

Morigaon College (Autonomous)

Morigaon: Assam



SYLLABUS

Botany

FYUGP

(3rd Semester)

List of Courses for B. Sc. Botany (Major)

Semester	Course Title
III	Laboratory and Field Techniques in Plant Science
	Plant Physiology

List of Courses for B. Sc. Botany (Minor)

Semester	Course Name
III	Laboratory and Field Techniques in Plant Science

MORIGAON COLLEGE (AUTONOMOUS)
DEPARTMENT OF BOTANY
SYLLABUS
FYUGP Semester – 3

Course Type: CORE
Course Title: Laboratory and Field techniques in Plant science
Course Code: BOT-CORE-(MJ/MN)-MC-0300104
Total Credit: 04

Course Objectives:

This paper will provide a basic knowledge and understanding about good practices that should be followed in a laboratory, waste management, dealing with hazards and risks to ensure a safe laboratory environment. This course will also enlighten the students about operations and maintenance of laboratory instrument or equipment, measurements, units, calculations, preparation of different solutions, media, and statistical data interpretation.

Course Outcomes:

On successful completion of the course, students will have:

1. Able to learn basic fundamental skills which are important for performing laboratory and field experiments.
2. Able to prepare, analyse data and interpretation of results

Course Contents:

Section A: Theory (Credit: 03)

Unit 1: Laboratory safety and good practices:

Lab safety measures; Handling of chemicals, glass apparatus, instruments; First-aid practices in case of burn, acid spills and injury; Safety symbols, classes and grades of chemicals; Disinfectants; Laboratory waste management: Disposal of hazardous chemicals, radioactive and biological waste.

Unit 2: Handling and maintenance of instruments:

Weighing balance, pH meter (calibration and use), Pipettes and micropipettes, Autoclave, Laminar airflow, Incubator, Centrifuge, Magnetic stirrer, Micrometer, Haemocytometer, Spectrophotometer, Electrophoresis: Agarose Gel and SDS PAGE, Distillation unit.

Unit 3: Measurements and calculations:

Units of measurements and conversion of unit; Measurement of volumes of liquids; Weighing, Calculations: Scientific notations and fractions.

Unit 4: Solutions and Buffers:

Molarity, Molality, Normality, Percentage solution, ppm, ppb, stock solution and standard solution; Dilution; pH, Acids and Bases; Buffers - Phosphate, Tris-HCl and Citrate buffer

Unit 5: Microscopy and Culture Techniques:

Working principles and types of Light and Electron microscopes; Sample preparation for light and electron microscopy

Basic culture media: Nutrient Agar, Nutrient Broth, PDA, MS; Special media: Selective and Differential media; Culture techniques: plating (streak, spread & pour) and serial dilution.

Unit 6: Biostatistics, Computing and field skills

Primary and secondary data, Methods of data collection, Sampling methods - merits and demerits, Tabulation and presentation of data; Descriptive statistics - Mean, Mode, Median, Variance, Standard Deviation, Standard error, Coefficient of Variation

MS Office (Word, PowerPoint, Excel); Introduction to biological databases

Identification, Collection, Preparation and preservation of plant specimens (Herbarium and Museum)

Section B: Practical (Credit: 01)

1. Preparation of solutions- molar, molal, normal, percentage, stock, standard and dilution.
2. Preparation of Buffers (Phosphate/Citrate).
3. Determination of pH of solutions using pH strip and pH meter.
4. Working with instruments: Autoclave, Laminar air flow, Incubator, Hot air oven, Light microscope.
5. Preparation of Nutrient Agar/PDA media for bacterial/fungal culture.
6. Calculation of Mean, Mode, Median and Standard deviation using set of data.
7. Drawing of tables, graphs and to carry out statistical calculation using Microsoft Excel.
8. Preparation of herbarium specimen: collection, processing, mounting and labelling of plant specimen.

Recommended Readings:

- Bisen, P.S. (2014). Laboratory Protocols in Applied Life Sciences, 1st edition. CRC Press
- Danniel, W.W. (1987). Biostatistics. New York, NY: John Wiley Sons.
- Evert, R. F., Eichhorn, S. E., Perry, J.B. (2012). Laboratory Topics in Botany. W.H. Freeman and Company.
- Jones, A.M., Reed, R., Weyers, J. (2016). Practical Skills in Biology, 6th Edition, Pearson
- Mann, S. P. (2016) Introductory Statistics, 9th edition. Hoboken, NJ, John Wiley and Sons Inc.
- Mesh, M.S., Kebede-Westhead, E. (2012). Essential Laboratory Skills for Biosciences. John Wiley & Sons, Ltd.
- Mu, P, Plummer, D. T. (2001). Introduction to practical biochemistry. Tata McGraw-Hill Education.
- Zar, Z. H. (2010). Biostatistical Analysis, 5th edition, Pearson Prentice Hall, New Jersey, USA.

MORIGAON COLLEGE (AUTONOMOUS)
DEPARTMENT OF BOTANY
SYLLABUS
FYUGP Semester – 3

Course Type: CORE
Course Title: Plant Physiology
Course Code: BOT-CORE-(MJ)-MC-0300204
Total Credit: 04

Course Objectives:

This paper will elucidate the crucial role of water in diverse physiological functions of plants. The paper will also highlight the importance of mineral elements in plant physiology and various mechanisms applied to uptake mineral elements by plants. It will provide the basic idea of pathways and mechanisms of translocation of organic solutes synthesised in plant. Furthermore, this paper will explain the role and mechanisms of action of various plant growth regulators as well as physiology of flowering and dormancy of seeds. Additionally, the paper will also focus on the different abiotic and biotic stresses encountered by the plants in their environment as well as various stress mitigation strategies employed by plants to overcome the effects of stress.

Course Outcomes:

On successful completion of the course, students will have:

Knowledge on mechanisms of water, minerals, and nutrient absorption of plants

1. Knowledge on roles of plant hormones and mechanism of flowering in plants
2. Practical knowledge on effects of growth regulators on plant parts
3. Practical knowledge on determination of osmotic and water potential

Course Contents:

Section A: Theory (Credit: 03)

Unit 1: Plant-water relations

Water Potential and its components; Water absorption by roots: aquaporins; Pathway of water movement: symplast, apoplast, transmembrane pathways; Ascent of sap: Mechanisms, cohesion-tension theory, root pressure, guttation; Transpiration: Factors affecting transpiration, anti-transpirants, mechanism of stomatal movement.

Unit 2: Mineral nutrition and nutrient uptake

Criteria for essentiality of mineral elements, macro and micronutrients, nutrient solutions for plant growth experiments, roles of essential elements, mineral deficiency symptoms, chelating agents, Ion antagonism and toxicity. Soil as a nutrient reservoir; Transport of ions across cell membrane: Passive and active absorption, electrochemical gradient, facilitated diffusion, carrier systems, proton ATPase pump and ion flux, uniport, symport, antiport, co-transport.

Unit 3: Translocation of organic solutes:

Phloem as the path of organic solute translocation: Experimental evidences, Mechanisms of solute transport, Pressure-Flow Model and Munch's hypothesis, Phloem loading and unloading, Source - sink relationship.

Unit 4: Plant growth regulators (PGRs)

Discovery, chemical nature (basic structure), bioassay and physiological roles of Auxins, Gibberellins, Cytokinins, Abscissic acid, Ethylene, Brassinosteroids and Jasmonic acid; Synthetic PGRs; Application of PGRs in agriculture and horticulture.

Unit 5: Physiology of flowering and seed dormancy:

Photoperiodism: SDPs and LDPs, flowering 8 12stimulus, florigen concept; Vernalization; Photoreceptors: Phytochrome, cryptochrome and phototropin; Discovery, chemical nature, mechanism of action, role in photomorphogenesis, low energy responses (LER) and high irradiance responses (HIR); Seed dormancy: Significances, causes of dormancy, mechanisms to break dormancy.

Unit 6: Plant stress physiology:

Abiotic and biotic stress: Plants' responses to drought, water logging, salinity, heavy metals, freezing, heat stress and pathogen attack. Oxidative stress: Generation of reactive oxygen species (ROS); Effect of ROS on metabolism; ROS detoxification mechanisms in plants; Stress mitigation strategies (Enzymatic and non-enzymatic).

Section B: 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 (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. To demonstrate water stress by application of PEG/ water withdrawal in germinating seeds /growing plants (Demonstration)
9. Fruit ripening/Rooting from cuttings (Demonstration).

Recommended Readings:

- Bajracharya D (1999) Experiments in Plant Physiology-A Laboratory Manual. Narosa Publishing House, New Delhi.
- Bhatla SC, Lal MA (2018) Plant Physiology, Development and Metabolism. Springer Nature Singapore Pte Ltd.
- Devlin RM (2017) Outline of Plant Physiology. Medtech: Scientific International Pvt. Ltd.
- 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.
- Kochhar SL, Gujral SK (2021) Plant Physiology: Theory and Applications (2nd edition). Cambridge University Press.
- Malik CP, Srivastava (2015) Text Book of Plant Physiology. Kalyani Publishers, New Delhi.
- Salisbury FB, Ross CW (2004) Plant Physiology (4th edition). Cengage Learning India Pvt. Ltd., New Delhi, India.

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FYUGP Semester – 3

Course Type: Skill Enhancement Course
Course Title: Environmental Ethics
Course Code: SEC-BOT-MC-0300103
Total Credit: 03

Course Objectives:

This paper will provide an understanding of environmental ethics and create environmental awareness among students regarding their roles and responsibilities toward nature. It will encourage students to rethink and rectify the lapses in human and nature relationships and promote sustainable environmental practices. The course will also provide insights into the interrelationship between environment and politics, enabling students to understand environmental issues from social, ethical, and policy perspectives.

Course Outcomes:

On successful completion of the course, students will have:

1. Able to understand environmental problems and develop awareness regarding environmental protection through environmental ethics.
2. Able to utilize natural resources in a sustainable manner and apply environmentally responsible practices in daily life.

Course Contents:

Section A: Theory (Credit: 02)

Unit 1: Understanding Environmental Ethics, Concept of environmental ethics, Importance of environmental ethics

Unit 2: Environmental issues, Pollution- various types, sources and control measures

Unit 3: Environment and Politics, Ecologism, Ecofeminism, Sustainable Development

Section B: Project/ Assignment (Credit: 01)

Recommended Readings:

- Attfield. Robin, Environmental Ethics A Very Short Introduction, Oxford, 2019
- Baker. Susan, Sustainable Development, Routledge, New York, 2006
- Basak. Anindita, Environmental Studies, Pearson, 2009
- Carter. Neil, The Politics of the Environment: Ideas, Activism, Policy, Cambridge University Press, New York, 2007
- Heywood. Andrew, Political Ideologies An Introduction, Red Globe, 2022
- Kaushik. Anubha& Kaushik, C.P., Perspectives in Environmental Studies, New Age International Publishers, 2018
- Raju. Parlapalli, Anand. Konkala, Palve. Anil. E. & Kumar. Ashok, Environmental Principles and Ethics, AG Publishing House, 2022
- Shiva. Vandana, Ecofeminism, London, Zed Books, 1984