaria</i> and <i>Colletotrichum</i> .	5	8
Unit 5	Unit 5 – Phytopathology: Concept of plant diseases; disease symptoms; etiology and disease cycle; host–pathogen interactions; disease control and quarantine; bacterial diseases – citrus canker and angular leaf spot of cotton; viral diseases – tobacco mosaic virus and vein clearing; fungal diseases – early blight of potato, black stem rust of wheat, and white rust of crucifers	10	12
Unit 6	Applied Mycology: Role of fungi in biotechnology; applications in food industry (flavour and texture, fermentation, organic acids and enzymes);	8	10

	pharmaceutical uses (secondary metabolites); agricultural roles (biofertilizers and biological control); mushroom cultivation; medical mycology.		
PRACTICAL [Credit: 01]			
1. Study of vegetative and reproductive structures of Mastigomycotina (<i>Phytophthora</i>) and Zygomycotina (<i>Mucor/Rhizopus</i>) by temporary mounts and permanent slides.			
2. Study of vegetative and reproductive structures of Ascomycotina (<i>Aspergillus</i> and <i>Penicillium/Peziza</i>) and Basidiomycotina (<i>Agaricus</i> and <i>Puccinia</i>) using temporary mounts and permanent slides.			
3. Study of vegetative and reproductive structures of Deuteromycotina (<i>Alternaria</i> and <i>Colletotrichum/Fusarium</i>) using temporary mounts and permanent slides; Study of thallus and reproductive structures of lichen and mycorrhiza through permanent slides/photographs.			
4. Study of symptoms of locally available plant diseases caused by fungi, bacteria, and virus by preparation of disease album and bottle specimens.			
5. Applied mycology: Preparation of photographs/report on fungi used in medicine, fungi used as biological control agents, fungi utilized in industry, fungi causing human infections .			
		30	40

Reading list:

1. Agrios GN (1997) Plant Pathology, 4th edition, Academic Press, U.K.
2. Alexopoulos CJ, Mims CW, Blackwell M (1996) Introductory Mycology, John Wiley & Sons (Asia) Singapore. 4th edition.
3. Gangulee HC, Kar AK. College Botany, Vol. II., New Central Book Agency, Kolkata.
4. Hait G (2022) A Textbook of Plant Pathology: Principles and Diseases. Global Net Publication, India.
5. Hait G, Bhattacharya K, Ghosh AK (2011) Text Book of Botany, Vol. I & II., New Central Book Agency, Kolkata.
6. Mitra JN, Mitra D, Chowdhury S. Studies in Botany. Vol. I., Moulik Library, Kolkata.
7. Pandey BP (2020) Plant Pathology - Pathogen and plant disease. S. Chand and Company Limited, New Delhi, India.
8. Sethi IK, Walia SK (2011) Text book of Fungi and Their Allies, Macmillan Publishers India Ltd.
9. Sharma PD (2011) Plant Pathology, Rastogi Publication, Meerut, India.
10. Webster J, Weber R (2007) Introduction to Fungi, Cambridge University Press, Cambridge. 3rd edition.

Graduate Attributes

Course Objective:

This paper will discuss the general characteristics and reproductive methods of fungi from various groups such as Mastigomycotina, Zygomycotina, Ascomycotina, Basidiomycotina and Deuteromycotina. It will further highlight the essential concept of host-pathogen interactions during disease development, along with symptomatology and the disease cycle of common fungal, bacterial, and viral diseases. Moreover, the paper will highlight the importance of fungi in biotechnology, pharmaceuticals, and agriculture.

Course outcomes:

On successful completion of the course, students will have:

1. Knowledge on general structures of fungi and their classification
2. Knowledge on different classes of fungi, symbiotic fungi, and their characteristics
3. Knowledge on the application of fungi in different fields
4. Knowledge of plant pathogens and some important plant diseases
5. Practical knowledge on different classes of fungi based on their morphological and reproductive features
6. Practical knowledge on morphology, anatomical features of symbiotic fungi and locally available important plant pathogens.
7. Understanding biotechnological applications of fungi in industry, agriculture, and medicine.

Theory Credit: 03

Practical Credit: 01

No. of Required Classes: 75 (Theory: 45; Practical: 30)

No. of Contact Classes: 75 (Theory: 45; Practical: 30)

No. of Non-Contact Classes: Nil

Particulars of Course Designer

BOS, Department of Botany

GOALPARA COLLEGE, GOALPARA

Four-year Undergraduate Programme
Subject: Botany
Semester: Fourth

Major 6

Course Name: *Morphology and Anatomy of Angiosperms*

SUBJECT CODE: BOT-01-CC-20406

Existing Base Syllabus: UG CBCS Syllabus

Course Level: 200-299, and subsequent level as per NEP structure

THEORY [Total marks: 60] Credit: 03; Total No. of classes: 45			
Unit no.	Unit content	No. of classes	Marks
Unit 1	Introduction to Plant Morphology and Anatomy Plant morphology includes the study of flowers and their parts, inflorescences, and fruits, along with concepts such as the Telome theory and Phyllode theory. Role of morphological features in plant classification. Application of plant anatomy in systematics, forensic investigations, and pharmacognosy.	6	10
Unit 2	Tissue and Tissue Systems: Classification of tissues : simple and complex types; tissue systems; presence of pits and plasmodesmata; wall ingrowths and transfer cells; types of vascular bundles; structure and role of endodermis and exodermis, along with the origin of lateral roots. Special structures such as hydathodes, cavities, lithocysts, and laticifers; Ergastic substances.	7	8
Unit 3	Structure and Development of Plant Body Internal organization and developmental processes in plant body, Polarity, cytodifferentiation, and organogenesis during embryogenic development. Origin and development of leaves, the structural features of dicot and monocot stems, roots, and leaves; Kranz anatomy.	5	8
Unit 4	Apical meristems: Concept of organization of shoot apex (Apical cell theory, Histogen theory, Tunica Corpus theory); Organization of root apex (Apical cell theory, Histogen theory, Korper-Kappe theory); Quiescent center; Root cap.	11	14
Unit 5	Vascular Cambium and Wood: Structure, function, and seasonal activity of the cambium; secondary growth in stem and root. Characteristics of sapwood and heartwood; distinction between ring-porous and diffuse-porous wood; formation of early and late wood, tyloses; principles of dendrochronology. Development and composition of the periderm, rhytidome, and lenticels. Anomalous secondary in monoct stem and dicot stem with	11	12

	special reference to to (Bignonia Boerhaavia, Amaranthus, and Dracaena.)		
Unit 6	Adaptive and Protective Systems: Epidermis, cuticle, epicuticular waxes, trichomes (uni- and multicellular, glandular and non- glandular, two examples of each), stomata (classification); Adcrustation and incrustation; Anatomical adaptations of xerophytes and hydrophytes.	5	8
PRACTICAL [Credit: 01]			
1. Study of special types of inflorescences – Cyathium, Hypanthodium, Verticillaster, Hypanthium. 2. Study of special types of fruits- Spurious fruits (<i>Dillenia</i>); Aggregate fruits (Custard apple, <i>Michelia</i>, Periwinkles, <i>Polyalthia</i>); Multiple fruits (Pineapple, Jack fruits). 3. Study of anatomical details through permanent slides/temporary stain mounts / macerations / museum specimens with the help of suitable examples. 4. Apical meristem of root, shoot and vascular cambium (permanent slides/ photographs) 5. Epidermal system: cell types, stomata types; trichomes: non-glandular and glandular. 6. Study of root anatomy in monocots and dicots. 7. Stem: monocot, dicot - primary and secondary growth; periderm; lenticels. 8. Study of leaf anatomy – isobilateral, dorsiventral, and C4 leaves (Kranz anatomy). Adaptive Anatomy: xerophytes, hydrophytes. 9. Study of secretory tissues such as cavities, lithocysts, and laticifers.		30	40

Reading list:

1. Dickison WC (2000) Integrative Plant Anatomy. Harcourt Academic Press, USA.
2. Eames, A J.(1983), Morphology of Vascular plants, Standard University press.
3. Easu, K. (1996). Anatomy of Seed Plants. First wiley Reprint, New Delhi.
4. Evert RF (2006) Esau's Plant Anatomy: Meristems, Cells, and Tissues of the Plant Body: Their Structure, Function and Development. John Wiley and Sons, Inc.
5. Fahn A (1974) Plant Anatomy. Pergmon Press, USA.
6. Mauseth JD (1988). Plant Anatomy. The Benjammin/Cummings Publisher, USA.
7. Mitra J.N. (1988), An introduction to systematic Botany and Ecology, The world press private Ltd., Calcutta
8. Pandey B.P.(2001). Plant Anatomy. S. Chand and Company Ltd., New Delhi.

Graduate Attributes

Course Objective:

This paper provides a detailed explanation of the morphological and anatomical features of Angiosperms.

Course outcomes:

1. Knowledge on morphology of angiosperms and developmental biology of plant body.
2. Knowledge of the structural and anatomical organization of plant tissue systems and their classification.
3. Knowledge on cambial activity, wood anatomy, and anomalous secondary growth.
4. Knowledge epidermal features, stomata, trichomes, and adaptive anatomy of xerophytes and hydrophytes.
5. Practical knowledge on inflorescences and fruits of angiosperms.
6. Practical knowledge on anatomical features of different plant body parts.

Theory Credit: 03

Practical Credit: 01

No. of Classes: 75 (Theory: 45; Practical: 30)

No. of Contact Classes: 75 (Theory: 45; Practical: 30)

No. of Non-Contact Classes: Nil

Particulars of Course Designer

DEPT OF BOTANY, GOAPARA COLLEGE, GOAPARA-783101

Semester: Fourth
Major 7
Course Name: Microbiology
SUBJECT CODE: BOT-01-CC-20407

Existing Base Syllabus: UG CBCS Syllabus
Course Level: 200-299, and subsequent level as per NEP structure

THEORY [Total marks: 60] Credit: 03; Total No. of classes: 45			
Unit no.	Unit content	No. of classes	Marks
Unit 1	Introduction to microbial world: History of development of Microbiology as a subject, Germ theory of diseases, Koch postulates, Major groups of microorganisms, Microbial nutrition and metabolic diversity, Growth and growth curves, Ecological importance of microorganisms.		6
Unit 2	Viruses: Characteristics of viruses, viroids and prions; Biomolecules and genetic materials of viruses; Baltimore system of classification; Morphological structure of TMV and Corona viruses; Lytic and Lysogenic Cycle; Replication of viral RNA and DNA; Plant Viral diseases and their transmission	8	10
Unit 3	Bacteria: General characteristics of bacteria, shapes and sizes, ultrastructure, major groups of bacteria with their general characteristics; Actinomycetes, Mycoplasma and Rickettsiae; growth and nutrition, reproduction – binary fission and endospore formation, horizontal gene transfer and genetic recombination in bacteria (conjugation, transformation and transduction). Examples of agriculturally and industrially important bacteria.	8	12
Unit 4	Environmental Microbiology: Microorganisms in different habitats: Air, soil and water; Soil microorganisms and their role in soil health; Role of microorganisms in biogeochemical cycles (C, N, P and S); Microorganisms in extreme environments (cold desert, hot water spring, marine water, hydrothermal vent, aquifers)	8	8
Unit 5	Pathogenic microorganisms and Host Immunity: Concept of pathogen, Major Bacterial diseases in plants, animals and humans; Host-pathogen interactions; Host immunity – Innate and adaptive immunity; Humoral and Cell-mediated Immunity; Vaccination and Immunization; hypersensitivity and autoimmunity; concept of Rh antigens	8	12

Unit 6	Applied Microbiology: Application of microorganisms in food industries for food fermentation and SCP production; in agriculture for biofertilizer, biopesticides, biocompost production; in pharmaceuticals for insulin and antibiotics production; in industries for alcohol and organic acid productions; citric acid and acetic acid; in genetic engineering for GMO development and other research purposes; in space and oil exploration and in pollution and waste management.	7	12
PRACTICAL [Credit: 01]			
	- Slide preparation and Gram staining of bacteria (urd bacteria, nodule bacteria) - Slide preparation and study of <i>Nostoc</i>, <i>Anabaena</i>, <i>Mucor</i>, <i>Rhizopus</i>, <i>Aspergillus</i>, <i>Penicillium</i>, <i>Colletotrichum</i>, <i>Cladosporium</i> - Pure culture isolation of soil bacteria/fungi through serial dilution plating and subsequent sub-culturing methods, population estimation by CFU and haemocytometer. - Measurement of microbial cells/spores with the help of micrometers or inbuilt software in microscopic camera. - Study on symptoms of plant viral diseases - Endospore staining of soil bacteria with malachite green - Collection and study of diseases caused by virus, bacteria and fungi in crop plants	30	40

Reading list:

- Aneja KR, Jain P, Aneza R (2021) A Textbook of Basic and Applied Microbiology. New Age International Publisher.
- Aneja KR (2022) Experiments in Microbiology, Plant Pathology, Tissue Culture and Microbial Biotechnology. New Age International Publisher
- Bhattacharya IK, Bhattacharya RN (2017) Fundamentals of Microbiology.
- Pelczar MJ (2001) Microbiology, 5th edition, Tata McGraw-Hill Co, New Delhi.
- Sharma PD (2009) Microbiology. latest edition, Rastogi Publication, Meerut.
- Singh RS (2017) Plant Diseases.
- Wiley JM, Sherwood LM and Woolverton CJ (2013) Prescott's Microbiology. McGraw Hill International.

Course Objectives

- To provide concise knowledge of basic microbiology.
- To impart practical skills in handling microorganisms.

3. To develop understanding of the usefulness of microorganisms for sustainable development.

Course Outcomes

1. Knowledge of microbial diversity and their distribution across different habitats.
2. Knowledge of ecological roles and economic importance of microorganisms in daily life.
3. Knowledge of growth, reproduction, and life cycles of viruses and microorganisms.
4. Knowledge of genetic recombination processes in bacteria.
5. Practical skills in microscopy, slide preparation, staining, and morphological study of microorganisms.
6. Knowledge of pathogenic microorganisms, host–pathogen interactions, and immune responses.
7. Practical skills in isolation and pure culture of bacteria and fungi from soil samples.

Theory Credit: 03

Practical Credit: 01

No. of Classes: 75 (Theory: 45; Practical: 30)

No. of Contact Classes: 75 (Theory: 45; Practical: 30)

No. of Non-Contact Classes: Nil

Particulars of Course Designer

BOS, DEPT OF BOTANY, GOAPARA COLLEGE, GOAPARA-783101

Four-year Undergraduate Programme

Subject: Botany

Semester: Fourth

Major 8/Minor-4

Course Name: *Plant Resources and Economic Botany*

SUBJECT CODE: BOT-01-CC-20408/ BOT-01-MC-20404

Existing Base Syllabus: UG CBCS Syllabus

Course Level: 200-299, and subsequent level as per NEP structure

THEORY [Total marks: 60] Credit: 03; Total No. of classes: 45			
Unit no.	Unit content	No. of classes	Marks
Unit 1	Origin of Cultivated Plants: Centres of Origin, Vavilov's concept of centre of Origin. Introductions, domestication, and loss of crop genetic diversity; evolution of new crops/varieties, Importance of germplasm diversity and conservation. Classification of plant resources on the basis of their uses.	6	8
Unit 2	Food and Food Adjuncts: Cereals: Rice and wheat (origin, evolution, morphology, cultivation, postharvest management & economic uses); Millets: Brief account of millets and their climatic and nutritional importance. Legumes: Chick pea, Pigeon pea and fodder legumes (origin, morphology, cultivation, economic uses. Importance of legumes to man and ecosystem). Spices: Listing of important spices, their family and parts used. Turmeric, Ginger, Ghost Chilly and black pepper (Morphology, cultivation, postharvest management & economic importance). Beverages: Tea, Coffee (Origin, morphology, processing, cultivation, Types & uses).	12	14
Unit 3	Plants and Plant Products of Industrial Value: Oils and Fats: Groundnut, Coconut, Soybean, and Mustard (Morphology, Cultivation, Extraction, Processing, Economic importance and Health Implications). Essential Oils: General account, extraction methods, comparison with fatty oils & Economic Importance. Non edible oil yielding trees and their role as biofuel. Sugar and starches: Sugarcane- New varieties, Morphology, Cultivation, Processing, Economic importance, Products and by-products of sugarcane industry. Potato: Morphology, Cultivation, Post-Harvest Management, Economic importance. Natural Rubber: General Account, Latex Extraction, Processing, Economic importance and impact on environment due to rubber cultivation. Fibres: Types of fibres. Cotton, Coir and Jute (morphology, extraction and uses).	12	14
Unit 4	Drug-yielding plants: General Accounts of habit forming drugs Chirata, Kalmegh, Rauwolfia	5	8

	(Morphology, processing, uses and health benefits). Tobacco (Origin, morphology, processing, uses and health hazards).		
Unit 5	Forest Products: Forest and forest products. Timber and Non-Timber Forest Products (NTFP), Forest types of Assam and their conservation strategies; Community forestry.	5	8
Unit 6	Ethnobotany: Definition, concept and scope; relevance of ethnobotany in the present context; Traditional knowledge and IPR.	5	8

PRACTICAL [Credit: 01]		
1.Cereals: Study of useful parts: Rice (habit sketch, study of inflorescence and grain). Microchemical test. 2.Legumes: Bean (habit sketch, study of fruit, seed structure). Microchemical test. 3.Beverages: Tea (habit sketch, study of tea leaves). 4.Oils and fats: Coconut, Mustard, Groundnut (habit sketch) microchemical test/ oil extraction . 5.Rubber: Plant habit sketch, Rubber tapping process photographs, samples of rubber products. 6.Test for alkaloids in Neem & <i>Vinca rosea</i> . 7.Fibre-yielding plants: Cotton (specimen, whole mount of seed to show lint and fuzz; whole mount of fibre and test for cellulose), Jute (specimen, transverse section of stem, test for lignin).	30	40

Graduate Attributes

Course Objective:

This paper builds understanding of occurrence and distribution of major introduced plant species, how crops came under domestication, lost their genetic diversity and evolution of new crop varieties. This paper will also provide knowledge on germ plasm diversity and its importance, ethnobotany and economic importance of various plants.

Course outcomes:

On successful completion of the course, students will:

1. Know the centres of origin, how domestication happened and how crops lost their genetic diversity.
2. Understand the existence of new crops /varieties due to evolution.
3. Learn about the germplasm diversity.

4. Attain the knowledge about the economic values of various plant species.
5. Recognize the significance of ethnobotany in the present context.
6. Students will be able to assess ethnobotany, traditional knowledge, and intellectual property rights in the present context.

Theory Credit: 03

Practical Credit: 01

No. of Required Classes: 75 (Theory: 45; Practical: 30)

No. of Contact Classes: 75 (Theory: 45; Practical: 30)

No. of Non-Contact Classes: Nil

Particulars of Course Designer

Goalpara College (Autonomous), Department of Botany

Goalpara, Assam 783101

Four-year Undergraduate Programme

Subject: Botany

Semester: Fifth

Course Name: *Genetics*

SUBJECT CODE: BOT-01-CC-30509

Major 9

Existing Base Syllabus: UG CBCS Syllabus

Course Level: 300-399, and subsequent level as per NEP structure

THEORY [Total marks: 60] Credit: 03; Total No. of classes: 45			
Unit no.	Unit content	No. of classes	Marks
Unit 1	Mendelian genetics and its extension: Mendelism: historical background, principles of inheritance; chromosome theory of inheritance; role of autosomes and sex chromosomes; probability concepts and pedigree analysis. Patterns of inheritance including incomplete dominance and codominance; multiple alleles, lethal alleles, epistasis, pleiotropy; recessive and dominant traits; penetrance and expressivity; numerical problems	13	14

	related to inheritance. Study of polygenic inheritance.		
Unit 2	Extrachromosomal Inheritance: Chloroplast mutation: Variegation in Four o'clock plant; Mitochondrial inheritance in yeast; maternal effects exemplified by shell coiling in snails; and infective heredity involving Kappa particles in <i>Paramecium</i> .	4	6
Unit 3	Linkage, crossing over and chromosome mapping: Linkage and crossing over; cytological basis of crossing over; recombination frequency; two-factor and three-factor crosses; interference and coincidence; numerical problems related to gene mapping; and sex linkage.	8	10
Unit 4	Variation in chromosome number and structure: Deletion, Duplication, Inversion, Translocation, Position effect, Euploidy, aneuploidy and polyploidy.	6	8
Unit 5	Fine structure of gene and Gene mutations: Classical and molecular concepts of gene; Cistron, Racon, Mutton, rII locus; Types of mutations; Molecular basis of Mutations; Mutagens – physical and chemical (Base analogs, deaminating, alkylating and intercalating agents); Detection of mutations: ClB method. Role of Transposons in mutation. DNA repair mechanisms	10	12
Unit 6	Unit 6. Population and Evolutionary Genetics: Allele frequencies, Genotype frequencies, Hardy-Weinberg Law, role of natural selection, mutation, genetic drift. Genetic variation and Speciation.	4	10
PRACTICAL [Credit: 01]			
	1. Mendel's laws through seed ratios. 2. Chromosome mapping using point test cross data. 3. Incomplete dominance and gene interaction through seed ratios (9:7, 9:6:1, 13:3, 15:1, 12:3:1, 9:3:4). 4. Permanent Slides showing Translocation Ring, Photograph showing Laggards and Inversion Bridge.	30	40

Reading list:

1. Gardner EJ, Simmons MJ, Snustad DP (2015) Principles of Genetics, John Wiley & sons, India. 8th edition.
2. Griffiths AJF, Wessler SR, Carroll SB, Doebley J (2010) Introduction to Genetic Analysis. W. H. Freeman and Co., U.S.A. 10th edition.

3. Klug WS, Cummings MR, Spencer CA (2012) Concepts of Genetics. Benjamin Cummings, U.S.A. 10th edition.
4. Snustad DP, Simmons MJ (2010) Principles of Genetics, John Wiley & Sons Inc., India. 5th edition.

Graduate Attributes

Course Objective:

To gain knowledge on classical and modern concepts of genetics.

Course outcomes:

1. Knowledge of Demonstrate knowledge of Mendelian principles and extensions of inheritance.
2. Knowledge on gene structure, mutations, mutagens, transposons, and DNA repair mechanisms.
3. Knowledge of gene and chromosomal mutations
4. Knowledge of basic concepts of population and evolutionary genetics
5. Ability to work out problems related to Mendel's experiments, Chromosome mapping and gene interaction
6. Knowledge on population genetics, Hardy–Weinberg equilibrium, genetic variation, and speciation.

Theory Credit: 03

Practical Credit: 01

No. of Required Classes: 75 (Theory: 45; Practical: 30)

No. of Contact Classes: 75 (Theory: 45; Practical: 30)

No. of Non-Contact Classes: Nil

Particulars of Course Designer (Name, Institution, email id):

BOS, Department of Botany

GOALPARA COLLEGE, GOALPARA

Subject: Botany

Semester: Fifth

Major 10

Course Name: *Plant Ecology, Phytogeography and Climate Change*

SUBJECT CODE: BOT-01-CC-30510

Existing Base Syllabus: UG CBCS Syllabus

Course Level: 300-399, and subsequent level as per NEP structure

THEORY [Total marks: 60] Credit: 03; Total No. of classes: 45			
Unit no.	Unit content	No. of classes	Marks
Unit 1	Ecology and Ecosystem: Ecology: Basic concepts, Levels of organization, Inter-relationships between the living world and the environment. Ecosystem: Structure, functions, and types, trophic organisation, food chains and food webs, ecological pyramids, homeostasis.	8	8
Unit 2	Ecological Factors: Climatic, Edaphic and Biotic Factors, Factorial interactions, plant adaptations to environmental conditions such as light, temperature, wind, and fire. Modes of nutrition including autotrophy and heterotrophy. Types of ecological	8	8

	relationships- symbiosis, commensalism, amensalism, parasitism, and parasitoidism. Aquatic ecology – its concept and significance.		
Unit 3	Population ecology: Population characteristics, Growth curve, Lotka-Volterra model, population regulation, <i>r</i> and <i>k</i> -selection. Types of ecological speciation, Ecological equivalents.	7	12
Unit 4	Plant communities: Plant Community: Basic concept, types, characters (analytical and synthetic), Dynamics: succession – processes, types, models; climax concepts, Habitat and Niche: concept & types.	7	12
Unit 5	Functional Ecology: Principles and models of energy flow; concepts of production and productivity; ecological efficiencies and energetics; biogeochemical cycles involving carbon(C), nitrogen(N), and phosphorus(P); and hydrological cycle.	7	10
Unit 6	.Phytogeography and Climate Change: Fundamental principles; continental drift; theory of tolerance; concept of endemism; concise overview of major terrestrial biomes (one each from tropical, temperate, and tundra regions); phytogeographical divisions of India; vegetation types of North East India with reference to Assam. Climate change: Basic concepts; global warming, causes and consequences (Rise in Sea levels, Glacier melting, Biodiversity Loss), Adaptation, Mitigation, Global and National Efforts, Concept on Sustainable Development, Sustainable Development Goals (SDGs).	8	10
PRACTICAL [Credit: 01]			
	1. Determination of minimal quadrat size and number required for the study of herbaceous vegetation in the college campus by species area curve method (species to be listed). 2. Quantitative analysis of herbaceous vegetation for density and abundance in the college campus.	30	40

3. Quantitative analysis of herbaceous vegetation in the college campus for frequency and comparison with Raunkiaer's frequency distribution law. 4. Study of instruments used to measure microclimatic variables including oil thermometer, maximum and minimum thermometer, anemometer, psychrometer/hygrometer, rain gauge and lux meter. 5. Analysis of two soil samples for carbonates, chlorides, nitrates, sulphates, organic matter, and base deficiency using rapid field tests. 6. Determination of dissolved oxygen of water samples collected from polluted and unpolluted sources. 7. Study of morphological adaptations of hydrophytes and xerophytes (four each). 8. Study of biotic interactions of the Stem parasite, Root parasite, Epiphytes, Predation (Insectivorous plants). 9. Local field visit to nearby areas to familiarize students with diverse plant communities. 10. Study of soil respiration in two agricultural systems to measure CO₂ evolution. □		
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Reading list:

1. Ambasht and Ambasht (2002) A text book of Plant Ecology. CBS publisher and Distributors.
2. Bhattacharya K, Ghosh AK, Hait G (2017) A Text Book of Botany. New Central Book Agency (P), Kolkata, India.
3. Bowmen WD, Hacker SD, Cain ML (2018) Ecology, Oxford University Press.
4. Deka U, Dutta T (2022) Plant Ecology and Phytogeography. Asian Humanities Press, Guwahati, Assam.
5. Kapur P, Govil SR (2000, 2007). Experimental Plant Ecology. CBS Publishers and Distributors, New Delhi (India).
6. Kormondy EJ (1996) Concepts of ecology. PHI Learning Pvt. Ltd., Delhi, India. 4th edition.
7. Misra R (1968, Reprinted in 2019). Ecology Workbook. Scientific Publishers (India), Jodhpur
8. Odum EP (2005) Fundamentals of ecology. Cengage Learning India Pvt. Ltd., New Delhi. 5th edition.
9. Raj M, Deka H (2022) Plant Ecology and Phytogeography. Ashok Book Stall, Guwahati, Assam.
10. Sharma PD (2010) Ecology and Environment. Rastogi Publications, Meerut, India. 8th edition.
11. Smith TM, Smith RL (2015) Elements of ecology. Pearson publishers., London. 9th Edition
12. Stiling PD (1996) Ecology: theories and applications (Vol. 4). Upper Saddle River: Prentice Hall.
13. Verma PS, Agarwal VK (2003) Environmental Biology-Principles of Ecology. S Chand & Company Ltd. Ramnagar, New delhi-110055.

14. Wilkinson DM (2007) Fundamental Processes in Ecology: An Earth Systems Approach. Oxford University Press. U.S.A.

Graduate Attributes

Course Objective:

This course aims to build an understanding of ecology and ecosystems, focusing on both biotic and abiotic interactions, ecosystem processes, and the dynamics of terrestrial and aquatic environments. It will cover population and community interactions, plant distribution, and the impacts of climate change on natural systems. Special emphasis will be placed on practical learning through hands-on activities, fieldwork, and laboratory techniques.

Course outcomes:

On successful completion of the course, students will:

1. Understand the ecological principles, ecosystem organization, and functional relationships.
 2. Understand the population dynamics, community structure, biodiversity, and strategies for conservation.
 3. Know the principles of energy flow, productivity, ecological efficiency, and biogeochemical cycles.
 4. Understand the concept of phytogeography, endemism, and floristic distributions.
 5. Understand the science of climate change and sustainable development strategies
 6. Know the adaptation and mitigation against climate change-induced phenomena.
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Theory Credit: 03

Practical Credit: 01

No. of Required Classes: 75 (Theory: 45; Practical: 30)

No. of Contact Classes: 75 (Theory: 45; Practical: 30)

No. of Non-Contact Classes: Nil

Particulars of Course Designer

CCS, Department of Botany

GOALAPRA COLLEGE, GOALPARA-783101

Four-year Undergraduate Programme
Subject: Botany
Semester: Fifth
Course Name: *Plant Systematics*
SUBJECT CODE: BOT-01-CC-30511/ BOT-01-MC-30505
Major 11/Minor-5
Existing Base Syllabus: UG CBCS Syllabus
Course Level: 300-399, and subsequent level as per NEP structure

THEORY [Total marks: 60] Credit: 03; Total No. of classes: 45			
Unit no.	Unit content	No. of classes	Marks
Unit 1	Significance of Plant systematics: Introduction to systematics; Plant identification, Classification, Nomenclature. Evidences supporting systematics from palynology, cytology, phytochemistry and molecular data. Functions and importance of Herbarium and botanical garden in research and conservation; Important herbaria and botanical gardens of the world and India; Virtual herbarium;	8	8

	Categories and taxonomic hierarchy; Concept of taxa (family, genus, species).		
Unit 2	Botanical nomenclature: History, Principles and Rules (ICN); Ranks and names; Typification, Author citation, Effective and Valid publication, Rejection of names, Principle of priority and its limitations.	5	8
Unit 3	Systems of classification: Major contributions of Theophrastus, Bauhin, Tournefort, Linnaeus, Adanson, de Candolle, Bessey, Hutchinson, Takhtajan and Cronquist; Classification systems proposed by Bentham and Hooker, Engler and Prantl, Takhtajan; Brief account of Angiosperm Phylogeny Group (APG) classification.	9	12
Unit 4	Numerical taxonomy and cladistics: OTUs, characters, character weighting and coding; Cluster analysis; Phenograms & Cladograms (definitions and differences).	6	8
Unit 5	Phylogeny of Angiosperms: Terms and concepts (primitive and advanced, homology and analogy, parallelism and convergence, monophyly, Paraphyly, polyphyly and clades). Origin and evolution of angiosperms; Co-evolution of angiosperms and animals; Methods of illustrating evolutionary relationship (phylogenetic tree, cladogram).	6	10
Unit 6	Angiospermic Families: Detail study of the families : Magnoliaceae, Fabaceae, Asteraceae, Solanaceae, Acanthaceae, Lamiaceae, Euphorbiaceae, Orchidaceae, Musaceae, Zingiberaceae, Poaceae.	11	14
PRACTICAL [Credit: 01]			
1. Study of vegetative and floral characters of locally available angiospermic plants belonging to the following families (Description, V.S. flower, section of ovary, floral diagram/s, floral formula/e and systematic position according to Bentham & Hooker's system of classification): Fabaceae, Solanaceae, Acanthaceae, Lamiaceae, Euphorbiaceae, Musaceae, Orchidaceae. 2. Field visits to familiarise students with vegetation of an area and identification of plant species / Visit to Academic or Research Institutions.		30	40

3. Mounting of properly dried and pressed specimens of at least 20 (twenty) wild plant species with herbarium labels (to be submitted with the record book).		
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Reading list:

1. Jeffrey C (1982) An Introduction to Plant Taxonomy. Cambridge University Press, Cambridge.
2. Judd WS, Campbell CS, Kellogg EA, Stevens PF (2002) Plant Systematics-A Phylogenetic Approach. Sinauer Associates Inc., U.S.A. 2nd edition.
3. Mitra JN (1988) An Introduction to Systematic Botany and Ecology. The World Press Private Ltd. Calcutta.
4. Mondal AK (2009) Advanced Plant Taxonomy. New Central Book Agency (P) Ltd.
5. Naik VN (1984) Taxonomy of Angiosperms. Tata Mc Graw-Hill.
6. Pandey BP (2018) A Textbook of Botany: Angiosperm. S. Chand Publishing, 7361, Ram Nagar, Qutab Road, New Delhi-110055.
7. Simpson MG (2006) Plant Systematics. Elsevier Academic Press.
8. Singh G (2012) Plant Systematics: Theory and Practice. Oxford & IBH Pvt. Ltd., New Delhi. 3rd edition.

Graduate Attributes

Course Objective:

This paper provides a thorough knowledge of plant systematics, encompassing the core principles of plant identification, classification methods, and nomenclature. It emphasizes the significance of systematics across diverse fields of Botany and also exploring the phylogenetic and evolutionary connections among angiosperms. Furthermore, it highlights the essential role of herbaria and botanical gardens, both within India and internationally, in facilitating precise plant identification and advancing botanical research.

Course outcomes:

On successful completion of the course, students will be:

1. Able to obtain knowledge on plant systematics, identification, classification, nomenclature, and supporting evidences.
2. Detailed knowledge of the phylogenetic and evolutionary relationships of angiosperms.
3. Able to obtain knowledge on various herbaria and botanical gardens in India and abroad, along with their role and significance in plant systematics.
4. Able to Interpret phylogeny and evolutionary trends of angiosperms, including co-evolution and phylogenetic methods.
5. Acquainted with practical knowledge on vegetative and reproductive structures of angiosperms.
6. Acquainted with practical knowledge on vegetation of an area.

Theory Credit: 03

Practical Credit: 01

No. of Required Classes: 75 (Theory: 45; Practical: 30)

No. of Contact Classes: 75 (Theory: 45; Practical: 30)

No. of Non-Contact Classes: Nil

Particulars of Course Designer (Name, Institution, email id):

BOS, Department of Botany

GOALPARA COLLEGE, GOALAPRA-783101

Four-year Undergraduate Programme

Subject: Botany

Semester: Sixth

Major 12

Course Name: *Molecular Biology*

SUBJECT CODE: BOT-01-CC-30612

Existing Base Syllabus: UG CBCS Syllabus

Course Level: 300-399, and subsequent level as per NEP structure

THEORY [Total marks: 60] Credit: 03; Total No. of classes: 45			
Unit no.	Unit content	No. of classes	Marks
Unit 1	Nucleic acids: Nucleic acids as carrier of genetic information: Historical background; DNA as the genetic material (Griffith's, Avery–McLeod–McCarty, Hershey–Chase, Fraenkel–Conrat's experiments)..	3	4

Unit 2	The Structures of DNA and RNA / Genetic Material: DNA Structure: Miescher to Watson and Crick- historic perspective, DNA structure and Salient features of double helix, denaturation and renaturation, cot curves; Organization of DNA- Prokaryotes, Viruses, Eukaryotes. Organelle DNA - mitochondria and chloroplast DNA. The Nucleosome Chromatin structure- Euchromatin, Heterochromatin- Constitutive and Facultative heterochromatin. .	8	12
Unit 3	The replication of DNA, Central dogma and genetic code: Chemistry of DNA synthesis (Kornberg's discovery); General principles – bidirectional, semi- conservative and semi discontinuous replication, RNA priming; Various models of DNA replication, including rolling circle, θ (theta) mode of replication, replication of linear ds-DNA; Enzymes involved in DNA replication. Key experiments establishing-The Central Dogma (Adaptor hypothesis and discovery of mRNA template), Genetic code (deciphering & salient features)	10	12
Unit 4	Transcription: Transcription in prokaryotes and eukaryotes. Principles of transcriptional regulation; Prokaryotes: Regulation of lactose metabolism and tryptophan synthesis in <i>E. coli</i>. Eukaryotes: transcription factors, heat shock proteins, steroids and peptide hormones; Gene silencing.	10	12
Unit 5	Processing and modification of RNA: Split genes – introns and exons; intron removal, spliceosome machinery, splicing pathways (group I and group II introns), alternative splicing; eukaryotic mRNA processing (5' cap, 3' poly-A tail); ribozymes; RNA editing; mRNA transport.	7	10
Unit 6	Translation: Ribosome structure and assembly; mRNA; charging of tRNA and role of aminoacyl-tRNA synthetases; various stages of protein synthesis – initiation, elongation,	7	10

	termination; fidelity of translation; inhibitors of protein synthesis; post-translational protein modifications.		
PRACTICAL [Credit: 01]			
1. Isolation of DNA from plant material. 2. Estimation of DNA using diphenylamine reagent / UV spectrophotometry (demonstration). 3. Study of DNA replication mechanisms through photographs (Rolling circle, Theta replication and semi-discontinuous replication). 4. Study of prokaryotic RNA polymerase and eukaryotic RNA polymerase II structures through photographs. 5. Study of the following through photographs: Assembly of Spliceosome machinery; Splicing mechanism in group I & group II introns; Ribozyme and Alternative splicing.		30	40

Reading list:

1. Griffiths AJF, Wessler SR, Carroll SB, Doebley J (2010) Introduction to Genetic Analysis. W. H. Freeman and Co., U.S.A. 10th edition.
2. Klug WS, Cummings MR, Spencer CA (2009) Concepts of Genetics. Benjamin Cummings. U.S.A. 9th edition.
3. Russell PJ (2010) iGenetics - A Molecular Approach. Benjamin Cummings, U.S.A. 3rd edition.
4. Snustad DP, Simmons MJ (2010) Principles of Genetics. John Wiley and Sons Inc., U.S.A. 5th edition.
5. Watson JD, Baker TA, Bell SP, Gann A, Levine M, Losick R (2007) Molecular Biology of the Gene, Pearson Benjamin Cummings, CSHL Press, New York, U.S.A. 6th edition.

Graduate Attributes

Course Objective: To provide a comprehensive understanding of the molecular basis of genetic information, including the structure, replication, transcription, processing, and translation of nucleic acids, and their regulation in living systems.

Course Outcomes:

1. Knowledge of classical experiments that established DNA as the genetic material.
2. Knowledge of DNA structure, organization, and replication mechanisms.
3. Knowledge on DNA/RNA structures, chromatin organization, and organelle DNA.
4. Detailed knowledge of the central dogma, transcription processes, and RNA processing.
5. Knowledge of the genetic code, protein synthesis, and post-translational modifications.
6. Practical ability to isolate genomic DNA from plant samples.

Theory Credit: 03

Practical Credit: 01

No. of Required Classes: 75 (Theory: 45; Practical: 30)

No. of Contact Classes: 75 (Theory: 45; Practical: 30)
 No. of Non-Contact Classes: Nil
 Particulars of Course Designer (Name, Institution, email id):
 BOS, Department of Botany
 GOALPARA COLLEGE, GOALPARA

Four-year Undergraduate Programme
Subject: Botany
Semester: Sixth
Major 13
Course Name: *Reproductive Biology of Angiosperm*
SUBJECT CODE BOT-01-CC-30613
Existing Base Syllabus: UG CBCS Syllabus
Course Level: 300-399, and subsequent level as per NEP structure

THEORY [Total marks: 60] Credit: 03; Total No. of classes: 45			
Unit no.	Unit content	No. of classes	Marks
Unit 1	Introduction to reproductive biology of Angiosperms: historical overview highlighting the contributions of G.B. Amici, W. Hofmeister, E. Strasburger, S.G. Nawaschin, P. Maheshwari, B.M. Johri, W.A. Jensen, and J. Heslop-Harrison, its scope.	4	4

Unit 2	Reproductive development: Induction of flowering; flower as a modified determinate shoot. Flower development: genetic and molecular aspects.	4	6
Unit 3	Anther and pollen biology: Anther wall: Structural details and functions, microsporogenesis, callose deposition and its importance. Microgametogenesis; Organization of pollen wall, MGU (male germ unit) structure; Palynology and scope (a brief account); NPC system of classification of pollen; Pollen wall proteins; Pollen viability, storage and germination; Abnormal features: Pseudomonads, polyads, massulae, pollinia.	10	14
Unit 4	Ovule: Structure of ovule; Types; Special structures—endothelium, obturator, aril, caruncle and hypostase; Female gametophyte-megasporogenesis (monosporic, bisporic and tetrasporic) and megagametogenesis (details of <i>Polygonum</i> type); Organization and ultrastructure of mature embryo sac.	6	10
Unit 5	Pollination and fertilization: Types of pollination and their significance, adaptations; structure of stigma and style; pathway of pollen tube in pistil; process of double fertilization. Basic concept of Self incompatibility (interspecific, intraspecific, homomorphic, heteromorphic, GSI and SSI); Methods to overcome self-incompatibility: mixed pollination, bud pollination, stub pollination; Intra-ovarian and <i>in vitro</i> pollination; Modification of stigma surface, parasexual hybridization; Cybrids, <i>in vitro</i> fertilization.	12	12
Unit 6	Embryo, Endosperm, and Seed: Structure and types; developmental patterns of dicot and monocot embryos and endosperms; structure and functions of the suspensor; relationship between embryo and endosperm; nutrition of the embryo; unusual developmental features; embryo development in <i>Paeonia</i> . Seed: Structure, significance, and mechanisms of dispersal. Polyembryony and Apomixis: Introduction, classification, causes, and practical applications.	9	14
PRACTICAL [Credit: 01]			

1. Anther: Anther wall and its ontogeny; Tapetum structure (amoeboid and glandular); MMC, spore tetrads, uninucleate, bi-celled and dehiscent anther stages through slides/micrographs, male germ unit (MGU) through photographs and schematic representation. 2. Pollen grains: Fresh and acetolyzed showing ornamentation and aperture, pseudomonads, polyads, pollinia (slides/photographs, fresh material), ultrastructure of pollen wall(micrograph); Pollen viability: Tetrazolium test for germination: Calculation of percentage germination in different media using hanging drop method. 3. Ovule: Types-anatropous, orthotropous, amphitropous/campylotropous, circinotropous, unitegmic, bitegmic; Tenuinucellate and crassinucellate; Special structures: Endothelium, obturator, hypostase, caruncle and aril (permanent slides/specimens/photographs). 4. Female gametophyte through permanent slides/photographs: Types, ultrastructure of mature egg apparatus. 5. Intra-ovarian pollination; Test tube pollination through photographs. 6. Endosperm: Dissections of developing seeds for endosperm with free-nuclear haustoria. 7. Embryogenesis: Study of development of dicot embryo through permanent slides; dissection of developing seeds for embryos at various developmental stages.	30	40
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Reading list:

1. Bhattacharya M, Bhattacharya. (2012). A Textbook of Palynology: Basic and Applied. New Central Book Agency (P) Ltd. Guwahati.
2. Bhojwani SS, Bhatnagar SP (2011) The Embryology of Angiosperms, Vikas Publishing House. Delhi. 5th edition.
3. Johri BM (1984) Embryology of Angiosperms, Springer-Verlag, Netherlands.
4. Raghavan V (2000) Developmental Biology of Flowering plants, Springer, Netherlands.
5. Shivanna KR (2003) Pollen Biology and Biotechnology. Oxford and IBH Publishing Co. Pvt. Ltd. Delhi.

Graduate Attributes

Course Objective:

This paper presents a detailed account of the reproductive biology of angiosperms, integrating historical perspectives, structural and developmental processes, molecular mechanisms, and practical applications in plant science.

Course outcomes:

1. Knowledge of historical contributions and scope of reproductive biology in angiosperms.
2. Describe the induction of flowering and genetic regulation of flower development.
3. Analyse the structure, development, and functional aspects of anthers, pollen, and ovules.
4. Evaluate mechanisms of pollination, fertilization, and self-incompatibility along with methods to overcome them.
5. Interpret the developmental patterns of embryos, endosperms, and seeds, including unusual features and dispersal strategies.
6. Apply practical skills in studying reproductive structures, gametophytes, pollination techniques, and embryogenesis through laboratory methods.

Theory Credit: 03

Practical Credit: 01

No. of Required Classes: 75 (Theory: 45; Practical: 30)

No. of Contact Classes: 75 (Theory: 45; Practical: 30)

No. of Non-Contact Classes: Nil

Particulars of Course Designer (Name, Institution, email id):

BOS, Department of Botany

GOALAPRA COLLEGE, GOALPARA-783101

Four-year Undergraduate Programme

Subject: Botany

Semester: Sixth

Major 14

Course Name: *Plant Metabolism and Biochemistry*

SUBJECT CODE: BOT-01-CC-30614

Existing Base Syllabus: UG CBCS Syllabus

Course Level: 300-399, and subsequent level as per NEP structure

THEORY [Total marks: 60] Credit: 03; Total No. of classes: 45			
Unit no.	Unit content	No. of classes	Marks
Unit 1	Concepts of metabolism: Introduction, anabolic and catabolic pathways, regulation of metabolic process, role of regulatory enzymes; classification, nomenclature, and importance of enzyme; Concept of coenzyme, apoenzyme and prosthetic group; Enzyme inhibition (allosteric, covalent modulation); Isozymes.	6	8

Unit 2	Carbon assimilation: Role of photosynthetic pigments (chlorophylls and accessory pigments), antenna molecules and reaction centers, photochemical reactions, photosynthetic electron transport in photosynthesis, PSI, PSII, Q-cycle, CO ₂ fixation: C ₃ , C ₄ , and CAM pathways; photorespiration.	8	12
Unit 3	Carbon oxidation and ATP Synthesis: Glycolysis and its regulation, oxidative decarboxylation of pyruvate, TCA cycle and regulation, amphibolic role, anaplerotic reactions, mitochondrial electron transport, oxidative phosphorylation, cyanide-resistant respiration, pentose phosphate pathway; Factors affecting respiration; ATP synthesis: substrate level phosphorylation, chemiosmotic mechanism, ATP synthase, Boyer's conformational model, Racker's and Jagendorf's experiments, role of uncouplers.	10	12
Unit 4	Carbohydrate, Lipid and Nitrogen metabolism: Synthesis and breakdown of sucrose, starch and cellulose, triglyceride metabolism, β -oxidation, glyoxylate cycle, gluconeogenesis and its role in mobilisation of lipids during seed germination, α -oxidation. Nitrogen metabolism: biological nitrogen fixation (examples of legumes and non-legumes), biochemical aspects of nitrogen fixation, ammonia assimilation and transamination. .	12	14
Unit 5	Signal transduction mechanisms: Receptor-ligand interactions, concept of second messengers, calcium-calmodulin system, MAP kinase cascade, and two-component systems.	5	8
Unit 6	Secondary metabolites: Shikimate pathway and its role in biosynthesis of secondary metabolites; biosynthesis and physiological functions of terpenes, phenols, and nitrogen-containing compounds.	4	6
PRACTICAL [Credit: 01]			

1. Chemical separation of photosynthetic pigments by solvent method/paper chromatography 2. Estimation of sugar content by DNSA method 3. Determination of titratable acid number (TAN) in plant materials 4. Quantification of chlorophyll a, b and total chlorophyll and calculation of chlorophyll a/b ratio 5. Estimation of phenol/tannin/flavonoid using colorimetric method 6. Protein estimation in plant samples by Lowry's or Biuret method 7. Separation of amino acids by paper chromatography 8. Demonstration of Thin layer chromatography (TLC) or Column chromatography 9. To compare the rate of respiration by Ganong's respirometer in different parts of plant (Demonstration)	30	40
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Reading list:

1. Cox MM, Nelson DL (2017) Principles of Biochemistry (7th Edition). WH Freeman & Co., Newyork.
2. Goodwin TW, Mercer EI (2005) Introduction to Plant Biochemistry. CBS Publishers and Distributors Pvt. Ltd., New Delhi.
3. Jain J L, Jain S, Jain N (2016) Fundamentals of Biochemistry (7th edition). S Chand & Co. PVT. Ltd., New Delhi, India;
4. Palmer T, Bonner P (2008) Enzymes: Biochemistry, Biotechnology, Clinical Chemistry. East West Press Pvt. Ltd., New Delhi;
5. Plummer D (2017) An Introduction to Practical Biochemistry (3rd edition). McGraw Hill Education, New Delhi, India
6. Sadasivam A, Manickam S (2022) Biochemical Methods (4th edition). New Age International Pvt. Ltd.
7. Satyanarayana U, Chakrapani U (2021) Biochemistry (6th edition). Elsevier;
8. Voet D, Voet JG, Pratt CW (2018) Principles of Biochemistry (5th edition). J Wiley & Sons, Singapore Pte. Ltd.

Graduate Attributes

Course Objective:

. This course introduces students to the detailed concepts of plant metabolism and biochemical pathways. It emphasizes carbon assimilation, carbon oxidation, and ATP synthesis in plants, along with carbohydrate, lipid, and nitrogen metabolism. It also covers mechanisms of signal transduction and the biosynthesis and physiological roles of secondary metabolites.

Course outcomes:

1. Knowledge of plant metabolism and its regulation
2. Knowledge of carbon assimilation, oxidation, and ATP synthesis.
3. Knowledge in basic concepts of carbohydrate, Lipid and Nitrogen metabolism
4. Knowledge in basic concepts of signal transduction
5. Practical skills in pigment separation, estimation of sugars, and respiration studies
6. Ability to perform experiments on chromatographic techniques, spectrophotometric analysis.

Theory Credit: 03

Practical Credit: 01

No. of Required Classes: 75 (Theory: 45; Practical: 30)

No. of Contact Classes: 75 (Theory: 45; Practical: 30)

No. of Non-Contact Classes: Nil

Particulars of Course Designer (Name, Institution, email id):

BOS, Department of Botany

GOALAPRA COLLEGE, GOALPARA

Four-year Undergraduate Programme

Subject: Botany

Semester: Sixth

Major 15

Course Name: *Applied Plant Biology*

SUBJECT CODE: BOT-01-CC-30615/ BOT-01-MC-30606

Existing Base Syllabus: UG CBCS Syllabus

Course Level: 300-399, and subsequent level as per NEP structure

THEORY [Total marks: 60] Credit: 03; Total No. of classes: 45			
Unit no.	Unit content	No. of classes	Marks
Unit 1	Plant Tissue Culture: Historical background and development; composition of culture media; essential nutrients and hormone requirements, role of vitamins and plant growth regulators; concept of totipotency; processes of organogenesis and embryogenesis (somatic and zygotic); techniques for protoplast isolation, culture, and fusion.	8	10

Unit 2	Application of tissue culture: Micropropagation, androgenesis, virus elimination, secondary metabolite production, haploids, triploids and hybrids; Cryopreservation; Germplasm conservation.	4	6
Unit 3	Recombinant DNA technology: Restriction Endonucleases (History, Types I-IV, biological role and application); Restriction Mapping (Linear and Circular); Cloning Vectors: Prokaryotic (pUC 18 and pUC19, pBR322, Ti plasmid, BAC); Lambda phage, M13 phagemid, Cosmid, Shuttle vector; Eukaryotic Vectors (YAC).	8	10
Unit 4	Gene Cloning: Recombinant DNA, Bacterial Transformation and selection of recombinant clones, PCR- mediated gene cloning; Gene Construct; construction of genomic and cDNA libraries, screening DNA libraries to obtain gene of interest by genetic selection; complementation, colony hybridization; PCR	9	12
Unit 5	Methods of gene transfer: <i>Agrobacterium</i> -mediated, Direct gene transfer by Electroporation, Microinjection, Microprojectile bombardment; Selection of transgenics - selectable marker and reporter genes (Luciferase, GUS, GFP).	6	10
Unit 6	Applications of genetic engineering: Pest resistant (Bt-cotton); herbicide resistant plants (Round Up Ready soybean); Transgenic crops with improved quality traits (FlavrSavr tomato, Golden rice); Improved horticultural varieties (Moondust carnations); Role of transgenics in bioremediation (Superbug).	10	12
PRACTICAL [Credit: 01]			
1. (a) Preparation of Murashige and Skoog (MS) medium. (b) Demonstration of <i>in vitro</i> sterilization and inoculation methods using leaf and nodal explants of any plant species. 2. Study of anther, embryo and endosperm culture, micropropagation, somatic embryogenesis & artificial seeds through photographs. 3. Protoplast isolation procedure. 4. Construction of restriction map of circular and linear DNA from the data provided. 5. Study of gene transfer methods through photographs: <i>Agrobacterium</i> -mediated, direct transfer by electroporation, microinjection, and microprojectile		30	40

bombardment. 6. Study of genetic engineering steps for production of Bt cotton, Golden rice, and FlavrSavr tomato through photographs. 7. Isolation of plasmid DNA. 8. Restriction digestion and gel electrophoresis of plasmid DNA.		
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Reading list:

1. Bhojwani SS, Bhatnagar SP (2011) The Embryology of Angiosperms. Vikas Publication House Pvt. Ltd., New Delhi. 5th edition.
2. Bhojwani SS, Razdan MK (1996) Plant Tissue Culture: Theory and Practice. Elsevier Science Amsterdam. The Netherlands.
3. Ganguli P (2001) Intellectual Property Rights: Unleashing the Knowledge Economy. New Delhi: Tata McGraw-Hill Pub.
4. Glick BR, Pasternak JJ (2003) Molecular Biotechnology- Principles and Applications of recombinant DNA. ASM Press, Washington.
5. Kuhse H (2010) Bioethics: An Anthology. Malden, MA: Blackwell.
6. Snustad DP, Simmons MJ (2010) Principles of Genetics. John Wiley and Sons, U.K.
7. Stewart CN Jr (2008) Plant Biotechnology & Genetics: Principles, Techniques and Applications. John Wiley & Sons Inc. U.S.A.

Graduate Attributes

Course objectives:

To provide fundamental knowledge and practical skills in plant tissue culture, recombinant DNA technology, gene cloning, and genetic engineering, with emphasis on their applications in agriculture, medicine, and industry and other fields

Course outcomes:

1. Knowledge of principles and applications of plant tissue culture.
2. Explain recombinant DNA technology and cloning vector systems.
3. Demonstrate gene cloning techniques and library construction methods.
4. Describe various methods of gene transfer and selection of transgenics.
5. Apply genetic engineering approaches for crop improvement and bioremediation.
6. Perform basic laboratory procedures including media preparation, DNA isolation, and restriction analysis.

Theory Credit: 03

Practical Credit: 01

No. of Required Classes: 75 (Theory: 45; Practical: 30)

No. of Contact Classes: 75 (Theory: 45; Practical: 30)

No. of Non-Contact Classes: Nil
Particulars of Course Designer (Name, Institution, email id):
BOS, Department of Botany
GOALPARA COLLEGE, GOALPARA-783101

Four-year Undergraduate Programme
Subject: Botany
Semester: Seventh
Course Name: *Plant Breeding, Genomics and Bioinformatics*
SUBJECT CODE: BOT-01-CC-40716
Existing Base Syllabus: UG CBCS Syllabus
Course Level: 400-499, and subsequent level as per NEP structure

THEORY [Total marks: 60] Credit: 03; Total No. of classes: 45			
Unit no	Unit content	No. of classes	Marks
Unit 1	Principles of plant breeding, methods of selection and hybridization; concepts in improvement of major crop species; inheritance patterns in polyploidy and mechanisms of self-incompatibility.	6	8

Unit 2	QTL mapping using molecular marker, population statistics; heritability, Hardy-Weinberg law of equilibrium, Novel plant breeding tools (TALEN's, CRISPR-Cas9, Base editing).	7	10
Unit 3	Chromosomal variations in higher plants; haploid production systems and their applications in plant breeding; types of aneuploidy- trisomic, tetrasomic, and nullisomic forms, their significance in genetic research; mechanisms of parthenogenesis and apogamy; action of physical and chemical mutagens and the role of mutation in crop improvement.	8	10
Unit 4	Intellectual Property Rights -- Intellectual property rights (IPR); Patents, trade secrets, copyright, trademarks; Geographical Indicators (GI); Registration, subject matter and ownership of IPRs. Plant genetic resources; GATT & TRIPPS; Patenting of biological material; Plant breeders rights (PBRs) and farmers rights.	8	10
Unit 5	Genomics: Organization of nuclear and organellar genomes, Sequencing Genomes, Comparative genomics, Functional genomics	6	10
Unit 6	Bioinformatics: Introduction to bioinformatics, biological databases, data mining and retrieval, scope and application of bioinformatics, nucleic acid and protein sequence analysis, sequence alignment, local and global alignment, database search for homologous sequences-BLAST and FASTA, protein structure analysis, Ramachandran plot, computer-aided drug discovery.	10	12
PRACTICAL [Credit: 01]			
1. Principle, techniques and procedure involve in emasculation. 2. Sequence (protein/DNA) downloading from databases, alignment and homologous sequence search 3. Sequence BLAST, annotation and gene prediction with the help of bioinformatical tools.		30	40

4. Protein modelling, structure prediction and analysis of Ramachandran plot 5. Chromosome analysis, study of chromosome behaviour during mitosis and meiosis, chromosome anomalies in plant cells. 6. Comparative genomics of bacteria		
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Reading list:

1. Acquaah, G. (2012). Principles of Plant Genetics & Breeding. 2nd edition. Hoboken, NJ, Wiley.
2. Allard, R.W. (1999). Principles of Plant Breeding. John Wiley, New York.
3. Singh, B.D. (2022). Plant Breeding: Principles and Methods, 12th edition. New Delhi, Delhi: Kalyani Publishers.
4. Frey, K. J. (1982). Plant Breeding II. Kalyani Publishers, New Delhi.
5. Chopra, V.L. (2023). Plant Breeding: Theory and Practice 2nd Restructured Edition, New India Publishing Agency, New Delhi.
6. Poehlman J. M. and Sleper D. A. (1995). Breeding Field Crops, 4th Ed. Panima Publishing Corporation, New Delhi.
7. Welsh, J. R. (1981). Fundamentals of Plant Genetics and Breeding. John Wiley and Sons, New York.
8. Ahuja, V.K. (2007) Laws related to IPR. LexisNexis, India.
9. Snustad DP, Simmons MJ (2010) Principles of Genetics, John Wiley & Sons Inc., India. 5th edition
10. Pierce BA (2016) Genetics-A conceptual approach, W.H. Freeman and Co. USA, Sixth edition.
11. Primerose SB and Twyman RM (2014), Principles of Gene manipulation and genomics. Wiley Blackwell. Seventh Edition.

Theory Credit: 03

Practical Credit: 01

No. of Required Classes: 75 (Theory: 45; Practical: 30)

No. of Contact Classes: 75 (Theory: 45; Practical: 30)

No. of Non-Contact Classes: Nil

Particulars of Course Designer (Name, Institution, email id):

BOS, Department of Botany

GOALPARA COLLEGE, GOALPARA-783101

Four-year Undergraduate Programme
Subject: Botany
Semester: Seventh
Course Name: *Conservation Ecology and Biodiversity Assessment*
SUBJECT CODE: BOT-01-CC-40717
Existing Base Syllabus: UG CBCS Syllabus
Course Level: 400-499, and subsequent level as per NEP structure

THEORY [Total marks: 60] Credit: 03; Total No. of classes: 45			
Unit No	Unit Content	No. of classes	Marks
Unit 1	Conservation Ecology- Concept, principles, postulates and ethics, genetic variation and its loss, variation in natural populations, Species and habitat conservation- prioritizing species and habitat, protected area networks; major approaches to their management, Indian case studies on conservation/management strategy.	8	10
Unit 2	Conservation strategies- In-situ, Ex-situ and hybrid approaches, conservation: facilities, the establishment of new populations, captive breeding, reintroduction, advantages and disadvantages, Metapopulation- concept, types, and conservation importance	7	8
Unit 3	Biodiversity: Concept, levels, types, and significance; methods for biodiversity assessment and monitoring; indicators of biodiversity; zones of megadiversity and biodiversity hot spots, including the hottest hot spots; mega-diversity nations; centers of plant diversity and endemism; and biodiversity and ecosystem services.	6	8
Unit 4	Threats to biodiversity: Causes of biodiversity loss, species extinction, vulnerability of species to extinction, IUCN threat categories, Red data book; Biodiversity Act and biodiversity action plan; IPRs, national and international programs for biodiversity conservation, wildlife values and eco-tourism, wildlife distribution in India, problem in wildlife protection, role of WWF, WCU, CITES, TRAFFIC.	10	12
Unit 5	Biodiversity Assessment concept and significance, applying methodologies for evaluating and analyzing different species groups, and monitoring their status over time. Importance of proper documentation and integration of information	7	10

	technology in biodiversity studies. Sustainable utilization of biodiversity loss and its serious ecological, economic, and social consequences.		
Unit 6	Protected Area Network: Concept, History, Indian Scenario: Biospheres, National Parks and Wildlife Sanctuaries, Wildlife conservation projects, Conservation of population, design and management of protected areas; problems of protected areas in India, connectivity and corridors; population biology of endangered species. Population viability analysis, Wildlife conservation in NE India- Case Studies	7	12
PRACTICAL [Credit: 01]			
	1. Ecological data analysis in Microsoft Excel: Data entering in Excel worksheet; Statistical interpretation in Excel; Data analysis tool, Pak: Basic graphical tools; T-test; Chi-Square test for independence of attributes; Spearman's rank correlation test. 2. Introduction to MS-Access: Creation of databases, tool bars, menu bars, opening of a data bar, entry format, entry of data, saving and formatting of data, queries of data, sorting of data and others. 3. Demonstration of biodiversity assessment methods in the University campus; 4. Qualitative and Quantitative analysis of vegetation. 5. Field visit to the forest nearby or protected area to study the biodiversity and understand the conservation strategies employing the protected area.	30	40

Reading list:

1. Anna A. Sher, Richard B. Primack · (2019) an Introduction to Conservation Biology. Oxford University Press
2. Anne E. Magurran, Brian J. McGill (2011) Biological Diversity: Frontiers in Measurement and Assessment. Oxford University Press.
3. Fred Van Dyke, Rachel L. Lamb (2020). Conservation Biology: Foundations, Concepts, Applications. Springer International Publishing 6
4. Jase Fitzgerald (2017). Biodiversity: An Introduction. Larsen and Keller Education.
5. Kelsey Malone (2020) Ecology: Evolution, Biodiversity and Conservation CALLISTO REFERENCE.
6. Krishnamurthy KV (2018) an Advanced Textbook on Biodiversity – Principles and Practice, Oxford and IBH Publishing, New Delhi.
7. Lisa Idzikowski (2019). Biodiversity and Conservation. Greenhaven Publishing LLC
8. Malcolm L. Hunter, Jr., James P. Gibbs, Viorel D. Popescu. (2021). Fundamentals of Conservation biology (4th edition). Wiley

9. Michael O'Neal Campbell. 2021. Critical Research Techniques in Animal and Habitat Ecology. Nova Science Publishers.
10. Peter Stiling (2015). Ecology: Global Insights & Investigations 2nd Edition. McGraw-Hill international edition Reference books
11. PetrosGanatsas (2021). Forest Biodiversity, Conservation and Sustainability. Mdpi AG
12. Singh JS, Singh SP and Gupta SR (2014) Ecology, Environmental Science and Conservation. 4th Edition. S. Chand & Company Pvt. Ltd.

Graduate Attributes

Course Objective:

This course will provide an understanding on importance of conservation ecology, the current status of the global biological diversity, the value of biodiversity and drivers of its loss. This course will provide an understanding of the importance of conservation ecology, the current status of global biological diversity, the value of biodiversity and the factors driving its decline.

Course outcomes:

On successful completion of the course, students will:

1. Understand the concept and significance of biodiversity
2. Understand the factors influencing biodiversity changes and factors associated with the changes
3. Understand the biodiversity assessment methods
4. Understand the ecological, social, and economic consequences of biodiversity loss, and
5. Acquire knowledge of management principles and tools for conserving biodiversity at different levels.

Particulars of Course Designer (Name, Institution, email id):

Theory Credit: 03

Practical Credit: 01

No. of Required Classes: 75 (Theory: 45; Practical: 30)

No. of Contact Classes: 75 (Theory: 45; Practical: 30)

No. of Non-Contact Classes: Nil

Particulars of Course Designer (Name, Institution, email id):

BOS, Department of Botany

GOALPARA COLLEGE, GOALPARA-783101

Four-year Undergraduate Programme
Subject: Botany
Semester: Seventh
Course Name: *Plant diseases, diagnostic and management*
SUBJECT CODE: BOT-01-CC-40718

Existing Base Syllabus: UG CBCS Syllabus
Course Level: 400-499, and subsequent level as per NEP structure

THEORY [Total marks: 60] Credit: 03; Total No. of classes: 45			
Unit no.	Unit content	No. of classes	Marks
Unit 1	Introduction to Plant Diseases: Koch's postulate and germ theory of diseases, biotic and abiotic factors responsible for plant diseases characteristic symptoms and diagnostic signs of plant diseases caused by fungi, bacteria, virus, and nematode.	6	6
Unit 2	Dissemination of plant pathogens; disease cycle; physiological changes due to disease in plants; Genetics of plant diseases	8	10
Unit 3	Diagnosis of Plant Diseases: Identification of common plant diseases through observable symptoms, Laboratory techniques (microscopy, culturing, and serological tests); molecular methods (PCR, DNA sequencing, and ELISA)	8	12
Unit 4	Epidemiology of plant diseases; Disease mapping, forecasting and surveillance techniques	8	8
Unit 5	Concept of plant disease control: Cultural, Chemical, and biological control of plant diseases; Integrated pest management (IPM); Management of soil borne plant pathogens; Management of seed borne pathogens	8	12
Unit 6	Resistant gene identification and development of disease resistant plant (Traditional and biotechnological approach), GMO (Bt-cotton, Bt-brinjal, Bt-chickpea)	7	12
PRACTICAL [Credit: 01]			
	1. Study of plant disease symptoms and their causal organisms 2. Isolation and identification of pathogen from diseased plant materials 3. Isolation of soil borne fungal pathogens and their control 4. Proving of Koch's postulate at least one disease	30	40

Reading list:

1. Agrios, G. N. (2005). Plant pathology (5th ed.). Academic Press.

2. Lucas, J. A. (2015). Plant pathology and plant pathogens (4th ed.). Wiley-Blackwell.
3. Schumann, G. L., & D'Arcy, C. J. (2010). Essential plant pathology. American Phytopathological Society Press.
4. Maloy, O. C., & Murray, T. D. (Eds.). (1993). Encyclopedia of plant pathology (Vol. 1-2). Wiley-Interscience.
5. Madden, L. V., Hughes, G., & van den Bosch, F. (2007). The study of plant disease epidemics. American Phytopathological Society Press.
6. Hammond, B. G., & Lemaux, P. G. (2008). Genetically modified crops: Promises, perceptions, and realities. *Advances in Agronomy*, 98, 1-41.
7. Staskawicz, B. J., & Jones, J. D. (2000). Molecular plant pathology since 2000. *Molecular Plant Pathology*, 1(1), 9-20.

Graduate Attributes

Course Objective:

This paper aims to provide a comprehensive understanding of plant diseases along with their diagnosis and effective management approaches

Course outcomes:

On completion of the course, students will-

1. Understand the core principles of plant diseases, including Koch's postulates, the germ theory, and the distinction between biotic and abiotic causal factors.
2. Analyse the dissemination of plant pathogens, understand the disease cycle, and evaluate the physiological changes induced by diseases in plants, with emphasis on the genetic aspects of plant pathogens.
3. Employ diagnostic methods for plant diseases, ranging from visual observation and laboratory techniques such as microscopy and culturing, to advanced molecular approaches like PCR, DNA sequencing, and ELISA.
4. Evaluate the epidemiology of plant diseases, through mapping, forecasting, and surveillance techniques to analyze pathogen spread and devise control measures across diverse environments.
5. Recommend and evaluate strategies for managing plant diseases, including cultural, chemical, and biological methods, alongside integrated pest management approaches for soil-borne and seed-borne pathogens. Additionally, consider the identification and breeding of disease-resistant plants, incorporating biotechnological innovations such as genetically modified organisms (GMOs).

Theory Credit: 03

Practical Credit: 01

No. of Required Classes: 75 (Theory: 45; Practical: 30)

No. of Contact Classes: 75 (Theory: 45; Practical: 30)

No. of Non-Contact Classes: Nil

Particulars of Course Designer (Name, Institution, email id):

CCS, Department of Botany

GOALPARA COLLEGE, GOALAPRA

Four-year Undergraduate Programme
Subject: Botany
Semester: Seventh
Course Name: *Environmental Microbiology*
SUBJECT CODE: BOT-01-CC-40719

Existing Base Syllabus: UG CBCS Syllabus
Course Level: 400-499, and subsequent level as per NEP structure

THEORY [Total marks: 60] Credit: 03; Total No. of classes: 45			
Unit no.	Unit content	No. of classes	Marks
Unit 1	Microbiology of soil, water and air (common soil microflora, microbes in soil health improvement, common water microflora, microbial water quality analysis, common air microflora)	6	6
Unit 2	Culture-Dependent Microbial Studies (Growth media preparation; culture techniques; CFU counting and enumeration; isolate characterization and species identification)	8	10
Unit 3	Culture-independent microbial study (direct microscopic methods, meta-genomics, transcriptomics, proteomics and metabolomics)	8	12
Unit 4	Microbial interactions (symbiosis, antagonism, parasitism, commensalism, amensalism, cooperation, quorum and anti-quorum sensing)	8	8
Unit 5	Biogeochemical cycling (Role of microbes in biogeochemical cycling, carbon cycle, nitrogen cycle, sulfur cycle, phosphorus cycle)	8	12
Unit 6	Scope of microbiology in environmental engineering (reclamation of degraded soil, purification of polluted water, biodegradable waste management)	7	12
PRACTICAL [Credit: 01]			
1. Enumeration and identification of common soil microbes 2. Enumeration and identification of common water microbes 3. Use of differential media/specific media to identify a particular group of microbes 4. Catalase and Phosphatase test for bacteria 5. MPN test for water quality assessment. 6. Methylene blue reductase test for milk quality ☐		30	40

Reading list:

1. Sylvia DM, Fuhrmann JJ, Hartel PG, Zuberer DA (2005) Principles and Applications of Soil Microbiology, Pearson, USA.

2. Pepper IL, Gerba CP, Gentry TJ (2014) Environmental Microbiology, Academic Press, USA.
3. Atlas RM (2010) Handbook of Microbiological Media, CRC Press, USA.
4. Madigan MT, Martinko JM, Bender K, Buckley D, Stahl D (2018) Brock Biology of Microorganisms, Pearson, USA.
5. Riesenfeld CS, Schloss PD, Handelsman J (2004) Metagenomics: Genomic Analysis of Microbial Communities, Kluwer Academic Publishers, USA.
6. Hugenholtz P, Tyson GW (2008) Metagenomics, Springer, USA.
7. Falkowski PG, Fenchel T, Delong EF (2008) The Microbial Engines That Drive Earth's Biogeochemical Cycles, Science, USA.
8. Fuqua C, Greenberg EP (2002) Signaling in Bacteria: New Insights into Microbial Ecology and Evolution, ASM Press, USA.
9. Schlesinger WH, Bernhardt ES (2013) Biogeochemistry: An Analysis of Global Change, Academic Press, USA.
10. Paul EA (2014) Soil Microbiology, Ecology, and Biochemistry, Academic Press, USA.
11. Bitton G (2011) Wastewater Microbiology, Wiley-Blackwell, USA.
12. Thakur IS (2006) Environmental Biotechnology: Basic Concepts and Applications, I.K. International Publishing House, India.
13. Cappuccino JG, Welsh CT (2016) Microbiology: A Laboratory Manual, Pearson, USA.
14. Benson HJ (2012) Microbiological Applications: Laboratory Manual in General Microbiology, McGraw-Hill, USA.

Graduate Attributes

Course Objective:

This course is designed to deliver a comprehensive understanding of environmental microbiology, with emphasis on microbial communities in soil, water, and air, and their contributions to soil fertility, water treatment, and biogeochemical cycles. Students will acquire knowledge of both culture-based and culture-free techniques, including preparation of growth media, CFU estimation, and modern genomic tools. The program highlights microbial interactions and their ecological relevance, supported by practical training in microbial enumeration, identification, and biochemical assays. Applications of microbiology in environmental engineering are integrated, preparing learners for advanced academic research or professional careers in the discipline.

Course Outcomes:

Course outcomes:

On completion of the course, students will be able to-

1. Identify common soil microorganisms and describe their function in the nitrogen cycle.
2. Understand the concept of symbiosis and provide examples of how this interaction benefits soil health.
3. Perform CFU counting and use meta-genomics data to analyze microbial diversity in a soil sample.
4. Analyze results from the methylene blue reductase test to determine milk quality and identify the presence of specific microbial contaminants.

5. Evaluate various microbial bioremediation approaches for cleaning polluted water and recommend the most effective strategy supported by scientific evidence.

Theory Credit: 03

Practical Credit: 01

No. of Required Classes: 75 (Theory: 45; Practical: 30)

No. of Contact Classes: 75 (Theory: 45; Practical: 30)

No. of Non-Contact Classes: Nil

Particulars of Course Designer (Name, Institution, email id):

BOS, Department of Botany

GOALAPRA COLLEGE, GOALPARA

Four-year Undergraduate Programme
Subject: Botany
Semester: Seventh
Research component
Course Name: *Research Methodology*
Subject code:
Existing Base Syllabus: UG CBCS Syllabus
Course Level: 400-499, and subsequent level as per NEP structure

THEORY [Total marks: 60] Credit: 03; Total No. of classes: 45			
Unit no.	Unit content	No. of classes	Marks
Unit 1	Research Methodology: Concept of research, identification of the research gap, understanding the scientific question(s); establishing the novelty of research in relation to existing literature, formulation of hypotheses and objectives, and preparation of the research proposal and synopsis.	6	6
Unit 2	Experimental designs: Formulation of research problem, sampling technique, selection of appropriate methods, selection of appropriate methods, establishment of the experimental setup, generation and acquisition of data, coding and decoding processes, and ensuring reproducibility of data.	8	10
Unit 3	Statistical analysis and data representation: Standard Deviation (SD), Standard Error (SE), Correlation and Regression, Significance of testing, ANOVA, DMRT, data verification, biological significance of data, impact of small sampling size in data analysis, utility of computer/software (MS office, excel, power point, graphics, sigma plot, SPSS etc.) in data computation and visualization.	8	12
Unit 4	Scientific writings: Forms of scientific writing i.e. research articles, notes, reports, review, monograph, dissertation/thesis, popular article, etc. Components of research article, Writing strategy for a research article. Research ethics and Plagiarism	8	8

Unit 5	Field Techniques: Collection and preservation techniques of specimens (Algae, Fungi, Higher Plants), Instrumentation and safety measures in laboratory and field, sampling methods/strategy, Principle and application of GIS, GPS, Remote sensing Unit	8	12
Unit 6	Basic knowledge on analytical (Principle and application of UV-Vis, IR, FTIR and NMR Spectroscopy), Basic knowledge on separation techniques (Principal and application of Chromatography techniques, Gel filtration, Ion exchange, GC, HPLC), Centrifugation, Microscopy (Principle and application of Phase contrast, DIC, Fluorescence, Confocal, SEM, TEM) and molecular techniques.	7	12
PRACTICAL [Credit: 01]			
	1. A local field visits for collection and preservation of specimens such as algae, fungi, and higher plants. 2. To perform statistical analysis using the software tool like Excel. 3. Calculation of standard deviation (SD), standard error (SE), correlation and regression, and test of significance. 4. Demonstrations on HPLC and gel filtration. 5. Detection of plagiarism using any plagiarism detection tool.	30	40

Suggested Readings:

1. Box GEP, Hunter JS, Hunter WG (2005) Statistics for Experimenters: Design, Innovation, and Discovery. Wiley-Interscience, US.
2. Booth WC, Colomb GG, Williams JM (2016) The Craft of Research. University of Chicago Press, US.
3. Brower JE, Zar JH, von Ende CN (1998) Field and Laboratory Methods for General Ecology. McGraw-Hill, US.
4. Hofmann AH (2019) Scientific Writing and Communication: Papers, Proposals, and Presentations. Oxford University Press, US.
5. Kirkup L (2002) Data Analysis with Excel®: An Introduction for Physical Scientists. Cambridge University Press, UK.
6. Kumar R (2014) Research Methodology: A Step-by-Step Guide for Beginners. Sage Publications, UK.
7. Leech NL, Barrett KC, Morgan GA (2011) SPSS for Intermediate Statistics: Use and Interpretation. Routledge, US.
8. Montgomery DC (2019) Design and Analysis of Experiments. Wiley, United States.

9. Quinn GP, Keough MJ (2002) Experimental Design and Data Analysis for Biologists. Cambridge University Press, UK.
10. Schimel J (2012) Writing Science: How to Write Papers That Get Cited and Proposals That Get Funded. Oxford University Press, US.
11. Skoog DA, Holler FJ, Crouch SR (2017) Principles of Instrumental Analysis. Cengage Learning, US.
12. Upadhyay A, Upadhyay K, Nath N (2014) Biophysical Chemistry: Principles and Techniques. Himalaya Publishing House, India.
13. Wegmann M, Leutner B, Dech S (2016) Remote Sensing and GIS for Ecologists: Using Open Source Software. Pelagic Publishing, UK.
14. Zar JH (2010) Biostatistical Analysis. Pearson, US.

Graduate Attributes

Course Objective:

The course is designed to provide students with a thorough grasp of research methodology, encompassing essential elements such as recognizing research gaps, developing hypotheses, and constructing reproducible experiments. Learners will gain proficiency in statistical analysis and data visualization through software tools including MS Office, SPSS, and SigmaPlot. Besides, they will be trained in scientific writing and ethical practices, alongside field techniques such as specimen collection and adherence to safety measures. Foundational knowledge of analytical methods like spectroscopy and microscopy will also be imparted to strengthen research capabilities.

Course outcomes:

On successful completion of the course, students will be able to:

1. Comprehend essential research concepts, critically evaluate literature to detect gaps, and frame scientific questions by establishing precise hypotheses and objectives within the framework of existing studies.
2. Apply experimental design principles to define research problems, choose sampling methods, construct experimental setups, and guarantee reproducibility through systematic data coding and decoding.
3. Apply statistical methods and use software tools for data analysis and presentation, understanding the impact of sample size on data validity.
4. Create diverse forms of scientific writing, understand research article components, develop writing strategies, and evaluate ethical considerations and plagiarism.
5. Acquire knowledge of collection and preservation methods for diverse specimens (Algae, Fungi, Higher Plants), apply GIS, GPS, and remote sensing, and gain proficiency in analytical techniques and microscopy practices while adhering to safety protocols.

Theory Credit: 03

Practical Credit: 01

No. of Required Classes: 75 (Theory: 45; Practical: 30)

No. of Contact Classes: 75 (Theory: 45; Practical: 30)

No. of Non-Contact Classes: Nil

Particulars of Course Designer (Name, Institution, email id):

BOS, Department of Botany

GOALAPRA COLLEGE, GOALPARA

Four-year Undergraduate Programme
Subject: Botany
Semester: Eighth
Course Name: *Molecular Genetics and Cell Signaling*
SUBJECT CODE: BOT-01-CC-40820
Existing Base Syllabus: UG CBCS Syllabus
Course Level: 400-499, and subsequent level as per NEP structure

THEORY [Total marks: 60] Credit: 03; Total No. of classes: 45			
Unit no	Unit content	No. of classes	Marks
Unit 1	Structure and processing of messenger RNA, transfer RNA, ribosomal RNA, small interfering RNAs and micro RNAs, regulation through RNA processing and decay, alternative splicing	6	8
Unit 2	Transcription, RNA polymerases, initiation, elongation and termination; eukaryotic promoters, enhancers, transcription factors, processing of mRNA for translation. Operon concept in prokaryotes, Mutation and DNA repair	8	12
Unit 3	Molecular techniques in genetics, Electrophoresis, restriction digestion, ligation, DNA probes and hybridization, DNA cloning, Cloning and expression vectors, genomic and cDNA library, PCR amplification, Plant and bacterial transformation, DNA sequencing. Genetic manipulation in plants	10	10
Unit 4	Applications of molecular genetic techniques: Developing transgenic plants, Genome editing in plants using CRISPR/Cas9 system, Gene silencing using RNAi, Gene therapy	7	10
Unit 5	Cell Signaling I: Cell signaling: Hormones and their receptors, cell surface receptor, signaling through G protein coupled receptors, Ion channel linked receptors, Enzyme linked receptors	6	8
Unit 6	Cell signaling II: Signal transduction pathways, second messengers, regulation of signaling pathways, bacterial chemotaxis and quorum sensing.	8	12
PRACTICAL [Credit: 01]			

1. Isolation of genomic DNA from plant materials, purification, estimation, separation with gel electrophoresis and documentation 2. RNA isolation and cDNA synthesis 3. PCR reaction and gel electrophoresis 4. Restriction digestion and mapping 5. Transformation of plasmids in bacteria 6. Plasmid isolation 7. Differential gene expression study using semi quantitative PCR or qPCR	30	40
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Reading list:

1. Cooper GM, Hausman RE (2009) The Cell: A Molecular Approach. 5th edition. ASM Press & Sunderland, Washington, D.C.; Sinauer Associates, MA.
2. Gardner EJ, Simmons MJ, Snustad DP (2015) Principles of Genetics, John Wiley & sons, India. 8th edition.
3. edition
4. Hardin J, Becker G, Skliensmith LJ (2012) Becker's World of the Cell, Pearson Education Inc. U.S.A. 8th Edition.
5. Karp G (2010) Cell Biology, John Wiley & Sons, U.S.A. 6th Edition.
6. Klug WS, Cummings MR, Spencer CA (2012) Concepts of Genetics. Benjamin Cummings, U.S.A. 10th edition.
7. Pierce BA (2016) Genetics-A conceptual approach, W.H. Freeman and Co. USA, Sixth
8. Primerose SB and Twyman RM (2014), Principles of Gene manipulation and genomics. Wiley Blackwell. Seventh Edition.
9. Snustad DP, Simmons MJ (2010) Principles of Genetics, John Wiley & Sons Inc., India. 5th edition.
10. Watson JD, Baker TA, Bell SP, Gann A, Levine M, Losick R (2007) Molecular Biology of the Gene, Pearson Benjamin Cummings, CSHL Press, New York, U.S.A. 6th edition.

Graduate Attributes

Course Objective:

This paper will provide knowledge of molecular genetics, and various techniques available for molecular genetics study. It will also provide in depth understanding of cell signaling and signal transduction pathways.

Course outcomes:

On successful completion of the course, students will be able to:

1. Identify and describe the different types of RNA (mRNA, tRNA, rRNA, siRNAs, miRNAs) and their roles in gene expression and regulation.
2. Explain the mechanisms of transcription, RNA processing, and the operon concept in prokaryotes, including the roles of RNA polymerases, promoters, enhancers, and transcription factors.
3. Apply molecular genetic techniques such as electrophoresis, restriction digestion, ligation, PCR amplification, and DNA cloning to manipulate and analyse genetic material.

4. Analyse the results of genetic manipulation experiments, such as plant and bacterial transformation, gene silencing using RNAi, and genome editing using CRISPR/Cas9, to assess the effectiveness of these techniques.
5. Evaluate the role and impact of various cell signalling pathways, including hormone-receptor interactions and second messenger systems, in regulating cellular processes and responses.

Theory Credit: 03

Practical Credit: 01

No. of Required Classes: 75 (Theory: 45; Practical: 30)

No. of Contact Classes: 75 (Theory: 45; Practical: 30)

No. of Non-Contact Classes: Nil

Particulars of Course Designer (Name, Institution, email id):

BOS, Department of Botany

GOALAPRA COLLEGE, GOALPARA

Four-year Undergraduate Programme
Subject: Botany
Semester: Eighth
Course Name: *Fungal Diversity, Genetics, and Applications*
SUBJECT CODE: BOT-01-CC-40821
Existing Base Syllabus: UG CBCS Syllabus
Course Level: 400-499, and subsequent level as per NEP structure

THEORY [Total marks: 60] Credit: 03; Total No. of classes: 45			
Unit no.	Unit content	No. of classes	Marks
Unit 1	Introduction to fungal diversity; Global fungal diversity and Biogeography; exploration of Cryptic fungi; Methods for estimation of fungal diversity and strategies for conservation	6	10
Unit 2	Diversity of Soil Fungi; Diversity of soil fungi; phytopathogenic fungi; mushroom diversity; endophytic fungi and their functional roles.	6	6
Unit 3	Molecular genetic analysis of fungi; Extra chromosomal and transposable genetic elements in fungi; Cell cycle control points in yeast	9	10
Unit 4	Mating-Type switching in Yeasts; Extra-chromosomal inheritance in fungi; Sex hormones in fungi; Retroposon and retrotransposon in fungi	9	14
Unit 5	Fungal secondary metabolites (Polyketides, Terpenes, and Indole alkaloids); Heat shock protein in filamentous fungi	5	8
Unit 6	Biotechnological application of fungi in food, industries, medicines, and agriculture; Myconanotechnology; Mycoremediation and mycofumigation; Mycoses (Types, diagnosis, and treatments)	10	12
PRACTICAL [Credit: 01]			
1. Isolation and enumeration of soil fungi 2. Study of phytopathogenic fungi from diseased samples 3. Molecular identification of fungal specimen 4. Fungal tissue- culture; cultivation of edible mushroom 5. Isolation and determination of secondary metabolites from fungi		30	40

Reading list:

1. Fungi Nutrition & Physiology. Michael O. Garraway and Robert C. Evans.
2. Introduction to Fungi. John Webster and Roland W. S. Weber
3. Introduction to Mycology. C. J. Alexopoulos, C. W. Mims and M. Blackwell.
4. Physiology of Fungi. Lilian E. Hawker
5. The Mycota; Vol: III: Biochemistry and Molecular Biology. K. Esser and P. A. Lemke.
6. The Mycota; Vol: VII: Systematics and Evolution (Part A). K. Esser and P. A. Lemke.

Graduate Attributes**Course Objective:**

This paper will explain the detailed account on the diversity, genetics, and applications of Fungi.

Course outcomes:

On completion of the course, students will-

1. Demonstrate knowledge of fungal diversity, their worldwide distribution, and the methods used for estimating and conserving fungal diversity.
2. Analyse the ecological roles of various fungi in soil and plants, along with their applications in agriculture and medicine.
3. Apply molecular genetic techniques to analyse fungal genomes, understand the mechanisms of genetic inheritance, and explore the molecular basis of fungal traits and behaviours.
4. Evaluate the significance of genetic elements, such as mating-type switching and retrotransposons, in fungal evolution and adaptation to different environments.
5. Design and propose biotechnological applications of fungi in food production, industrial processes, medicine, and environmental remediation, considering the principles of mycology and practical feasibility.

Theory Credit: 03

Practical Credit: 01

No. of Required Classes: 75 (Theory: 45; Practical: 30)

No. of Contact Classes: 75 (Theory: 45; Practical: 30)

No. of Non-Contact Classes: Nil

Particulars of Course Designer (Name, Institution, email id):

BOS, Department of Botany
GOALPARA COLLEGE, GOALPARA-783101

Four-year Undergraduate Programme
Subject: Botany
Semester: Eighth
Course Name: *Exploring Cryptogams and Gymnosperms*
SUBJECT CODE: BOT-01-CC-40822
Existing Base Syllabus: UG CBCS Syllabus
Course Level: 400-499, and subsequent level as per NEP structure

THEORY [Total marks: 60] Credit: 03; Total No. of classes: 45			
Unit no.	Unit content	No. of classes	Marks
Unit 1	Algae: Recent trends in the classification, pigmentation, phylogeny and interrelationships among different groups, patterns of life cycle and post fertilization stages in Chlorophyta, Xanthophyta, Phaeophyta and Rhodophyta.	6	10
Unit 2	Ecological importance of algae in different habitats, Algal indicators, Algal blooms, Eutrophication, Productivity in fresh water and marine environment, symbiotic association, Algal culture.		
Unit 3	Bryophytes: Origin, evolution, classification, diversity and distribution in North East India, Economic importance. Morphological, anatomical and reproductive diversity, Morphogenesis, Evolution of gametophytes and sporophytes; Bryophytes as pollution indicator and monitoring.	6	10
Unit 4	Pteridophyta: Origin and evolution of Pteridophytes; Telome concept; heterospory and origin of seed habit; classification of vascular cryptogams. Morphological, anatomical and reproductive diversity, soral evolution in ferns.	8	15
Unit 5	Palaeobotany: Geological time scale, fossilization process, techniques in studying fossils.	2	10
Unit 6	Gymnosperms: Classification and salient features of major taxa; characteristics, affinities and relationships of Ginkgoales, Coniferales, Taxales and Gnetales.	8	15
PRACTICAL [Credit: 01]			
1. Study of some important genera of Algae with respect to their morphology, anatomy and reproductive structures. Algal culture technique. 2. Study of some important genera of Bryophytes available in NE India with respect to their morphology, anatomy and reproductive structures.		30	40

3. Study of some important fossil and living members of major groups of Pteridophytes.		
4. Study of morphological, anatomical and reproductive features of gymnosperms available in the region.		

Reading list:

1. Bhatnagar SP, Moitra A (1996) Gymnosperms. New Delhi, Delhi: New Age International (P) Ltd Publishers.
2. Chopra RN and Kumar P K. (1989) Biology of Bryophytes. New York, Wiley.
3. Kumar HD (1999) Introductory Phycology, 2nd edition. Delhi, Delhi: Affiliated East-West. Press Pvt. Ltd.
4. Puri P (1985) Bryophytes. New Delhi, Delhi, Atma Ram and Sons.
5. Parihar NS (1991) An Introduction to Embryophyta. Vol. II. Pteridophytes. Prayagraj: U.P.: Central Book Depot.
6. Singh S. R. (2006). A Text Book of Bryophyta. Campus Book International. New Delhi.
7. Singh V, Pandey PC, Jain DK (2001) A Text Book of Botany. Meerut, UP: Rastogi and Co.
8. Singh V, Pandey PC, Jain DK (2001) A Text Book of Botany. Meerut, UP: Rastogi and Co.
9. Vashishta PC, Sinha AK, Kumar A (2010) Pteridophyta. New Delhi, Delhi: S. Chand & Co Ltd.

Graduate Attributes

Course Objective: This course will provide an understanding on the origin and evolutionary history of Algae, Bryophytes, Pteridophytes, and Gymnosperms. Understand the structural adaptations and reproductive strategies unique to each group with their importance to economic and ecological prospective.

Course outcomes:

On successful completion of the course, students will have:

1. Knowledge on Classification of algae based on recent trends.
2. Evaluate ecological roles and importance of these groups.
3. Analyze the evolutionary history and diversity of Algae, Bryophytes, Pteridophytes and Gymnosperms.
4. Synthesize knowledge of morphology and reproduction to understand evolutionary adaptations in Cryptograms.
5. Interpret the classification and characteristics of gymnosperm taxa to infer evolutionary relationships

Theory Credit: 03

Practical Credit: 01

No. of Required Classes: 75 (Theory: 45; Practical: 30)

No. of Contact Classes: 75 (Theory: 45; Practical: 30)

No. of Non-Contact Classes: Nil

Particulars of Course Designer (Name, Institution, email id):

BOS, Department of Botany

GOALPARA COLLEGE, GOALPARA-783101

Four-year Undergraduate Programme
Subject: Botany
Semester: Eighth
Course Name: *Plant Growth and morphogenesis*
SUBJECT CODE: BOT-01-CC-40823
Existing Base Syllabus: UG CBCS Syllabus
Course Level: 400-499, and subsequent level as per NEP structure

THEORY [Total marks: 60] Credit: 03; Total No. of classes: 45			
Unit no.	Unit content	No. of classes	Marks
Unit 1	Photomorphogenesis: Photochemical and biochemical characteristics of phytochromes, cryptochromes, and phototropins; biosynthesis, cellular distribution, and functional roles of phytochromes; mechanisms underlying the action of photomorphogenetic receptors.	8	12
Unit 2	Plant developments: Plant developments: Biochemical changes during development of seeds; Plant movement: tropic and nastic movements.	6	8
Unit 3	Post-harvest physiology: Ripening of fruit and its regulation, post-harvest management; Fruit and vegetable preservation: chemical and non-chemical preservation techniques, nutritional changes during preservation.	7	8
Unit 4	Plant Growth Regulators: Overview of the discovery, physiological role, and possible mechanisms of action of Triacontanol, Salicylic acid, and Polyamines. A brief account of the role of plant growth retardants CCC, Maleic hydrazide, Triazoles, and TIBA.	8	10
Unit 5	Senescence and Programmed Cell Death (PCD): Biochemical changes associated with leaf and petal senescence, regulation of senescence. Programmed Cell Death: biochemical changes at the cellular level, regulation of PCD, and the involvement of caspases and metacaspases.	8	10
Unit 6	Applied Plant physiology: Foliar nutrition: Conditions, factors affecting efficiency of Foliar nutrition; Advantages, and disadvantages. Chelators and soil conditioners. Phytoremediation: History, Mechanisms and types,	8	12

	Advantages, and disadvantages. Role of tissue culture, and mutants in plant physiological studies.		
	PRACTICAL [Credit: 01]		
1. Study of changes in starch / protein content during seed development.			
2. Study of lipid accumulation during development of oil seeds.			
3. Demonstration of hormonal regulation of leaf and petal senescence.			
4. To study the effect of different PGRs on seedling growth.			
		30	40

Suggested Readings:

1. Bajracharya D (1999) Experiments in Plant Physiology-A Laboratory Manual. Narosa Publishing House, New Delhi.
2. Bhatla SC, Lal MA (2018) Plant Physiology, Development and Metabolism. Springer Nature Singapore Pte Ltd.
3. Devlin RM (2017) Outline of Plant Physiology. Medtech: Scientific International Pvt. Ltd.
4. Devlin RM, Witham FH, Blaydes DF (2017) Devlin's Exercises in Plant Physiology. Medtech: Scientific international Pvt. Ltd.
5. Hopkins WG, Huner A (2008) Introduction to Plant Physiology (4th edition). John Wiley and Sons. U.S.A.
6. Kochhar SL, Gujral SK (2021) Plant Physiology: Theory and Applications (2nd edition). Cambridge University Press.
7. Malik CP, Srivastava (2015) Text Book of Plant Physiology. Kalyani Publishers, New Delhi.
8. Salisbury FB, Ross CW (2004) Plant Physiology (4th edition). Cengage Learning India Pvt. Ltd., New Delhi, India.
9. Taiz L, Zeiger E, MØller IM, Murphy A (2015) Plant Physiology and Development (6th edition). Sinauer Associates Inc. USA.

Graduate Attributes

Course Objective:

This course seeks to develop a comprehensive understanding of plant physiological processes, including photomorphogenesis, plant development, post-harvest physiology, growth regulation, senescence, and applied aspects. It will cover the functions and mechanisms of photoreceptors, biochemical changes during seed development and fruit ripening, preservation methods, and the roles of plant growth regulators and retardants. Students will also examine the regulation of senescence and programmed cell death, while applied topics such as foliar nutrition, chelators, soil conditioners, phytoremediation, and the use of tissue culture and mutants will highlight practical approaches in plant physiology.

Course outcomes:

On successful completion of the course, students will be able to:

1. Apply knowledge of the mechanism of action of photomorphogenesis receptors in plant responses to light.
2. Apply knowledge of tropic and nastic movements in plants and their adaptive roles.
3. Evaluate the advantages and disadvantages of chemical and non-chemical preservation techniques on nutritional changes in fruits and vegetables.
4. Evaluate the advantages and disadvantages of chemical and non-chemical preservation techniques on nutritional changes in fruits and vegetables.

Theory Credit: 03

Practical Credit: 01

No. of Required Classes: 75 (Theory: 45; Practical: 30)

No. of Contact Classes: 75 (Theory: 45; Practical: 30)

No. of Non-Contact Classes: Nil

Particulars of Course Designer (Name, Institution, email id):

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