Detailed curriculum outline of Second Year B.S. Honours Course

Departmental Courses	**Credit hours**
BOT 201: Higher Fungi	2
BOT 202: Gymnosperms, Paleobotany and Economic Botany	2
BOT 203: Anatomy	2
BOT 204: Synecology	2
BOT 205: Cytology	2
BOT 206: Fundamental Plant Physiology	2
BOT 207: Fundamental Genetics	2
BOT 208: Elementary Plant Breeding	2
BOT 209: **Practical-1:** Higher Fungi, Gymnosperm, Paleobotany & Economic Botany, Anatomy, Synecology	2
BOT 210: **Practical-2:** Cytology, Fundamental Plant Physiology, Fundamental Genetics, Elementary Plant Breeding	2
BOT 211: **Viva-Voce**	2
Extra-Departmental Courses (For the Students of Botany)	
BOT 212: Biostatistics	4
SOIL 002: Soil Chemistry and Soil Fertility	4
Extra-Departmental Courses (For the students of Microbiology, Zoology, Geography & Environment, respectively)	
BOT 2001: Genetics and Cytogenetics	4
BOT 2002: Ecology, Environment and Plants	4

BOT. 201: Higher Fungi — **Credit hour**: 2

Introduction

Higher Fungi is one of the basic course in 4-years integrated BS (Hons) in Botany program. The course aims to provide the concept of higher fungi and their importance to under graduate students. General characteristics of higher fungi, their classification, details of three classes of higher fungi *viz.* Asocomycetes, Basidiomycetes and Deuteromycete and life cycle pattern of selected members of aforesaid classes has been included in this course.

Course objectives

(a) Know the differences between lower and higher fungi.
(b) Occurrence and importance of higher fungi.
(c) Habitat, nutrition, vegetative structure and special vegetative structure of higher fungi.
(d) Reproduction of higher fungi.
(e) Life cycle pattern of higher fungi.

Course content

Units	Course content	No. of Lectures
1**: Introduction**	Contribution of different scientists in the field of Mycology, Classification of higher fungi and Importance of Higher fungi to mankind.	**4**

2: Ascomycetes	General characteristics, classification and studies of the following groups: a) Endomycetales- with emphasis on the cell structure and life cycle patterns of the members of Saccharomycetaceae. b) Eurotiales- with emphasis on the imperfect and perfect stages of aspergilli and penicilli and their economic importance. c) Erysiphales - a discussion on the genera causing powdery mildew diseases of crop plants and their separation on the basis of cleistothecial appendages. d) Meliolales - common dark mildew fungi and their effect on host plants. e) Clavicipitales - production of ergot by *Claviceps purpurea* on rye plant and its importance.	8
3: Basidiomycetes	General characteristics, classification and studies on the following groups: a) Ustilaginales - life cycle pattern, discussion on the important smut and bunt fungi and their mode of infecting host plants. b) Uredinales - life cycle patterns, heteroceism and biological specializations found amongst the members of this group. c) Aphyllophorales - moprhological and anatomical details of the basidiocarps of pore fungi and their role as wood-rotting fungi. d) Agaricales - morphological and anatomical details of the basidiocarps of agarics and boleti and their role as ecotrophic mycorrhizae; edible and poisonus mushrooms.	**12**
4: Deuteromycetes	General characteristics, classification and importance as plant pathogens.	6

Unit wise learning outcome

Units	Learning outcomes
1	• contribution of different scientists in the field of mycology • Importance of higher fungi to mankind
2	• comparative study between lower and higher fungi. • classification of higher fungi. • habitat, structure and reproduction of Ascomycetes, • Importance of Ascomycetes
3	• basic features, structures, reproduction, classification and importance of Basidiomycetes.
4	• gateher knowledge salient features of Deuteromycetes • classification of Deuteromycetes • habitat, structure and reproduction of Deuteromycetes. • importance of Deuteromycetes.

References

1. Alexopoulos CJ, CW Mims and M Blackwell 1996. Introductory Mycology. (4th Edn.), John Willy and Sons Inc., NY.
2. Moore-Landecker. 1982. Fundamentals of the fungi. Prentice Hall, Inc., New Jersey, USA.
3. Mundker BB 1967. Fungi and Plant Diseases, MacMillian & Co. Ltd., Calcutta (revised by S.B. Chattapadhay).
4. Webster J 1980. Introduction to Fungi, Cambridge University Press, London, U.K.

Instructional strategies/ Learning experiences

- Lecture followed by group discussion
- Question-answer
- Guided discussion
- Demonstration

Assignment: Students will be given assignment on particular units
Assessment: Final examination, practical and viva-voce

BOT 202: Gymnosperms, Paleobotany and Economic Botany Credit hour: 2

Introduction

This course aimed at highlighting Gymnosperms, Paleobotany and Economic Botany, designed in such a way that after completion the students will be able to understand the gymnosperms, its classification, characteristics and importance. They will be familiar with importance and necessity of studying of fossil, how plant or plant parts become fossils, and the factors responsible for fossilization. In addition, the methods of determining the age of fossil will be deliberated. Plants as source of economic products with special reference to Bangladesh will be discussed focusing on medicinal plants, pulses, species, essential and fatty oil, timber and fibre. Students will be able to be acquainted with medicinal plants which are commonly used in primary health care. Cultivation and processing of tea and rubber will be discussed in detail as well as processing of sugar.

Course objectives

(a) Define and explain the characteristics of gymnosperms and distinguish them from angiosperm. Identify the gymnosperms found in Bangladesh with their precise locality
(b) Know about fossils and their significance in plant systematics and evolution
(c) Learn how plant or plant parts become a fossil and the factors responsible for fossilization
(d) Know various techniques for determination of fossil age and would be able how to analyze the fossil
(e) Learn the medicinal plants, present scenario of medicinal plants in the country, their classification, and uses for treating different ailments
(f) Know the spices and condiments used in our food-stuffs, pulses with their nutritional value, high class timbers, essential and volatile oil with their uses, and different types of fibres including the most important cotton
(g) Learn how to cultivate and process rubber and tea as well as processing of sugar

Course content

Units	Course content	No. of Lectures
1: Gymnosperms	Introduction, general characteristics, differences between Gymnosperms and Angiosperms, Classification of Gymnosperms, diagnostic characters of Cycadofilicales, Bennettitales, Cycadales, Cordaitales, Ginkgoales, Coniferales and Gnetales with examples.	**3**
2:Gymnosperms of Bangladesh	Gymnosperms commonly found in Bangladesh: Distribution and characteristic features of *Cycas* and *Gnetum*, Primitive characters of *Cycas*; Advanced characters of *Gnetum*	**2**
3: Paleobotany	Introduction and scope of Paleobotany; Definition of fossil and living fossil, Different types of fossils, Factors responsible for fossilization.	**3**
4: Processing and analysis of Fossil	Process of fossilization, Analysis of fossils, Examples of fossils from Gymnosperms, Bryophytes and Pteridophytes, Various	**3**

	techniques for determining the age of fossils.	
5:Paleogeological era	Period and epoch mentioning its characteristic flora and events, Implication and importance of fossils.	**2**
6: Economic Botany	General knowledge of plants as source of economic products with special reference to Bangladesh. *Medicinal Plants*: Definition following WHO, Studies on medicinal plants in Bangladesh; Classification of medicinal plants; Scientific names, families, parts used and uses of important medicinal plants of Bangladesh.	**4**
7: Spices, Oil and Pulse	Definition of spices and condiments; classification; scientific names, family names, parts used, uses of common spices of Bangladesh, *Oil*: defination; difference between oil and fat; classification; different types of essential oil and fatty oils with examples and uses., *Pulse*: Common pulses of Bangladesh, Scientific names, family names, characteristics, parts used, chemical composition and uses.	**4**
8: Fibre and Timber	Definition, classification, textile fibre, broom fibre, rough weaving fibre, filling fibre, natural fabrics, paper making fibre, *Timber*: scientific names, family names, parts used, uses of important timber yielding plants of Bangladesh	**4**
9: Tea, Rubber and Sugar	*Tea*: Origin, Cultivation, Processing, *Rubber*: Introduction, para-rubber, characteristics, cultivation, processing, *Sugar*: Cultivation and Processing	**5**

Unit wise learning outcome

Units	Learning outcomes
1	• will be able to identify gymnosperms in nature and capable to differentiate between gymnosperms and angiosperms. They will understand the classification and characteristic features of different orders of the naked seeded plants.
2	• the commonly found gymnosperms will come in light and the precise locality of them to be known; the details characteristic features of *Cycas* and advanced characters of *Gnetum* will shed more light on these groups.
3	• the scope of this important branch will be underlined; in-depth information on fossil, its types and factors affecting fossilization will be learnt by the students.
4	• will learn how plant or plant parts become a fossil and what the techniques by which fossils can be analyzed; they will know the examples of fossils from different groups like gymnosperms, bryophytes and pretidophytes. In addition, how the age of fossils is determined will be perceptible to them.
5	• this unit will disclose different period, epoch and era when different groups of plants appeared and became extinct, how long they lasted for, and what was the climatic condition at that time.
6	• through this Unit the students will be able to define medicinal plants scientifically following WHO, and the scenario of medicinal plants of Bangladesh and their classification. Students will be familiar with important medicinal plants of the country used for treatment of different ailments including diabetes, cancer, cardiac diseases, jaundice, dysentery & diarrhoea, gastritis, cough & cold and other common diseases, and which parts are used for these diseases.
7	• the spices and condiments used in our daily life will be highlighted with their scientific names, parts and other uses. The nutritional composition, i.e. percentage of carbohydrate, protein, water, fat, fibre, etc. along with uses of common pulses of Bangladesh will come in light. Moreover, students will learn differences between oil and fat, different types of essential oil and fatty oils with examples and uses, all of which will be useful in practical life.

8	• fibre, being a very important and indispensable plant product in our daily life, students will know their classification, from where they are obtained and uses in detail. They will also learn the best timber yielding plants of the country and the characteristics of wood of those plants.
9	• the outcome of this Unit includes acquaintance of origin, cultivation and processing of tea; how rubber is cultivated and processed from latex and how it can have positive impact in our life; and what is the cultivation procedure of sugarcane and sugar is processed. Going through this Unit hands-on knowledge will be gained on these very important products which could be applied in practical life.

References

1. Chester R Amold 1977. An Introduction of Paleobotany. Tata McGraw-Hill Pub. House Co., New Delhi.
2. Farooq A Lone, Maqsooda Khan and GM Buth 1993. Palaeoethnobtany, Oxford and IBH Pub. House Co., New Delhi.
3. Hill AF 1951. Economic Botany (Indian reprint 1979), Tata McGraw-Hill Publ. Co., Ltd., New Delhi.
4. Panday SN, SP Misra and PS Trivedi 1997. A Text Book of Botany, Vol. (ii), Vikas Publ. House, New Delhi.
5. Pandey BP 1980. Economic Botany, S. Chand & Company Ltd.
6. Vashishta PC 1990. Gynmnosperms, S. Chand & Co. Ltd., New York.
7. Yusuf M, JU Chowdhury, MN Haque and J Begum 2009. Medicinal Plants of Bangladesh. Bangladesh Council of Scientific and Industrial Research, Chittagong, Bangladesh

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Instruction strategies and Learning experiences

- Lecture followed by group discussion
- Question-answer
- Demonstration

Assignment: Students will be given assignment on particular units

Assessment: In-course examination, final examination, assignment, practical and viva-voce.

BOT 203: Plant Anatomy **Credit hour**: 02

Introduction

A course in BS (Hons) in Botany curriculum which is targeted to give up to date knowledge on plant anatomy and cell biology to the 2nd year students of the 4 year honors course. The course covers detailed discussion on cell types and structures, tissue systems, and anatomical structures of stem, root and wood. The study of aforementioned topics will help students to understand the structures and function of plants from cell level to organism level. Moreover, this course offers basic knowledge on plant anatomy which is necessary of better understanding in 300/400 level courses i.e., physiology, breeding taxonomy, ecology, etc.

Course objectives:

(a) familiarize students with various types of cells
(b) introduce different types of tissues and tissue systems
(c) explain structures and growth in different stem, root and leaf
(d) study internal structures of studied plants
(e) provide necessary theoretical knowledge to develop skills (section and stain of fresh plant material in practical study)
(f) grow interests among students for acquiring advanced knowledge in plant anatomy

Course content

Units	Course content	No. of Lectures
1: Introduction	Different cell types and tissue systems.	**5**
2: Cell wall	Chemical and physical nature and its origin, structure and function.	**3**
3: Meristem	Origin, classification, structure and function. The role of meristem in organization of plant body.	**2**
4: Vascular tissue	Vascular tissue systems and their functions.	**2**
5: Primary structure	Primary structure of monocot and dicot root and stem; dorsiventral and isobilateral leaf.	**3**
6: Secondary growth	Normal and anomalous secondary growth in dicto root and stem.	**3**
7: Root stem transition	Root stem transition	**1**
8: Secretory tissue	Important secretary structures and their characteristics and function	**2**
9: Protective tissue:	Origin, function and structures and development of periderm and related tissue	**2**
10: Mechanical tissue	Types and characteristics	**2**
11: Wood anatomy	Physical and chemical nature of wood. Identifying procedures of transverse, tangential and radial sections.	**3**
12: **Internal Structures of wood**	*Tectona grandis, Artocarpus heteropjylla, Bombax ceiba, Magnolia grandiflora*.	**2**

Unit wise learning outcome

Units	Learning outcomes
1	• Learn basic structures and functions of different types of cells
2	• Understand structural components of plant cell walls and membranes
3	• Describe the mechanism of growth and development in plant organs
4	• Explain mineral and water transportation in different t part of plants
5	• Discuss the difference between monocot and dicot plants in organ level
6	• Outline and describe the process of secondary growth in root and stem
7	• Learn root stem transition process and location
8	• List and categorize the anatomy of internal and external secretory structures
9	• Summarize the formation of protective layers
10	• Explain mechanical balance in plants
11	• Identify and analyze wood structure
12	• Characterization of wood quality
13	• Design, carry out, and present a laboratory study in plant anatomy

References

1. Eames AJ and Macdaniels LH 1947. An introduction to plant anatomy (2nd Edn.), McGraw Hill Book Co., Inc., New York.
2. Esau K 1991. Plant anatomy (Reprint). Wiley Eastern, New York.
3. Fahn A 1968. Plant anatomy., Pergamon Press, Oxford.
4. Pandey BP 1989. Plant anatomy. S Chand and Co. Ltd., New Delhi.
5. Foster AS 1949. Practical anatomy (2nd Edn.) Van Nostrand Co., New York.

Instruction strategies and Learning experiences

- class lecture using black board/white board
- Question answer
- Practical demostration
- Group discussion

Assignment: Students will be given assignment on particular units

Assessment: Incourse examination will be taken after completing the lectures on units 1-3.

BOT 204: Synecology **Credit hour**: 2

Introduction

Ecology is a multidisciplinary synthetic branch of biology that embraces disciplines mainly of taxonomy, physiology, genetics and evolution. Synecology also known as Community ecology is more complex than other branches of ecology. It studies interactions between and among species as well as communities. Understanding the nature, structure and functions of the complex ecological communities and processes is important for sustainable use, conservation and management of the biological resources. The course 'Synecology' focuses on the aspects of adaptation, phytogeography, succession of plant communities, nutrient cycling, ecosystem structure and functions, distribution and diversity of forests and methods for studying vegetation.

Course objectives:

(a) teach students basic knowledge on ecological processes
(b) update knowledge on adaptation, phytogeography, biogeochemical cycles structure and functions of ecosystems
(c) get the students understand the community organization and succession of communities
(d) teach students types and current status of forests in Bangladesh
(e) help the students learn the survey techniques of vegetation and to apply statistical principles on analyzing vegetation data.

Course content

Units	Course content	No. of Lectures
1: Introduction	History, definition, scope and sub-divisions of Ecology; and interactions	**3**
2: Adaptation of hydrophytes, xerophytes and halophytes	Adaptation ecological features with examples, resource allocation, classification of life history patterns, r- and K-selection.	**3**
3: Plant succession	Types and causes of succession, hydrosere and xerosere, models of succession.	**3**
4: Methods of studying vegetation	Study of communities, life form classes and biological spectrum, community dynamics, classification of community, plant demography and population structure.	**4**
5: Ecosystem	Concept of the ecosystem, structure and components of eecosystems, dynamics of ecosystem with reference to energy flow, food chain, and food web, Antarctic food chain, soil food web (top down and bottom up regulation), causes of biodiversity, linkage between biodiversity and ecosystem function.	**5**
6: Forest ecology	Brief introduction to the forests of Bangladesh, description of Sundarban mangrove and deciduous forests of Bangladesh; dominant plants.	**2**

7: Biogeochemical cycles	Types of biogeochemical cycle, water cycle, gaseous (carbon cycle), sedimentary (phosphorus) cycle, dynamics of nutrient cycling and interactions of biogeochemical cycles.	**3**
8: Phytogeography	Brief account of phytogeographical regions of the world and Indian Sub-continent, interactions among floristic plant geography, taxonomy and geology; ecological plant geography.	**2**
9: Random sampling	Definition and types, tests of comparison, application of quadrat measures.	**3**
10: Land classification	Classification of land by climate, vegetation and land use.	**2**

Unit wise learning outcome

Units	Learning outcomes
1	• basic idea about the discipline of Ecology
2	• provide broad knowledge about the adaptation mechanisms of plants
3	• gaining knowledge about the ecological succession of plants
4	• learn about the techniques of vegetation survey as well as gain knowledge about the plant community structure
5	• learn about the structure and function of the ecosystem and gain knowledge about the underlying factors of global biodiversity
6	• learn about the ecological conditions of the forests of Bangladesh
7	• enhanced knowledge about the nature and functions of the nutrient cycles on Earth and their ecological implications
8	• gain idea about the distribution of the vegetation and the factors that regulate them
9	• learn how to do statistical analyses for vegetation
10	• gather knowledge about the global distribution of land and plant resources across the global.

References

1. Brbour MC, Burk JH, Pitts Wd, Gilliam FS and Schwartz MW 1999. Terrestrial plant ecology. Longman.
2. Daubenmire R 1978. Plant geography. Academic Press. London.
3. Greig-Smith A 1964. Quantitative plant ecology. Blackwell Scientific Publications.
4. Muller Dombis D and Ellenberg H 1974. Aims and methods of vegetation ecology. JohnWilley and Sons.
5. Shimwell DN 1971. Description and classification of vegetation. Sidgwick & Jackson. London.
6. Smith RL 1996. Ecology and field biology. Haper Collins, College Publ.
7. Weaver JE and Clements FE 1978. Plant ecology. McGraw-Hill Book. N.Y.
8. Wardle DA 2002. Communities and ecosystem: Linking the above and below ground components. Princeton University Press, Princeton and Oxford.

Instruction strategies and Learning experiences

- Lecture followed by group discussion
- Question answer
- Guided discussion
- Project discussion
- Demonstration

Assignment: Students will be given assignment on particular units

Assessment: In-course examination will be taken after completing the lectures on units 1-5.

Local excursions to study wetland and dry land habitat species; sun and shade habitat species.

BOT 205: Cytology **Credit hour**: 2

Introduction

This is a basic course in 4 -years integrated BS (Hons) in Botany program. It will be very helpful to the students for developing clear knowledge about the origin, structure, chemical composition and functions of different types of cell and cellular organelle. In addition the students will get detail information regarding cell cycle and cell division.

Course objectives

(a) Define and explain cell, Cell concept, Cell cycle, amitosis, mitosis, meiosis and their biological significance,
(b) Get clear idea about the origin, structure, chemical composition and functions of different types of cell and cellular organelles
(c) Explain the nature of different special types of chromosomes

Course content

Units	Course content	No. of Lectures
1: Introduction to Cytology	Introduction, cell, cell concept and primitive cell.	**1**
2: History	A brief history of cytology, PPLO-Discovery	**1**
3: Prokaryotic cell	Characteristics, physical and chemical structure, life cycle and importance.	**1**
4: Eukaryotic cell	Ultrastructure of a generalized plant and animal cell. Differences between: (i) prokaryotic and eukaryotic cells, (ii) plant and animal cells.	**1**
5: Cell wall	Kinds, ultrastructure, chemical composition and function.	**2**
6: Cell membrane	Origin, structure (fluid mosaic model), specialized structure, chemical structure and function.	**2**
7: Mitochondria	Discovery, distribution, morphology, ultrastructure, chemical composition and function.	**2**
8: Chloroplasts	Classification, chloroplast- discovery, distribution, morphology (shape, size, number), ultrastructure, chemical composition, quantosome concept and function.	**2**
9: Ribosome	Discovery, distribution, ultrastructure, kinds based on S-value, chemical composition, biogenesis and function.	**1**
10: Endoplasmic reticulum:	Discovery, origin, distribution, kinds, ultra structure, chemical composition and function.	**1**
11: Golgi complex	Discovery, origin, occurrence, distribution, ultra structure, chemical composition and function.	**1**
12: Lysosome	Discovery, origin, occurrence, kinds, ultrastructure, chemical composition and function.	**1**
13: Cytotubules	Discovery, distribution and function.	**1**
14: Nucleus	Discovery, morphology, nucleo-cytoplasmic index, ultra structure: nuclear membrane, nuclear pore, nuclear bleb, nucleoplasm, chromatin net, chromocenters, chromosomes and nucleolus.	**2**
15 : Nucleolus	Discovery, distribution, number, origin, ultrastructure, chemical composition and functions.	**1**
16: Cell	Cell cycle, amitosis, mitosis, meiosis and their biological	**5**

division	significance.	
17:Special type of chromosomes	(a) **Polytene chromosomes**: Discovery, occurrence, origin, ultra structure, chemical composition and function. (b) **Lamp brush chromosomes**: Discovery, occurrence, origin, ultrastructure, chemical composition, functions, differences and similarities between polytene and lampbrush chromosomes. (c) **B-chromosomes**: Discovery, occurrence, origin, number, features, morphology and function. (5)	**5**

Unit wise learning outcome

Units	Learning outcomes
1	• will get clear idea about cell, cell concept and primitive cell.
2	• will gather knowledge about brief history of cytology.
3	• will learn about chemical and physical structure of prokaryotic cell, life cycle and importance of prokaryotic cell.
4	• will obtain clear knowledge about ultrastructure of a generalized plant and animal cell, able to differentiate eukaryotic and prokaryotic cells.
5	• will get idea about ultrastructure of cell wall, chemical composition and function.
6	• will able to describe fluid mosaic model, origin, structure and function of cell membrane.
7	• will obtain brief idea about ultrastructure, morphology, chemical composition and function of mitochondria.
8	• will able to classify plastid and describe the distribution, morphology, chemical and physical structure of plastids.
9	• will get clear knowledge about structure and function of ribosome and able to classify ribosomes based on S-value.
10	• will obtain brief idea about discovery, origin, occurrence, distribution and function of endoplasmic reticulum.
11	• will obtain knowledge about discovery, origin, occurrence, distribution and function of golgi complex.
12	• Get clear knowledge about origin, distribution, structure and function of lysosome and able to classify lysosome.
13	• Learn about the ultrastructure and function of cytotubules and also know how it is distributed throughout the cell.
14	• gather brief knowledge about the discovery, morphology, ultrastructure and function of nucleus and also get clear idea about all the parts of nucleus.
15	• will obtain knowledge about discovery, origin, occurrence, distribution and function of nucleolus.
16	• will gather a brief and clear knowledge about all kinds of cell divisions.
17	• will learn about different special types of chromosomes. They also get clear knowledge about the distribution, origin, feature, morphology and biological significance of these special types of chromosomes.

References

1. Aktaruzzaman M 1997. Koshbidya (Cytology). Hassan Book House, Dhaka.
2. Sumner AT 2003. Chromosomes - organization and function. Blackwell Publication, UK.
3. Swanson CP 1965. Cytology, MacMillan Co. Ltd., London.
4. Wilson GB and JH Morrison 1967. Cytology (2nd ed.), Reinhold Publishing Corporation, NY.
5. Verma PS and VK Agarwal 1999. Cytology (8th ed.), S. Chand and Co. Ltd., New Delhi.
6. Taylor DJ, NPO Green and GW Stout 2004. Biological Science (3rd edition), Cambridge University Press, Cambridge, UK.

Instruction strategies and Learning experiences

- Lecture followed by group discussion
- Question answer
- Guided discussion
- Project discussion
- Demonstration

Assignment: Students will be given assignment on particular units

Assessment: In-course examination will be taken after completing the lectures on units 1-8.

BOT 206: Fundamental Plant Physiology **Credit hour**: 2

Introduction

This is a basic course in 4 –years integrated BS (Hons) in Botany program. It is structured in a way that the students develop clear understanding of plant physiology with special reference to the concept of water relations in plants, water absorption and translocation in plants, transpiration, photosynthesis and respiration. Students also understand about photoperiodism, vernalizaiton, physiology of seed, the reasons for seed dormancy and ways to overcome it through various artificial methods.

Course objectives

(a) Explain principles governing water movement into and inside of plants and finally how excess water evaporates from plants
(b) Describe how green plants trap sun light and convert it into chemical energy to manufacture their own food
(c) Distinguish how lower and higher groups of plants obtains energy in the form of ATP through respiration
(d) Correlate the connection of external factors viz. relative day and night length,low temperature with the flowering of plants.
(e) Tell different changes accompanying seed germination.
(f) Justify the reasons for seed dormancy and also be able to solve the problem

Course content

Units	Course content	No. of Lectures
1: Water relations in plants	Water properties, principles of water movement in plants, water potential in the soil, soil-plant-atmosphere continuum, movement of the xylem sap and Ψp, plasmolysis, imbibition, colloids.	**4**
2: Absorption and translocation of water	Mechanism of active and passive absorption, external factors affecting absorption of water, relative importance of active and passive absorption Translocation of water, path and mechanism of translocation of water, different theories with special emphasis on transpiration pull and cohesion of water theory.	**4**
3: Transpiration	Types of transpiration, mechanism of opening and closing of stomata, significance of transpiration.	**2**
4: Photosynthesis	Light reaction, action of light, photophosphorylation, Dark reaction or chemical reaction, assimilation of CO_2, Calvin cycle, Factors affecting photosynthesis.	**4**
5: Respiration	Introduction, aerobic respiration, glycolysis, pyruvate to acetyl CoA formation, TCA cycle, electron transport system, respiratory quotient Anaerobic respiration-fermentation with special reference to alcohol and lactic acid fermentation.	**4**
6: Photoperiodism	Brief history, classification, photoperiodic induction, importance of dark period, perception of photoperiodic stimulus, transmission	**3**

	of stimulus, presence of floral hormone, components of floral stimulus, role of phytochrome in flowering.	
7: Vernalization	Brief history, vernalization and flowering, site of perception of vernalization, devarnalization, mechanism of vernalization-phasic development theory and hormonal theories, gibberelline and the flowering response.	**3**
8: Physiology of seed	Seed structure and development, viability of seeds, germination process and types of germination, conditions necessary for germination, Physiological, biochemical and other changes accompanying seed germination.	**3**
9: Dormancy of seed	Causes of seed dormancy, methods of breaking seed dormancy, advantage of dormancy of seed, secondary dormancy of seeds.	**3**

Unit wise learning outcome

Units	Learning outcomes
1	• explain the mechanisms of xylem and phloem sap movements in plants and some life related phenomena.
2	• describe how water is absorbed from soil by root and then is translocated to the top of the plant.
3	• tell how plant releases its excess water.
4	• Interpret how green plants trap sunlight and manufacture their own food.
5	• describe how plants obtain their energy.
6	• elucidate the day's and night's influence on flowering of plants.
7	• explain the role of low temperature in plant's flowering.
8	• tell different changes accompanying seed germination.
9	• gain knowledge to identify different reasons for seed dormancy and also take steps to break the dormancy.

References

1. Salisbury FB and C Ross 1995. Plant Physiology, (4th Edn.) CBS, New Delhi.
2. Devlin RM and FH Witham 1986. Plant Physiology (4th Edn.), CBS Publishers and Distributors, New Delhi.
3. Hess D 1975. Plant Physiology, Springer International Student Edition.
4. Jain VK 2007. Fundamentals of Plant Physiology, S. Chand and Company Ltd., New Delhi.
5. Jain JL 1983. Fundamentals of Biochemistry, S. Chand and Company Ltd., New Delhi.

Instruction strategies and Learning experiences

- Lecture followed by group discussion
- Question answer
- Guided discussion
- Project discussion
- Demonstration

Assignment: Students will be given assignment on particular units

Assessment: Incourse examination will be taken after completing the lectures on units 1-3.

BOT 207: Fundamental Genetics **Credit hour**: 2

Introduction

Genetics is an area of science that is advancing perhaps more rapidly than any other, with each advancement offering us a fresh insight into biological sceince. It is a relatively young science but one that has had an immeasurable effect upon biological study. The potential of genetic research in many areas of life, from plant to animal, is overwhelming. Covering all the fundamental facets of genetics, including the biological construction of genes and how they work, how dominant and recessive genes influence the inheritance of particular inherited traits, and the importance of chromosomes, this course will provide you with an introduction to the scientific subject that has taught us the most about the origins of life.This course provides an ideal stepping stone to understand the principles of genetics with application to the study of biological function at the level of molecules, cells, and multicellular organisms, including plants and humans. The topics include: basic terms, principles, and research methods used in the study of genetics, Mendelian inheritance to exceptions, biological variation resulting from recombination, mutation, and selection, population genetics, use of genetic methods for sex determination. Students will discover the principles of heredity from its basic principles to the most recent advances in the field and learn how they can map genes, analyse the linkage and understand their function.

Course objectives

(a) Understand the principles and concepts of Genetics.
(b) Apply the principles of inheritance as formulated by Mendel.
(c) Apply the principles of extensions to Mendelian inheritance, including multiple allelism, lethal alleles, gene interactions, and sex-linked transmission.
(d) Understand how Mendelian genetics can be improvised in plant breeding research.
(e) Analyze genetic data using statistical procedures.
(f) Deduce the relationship between genetic, physical, and cytogenetic maps.
(g) Understand the nuclear and cytoplasmic inheritance pattern.
(h) Apply the Hardy-Weinberg Law in analyzing population genetics for gene frequency, sex linkage, equilibrium, and heterozygote frequency

Course content

Units	Course content	No. of Lectures
1: Mendelian inheritence	(a) Historical background of Genetics (b) Life of Gregor Johann Mendel, his experiments and achievements; reasons of Mendels success (c) Monohybrid, dihybrid and trihybrid inheritence, (d) back cross and test cross, (e) Probability in Mendelian inheritance, Chi-square test.	**2**
2: Exceptions of Mendelism	a)1st law-(i) Incomplete dominance,(ii) Co-dominance, (iii) Lethal gene, (b) 2nd Law-(i) Single recessive epistasis (9:3:4), (ii) Duplicate recessive epistasis (9:7), (iii) Single dominant epistasis-cumulative effect of duplicate genes (9:6:1), (iv) Duplicate gene-one incomplete dominance (12:3:1), (v) Pleiotropism.	**4**
3: Multiple allele and pseudoallele	(i) Definition, characteristics, and examples: ABO blood type alleles and Rh factor alleles in humans, self –incompatibility alleles in plants, eye-colour in *Drosophila* and coat colour in rabbit, (ii) Significance of multiple alleles.	**2**
4:Linkage and recombination	(a) Discovery of Linkage: autosomal and sex, (b) Linkage maps and Linkage detection, genetic interference and coincidence.	**4**
5: Gene and environment	(a) Effect of environmental factors on the genotype and phenotype of organisms, (b) Phenocopy.	**2**
6: Sex determination	(a) Different methods with examples- (i) XX-XO type,(ii) XX-XY type, (iii) ZZ-ZW type, (iv) X-Y type, (b) Balance concept of	**4**

	sex determination in *Drosophila* (c) Y chromosome and sex determination in mammals, (d) Sex-limited, sex-linked and sex-influenced traits.	
7: Quantitative inheritance	Qualitative versus quantative traits; multiple factor hypothesis; kernel colour in wheat, skin colour in human, corolla length in *Nicotiana longiflora*; polygenic inheritence and continuous variation.	**3**
8 Cytoplasmic inheritence	Nuclear versus cytoplasmic inheritence; (a) Extranuclear inheritence in eukaryotes, maternal effects (b) Extranuclear inheritence by cytoplasmic organelles; chloroplast and mitochondria, plastid inheritence- variegation in plants, inheritence in *Mirabilis jalapa*, iojop inheritence in corn.	**2**
9 Genetic constitution of a population	Gene pool and gene frequencies, equilibrium of gene frequencies and Hardy-Weinberg law; Changes in gene frequencies under mutation, migration, selection and genetic drift.	**3**
Review	Review of course contents and discussion on problem set assignment.	**2**

Unit wise learning outcome

Units	Learning outcomes
1	• explain Mendel's Principles of Segregation and Independent Assortment • describe the chromosomal basis of inheritance • evaluate the validity of research results by Probability analysis
2	• describe non-Mendelian inheritance • explain the influence of dominant and recessive genes in the inheritance of particular inherited traits
3	• understand the term multiple alleles and pseudo alleles. • explain the role of multiple and pseudo alleles behind Human blood typing, self-incompatibilty in plants etc.
4	• explain the effect of crossing-over on the inheritance of genes in linkage groups • construction of the genetic map of genes on chromosomes. • detect linkage and determine the genetic distance and interferences
5	• explain how the environmental factors regulate genotype and phenotype of the organism • understand genomic imprinting and genotype-environment interaction. • explain the Broad-Sense Heritability equation.
6	• distinguish between sex chromosomes and autosomes. • explain the role of sex chromosomes in sex determination. • describe how an X or Y-linked gene affects the inheritance of traits.
7	• understand the inheritance of polygenic traits and how it is influenced by multiple genetic factors and environmental factors • know what a quantitative vs. a categorical trait is • explain Multiple factor hypothesis • explain of genetic factors affect Quantitative traits (Additive gene action, dominant gene action and Epistatic gene action).
8	• understand the cytoplasmic inheritance and how it differs from nuclear inheritance • know the structure and endosymbiotic origin of mitochondria and chloroplasts • understand the various patterns of inheritance associated with extra nuclear genomes • understand the process of epigenetic inheritance • understand how maternal effect influences the phenotype of the offspring and the molecular basis of this pattern of inheritance.
9	• define the terms population, species, allelic and genotypic frequencies, gene pool, and fixed allele, genetic drift, bottle-neck effect, founder effect

	• what is the Hardy-Weinberg Equilibrium and what are its conditions • use the Hardy-Weinberg principle to explain when microevolution occurs • explain how mutations, gene flow, nonrandom mating, genetic drift, and natural selection contribute to the process of microevolution • calculate genotypic and allelic frequencies from a given population • name different kinds of natural selection, and with example discuss the effect of each on a population.

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Instruction strategies and Learning experiences

- Lectures with harmonized power point presentation on the Unit followed by interactive question-answer
- Group discussion
- Problem set assignments on each Unit

Assignment: Students will be given assignment on particular units

Assessment: Incourse examination will be taken after completing the lectures on units 1-4.

BOT 208: Elementary Plant Breeding **Credit hour**: 2

Introduction

This is a basic course in 4 years BS (Hons) in Botany, structured in a way that after completion the students will be able to understand the concept and activities of plant breeding, its nature and relation with other branches of sciences, the necessity of studying the reproductive biology of crop plants. The methods of crop improvement will be discussed with detailed field techniques, their merits and limitations following the procedure of releasing improved variety from laboratory to the farmer. Finally, the concepts of origin of cultivated crops will also be discussed.

Course objectives

(a) Define and explain the concept, activities and nature of plant breeding
(b) Know the relation of plant breeding with other branches of sciences
(c) Learn the field techniques various methods of crop improvement
(d) Learn the necessity of following plant quarantine rules.
(e) Know the process of release of improve variety from lab to Farmer
(f) Know the origin of cultivated crops

Course content

Units	Course content	No. of Lectures
1	Definition, activities, nature, aims and objectives of plant breeding Relation with other branches of biology, e.g. genetics, cytogenetics, plant physiology,	**6**

	plant pathology, entomology, microbiology, taxonomy, biometry, etc.	
2	a) Reproductive biology in crop plants: methods and mode of reproduction, fertility and incompatibility relationship. Different methods of crop improvement. Selection, Hybridization, Plant Introduction and Acclimatization, Mutation breeding, Plant Biotechnology brief discussion, In-course examination.	**6**
3	b) Selection methods in self- and cross-pollinated crops and clonal selection in vegetatively propagated plants. Hybridization: Historical backgrounds, hybridization with related and distantly related crops, back-cross breeding. Plant introduction and acclimatization of economically important crops. Mutation breeding: History, spontaneous vs induced mutations, effects of mutation on survival, mutagens, mechanism of action mutagens, procedure of mutation breeding, application and limitations of mutation breeding.	**14**
4	Release of an improved variety from laboratory to the farmers. Concepts of centre of origin of cultivated crops.	4

Unit wise learning outcome

Units	Learning outcomes
1	• know the definition, activities and nature of plant breeding. • learn the aims & objectives of plant breeding. • know the relationship of other branches of sciences with plant breeding
2	• learn the crops plants breeding system in relation to plant breeding activities. • briefly know the different methods of crop improvement with their merits and demerits.
3	• learn about the detailed methodologies of field techniques of the following crops improvement methods. Selection, Hybridization, Plant introduction & acclimatization and Mutation breeding.
4	• know the procedure of release of an improved variety developed in the laboratory. • know the different centers of origin of cultivated crops.

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Instruction strategies and Learning experiences

- Lecture followed by group discussion
- Question answer
- Demonstration

Assignment: Students will be given assignment on particular units

Assessment: Incourse examination will be taken after completing the lectures on units 1-2.

BOT 209: Practical -1 **Credit hour**: 2

A. Higher Fungi B. Gymnosperm Paleobotany and Economic Botany
C. Anatomy D. Synecology

A. Higher Fungi

Units	Title	Learning outcomes
1	Laboratory studies of the locally available members of fungi covered in theory: *Aspergillus niger, Penicilium* sp., *Oidium* sp., *Cercospora* sp., *Alternaria* sp. *Curvularia* sp., *Colletotrichum* sp., *Macrophomina phaseolina, Botryodiplodia theobromae, Sclerotium rolfsii, Agaricus* sp., *Pleuretus* sp., *Ganoderma* sp., *Polyporus* sp., *Ustilago tritici, Ustilago hordei*. Rust fungi.	• Know the structure of different fungi covered in theory. Study the selected fungi in nature.
2	Techniques of growing fungi on culture media	• Isolation of fungal organisms from diseased plant parts following blotter and tissue planting methods.

B. Gymnosperm, Paleobotany and Economic Botany

Units	Title	Learning outcomes
1	Morphology and anatomy of *Cycas* and *Pinus* leaflet	• Learn the external and internal morphology of gymnosperms, particularly *Cycas* and *Pinus* leaf and understand the anatomical xerophytic characters of these plants.
2	Identification of fossils	• Students will be able to identify different types of fossils.
3	Identification of medicinal plants in the field	• Students will be able to identify the important medicinal plants in the field in and around Dhaka University compound.
4	Studies on economically important plants and plant products including their commercial names, scientific names, family names, parts used and uses	• Understand the economically important plants and plant products, their commercial names, parts used and different uses of those plants.

C. Anatomy

Units	Title	Learning outcomes
1	Maceration technique and study of different cell types.	Variable characteristics features of main different types of plant cells e.g. parenchyma, collenchyma, sclerenchyma, simple and complex types of cells will be studied using differential staining and light microscopy.
2	Primary growth: Transverse section of dicot and monocot stem.	Organization of different types of cells and tissue within stem of both dicot and monocot plants through transverse section will make students familiar with the primary structure during development.
3	Anatomy of leaf: Transverse	Students will be acquainted with different tissue types and

	section of dorsiventral and isobilateral leaf.	their arrangement in the most important organ of plant i.e. leaf from both dicot and monocot species.
4	Secondary growth: Jute, *Boerhaavia* and *Dracaena* stem.	With different types of plant specimen students will acquire knowledge on how structurally plants are designed for their secondary growth to gain thickness.
5	Wood anatomy: Transverse, radial and tangential sections of *Tectona*, *Artocarpus*, *Bombax* and *Magnolia*.	Cellular structure and composition of different kinds of wood will give insight about their developmental characteristics as well as economic value.

D. Synecology

Units	Title	Learning outcomes
1	Students will maintain a field note book to study vegetation types and habitats of the University campus and from local excursion	• Understand natural vegetation as well as the components and functions of the ecosystems
2	Morphological and anatomical studies of hydrophytes and xerophytes	• Learn how to study adaptation of plant
3	Study of common hydrophytes and xerophytes of Bangladesh	• Know the plants of terrestrial and aquatic habitats
4	Determination of Dissolved Oxygen (DO) in aquatic habitat	• Know how to determine environmental pollution (e.g. water quality etc.)
5	Vegetation survey: Determine the frequency, density and abundance of the different species of the plant community by quadrat method	• Understand how to analyze/ survey vegetation
6	Application of computer software in community analysis	• Learn application of computer software for multivariate analysis of biotic community
7	Local excursions to study wetland and dry land habitat species; sun and shade habitat species	• Know the vegetation of different habitats and how to collect and preserve plant specimens

BOT 210: Practical -2 **Credit hour**: 2

E. Cytology B. Fundamental Plant Physiology G. Fundamental Genetics H. Elementary Plant Breeding

E. Cytology

Units	Title	Learning outcomes
1	Study and handling of simple and compound microscopes.	• This unit will help the students to develop expertise in using simple and compound microscopes to study microscope slides containing course-relevant materials.
2	Preparation of cytological stains such as acetocarmine and aceto-orcein.	• After attentive response of this unit, students will be able to prepare some stains that frequently used in cytological studies.
3	Study of cell types such as leaf epidermal	• This unit will enable the students to

	cells, root cells, pollen mother cells, pollen grain, stamenal hair, bast- fibre (phloem fibre) cells.	understand and identify several types of cell.
4	Preparation of temporary slide to study mitosis in onion root tip cells by aceto-orecin squash method.	• This unit will help the students to learn basic techniques of temporary slide preparation with different stages of mitotic cell division.
5	Study of permanent slides and photomicrographs of mitotic cell division.	• Upon successful completion of this unit, students will be able to identify different stages of mitotic cell division with the help of photographs and permanent slides.

F. Fundamental Plant Physiology

Units	Title	Learning outcomes
1	Chlorophyll is essential for photosynthesis	• Develop skill to demonstrate chlorophyll's essentialiality for photosynthesis
2	Evolution of oxygen during photosynthesis	• Demonstrate evolution of oxygen during photosynthesis
3	Demonstration of Osmosis with potatosmoscope	• Demonstrate osmosis in living plants
4	Demonstration of the stomatal transpiration by four leaves method	• Demonstrate stomatal transpiration in leaves
5	Evolution of heat during respiration	• Use Dewar flask to show heat evolution during respiration
6	Separation of leaf pigments by paper chromatography	• Show skill to use the qualitative and quantitative analytical methods to separate and determine leaf pigments

G. Fundamental Genetics

Units	Title	Learning outcomes
1	Solving the problems related to Mendelian inheritance	• Explain the inheritance pattern of traits where two or more than two alleles for the trait exist.
2	Verification of various monohybrid and dihybrid ratios by Chi-square and goodness of fit tests.	• Understand the segregation pattern of monohybrid and dihybrid ratios by Chi-square and verify it by goodness of fit tests.
3	Problems related to various types of alleles, gene interactions, linkage and crossing over.	• Explain the effect of crossing-over on the inheritance of genes in linkage groups.
4	Studies on the quantitative variations in available plant materials and segregating populations	• Perform statistical analysis of population genetic data, summarise and interpret the outcomes in written and oral form
5	Estimation of alleic and gene frequencies using data obtained from various populations.	• Calculate the genetic variability parameters including alleic and gene frequencies from various population.

H. Elementary Plant Breeding

Units	Title	Learning outcomes
1	Test of pollen grain fertility	• Students will learn how to test pollen grain fertility using nuclear stains

2	Study of floral biology in different plant species	• Know the reproductive biology of the selected crops plants, namely, flower structure including position and number of anthers, their morphology, anthesis time, etc.
3	Hybridization techniques in available economically important plants	• Students will learn how to select parents for hybridization including selfing of parents, hand emasculation tagging, bagging, pollination and proper record keeping.
4	Test of seed germination in clay pots and in the field conditions	• Students will know how to prepare pots and fields for sowing seeds and record the rate of seed germination.
5	Collection and preservation of germplasm of different crops	• Students will know the techniques of collection and preservation of different economically important germplasm of agricultural importance
6	Multiple alignments of selected sequences	• Able to identify conserve regions of DNA or protein sequences. They can also design degenerate primers from multiple alignment of peptide sequences and finding phylogenetic relationship.

BOT. 211: Viva-Voce **Credit hour: 02**

Extra Departmental Courses

BOT. 212: Biostatistics Credit hour: 04

(For the Students of Department of Botany)

Introduction

Biostatistics is the branch of statistics concerned with mathematical facts and data related to biological events. Moreover, biostatistics is the application of statistics to a wide range of topics covering almost all branches of biology. Biostatistical modeling forms an important part of numerous modern biological theories. Since its beginning the science of genetics used statistical concepts to understand observed experimental results. Using the tools of statistics, biostatisticians help answer pressing research questions in various branches of biology. This course is designed to provide the students the knowledge, skill and understanding on the collection, summarization, analysis and interpretation of results and findings from scientific investigations

Course objectives

(a) To understand the basic principles and concepts of biostatistics.
(b) To enhance students' learning capacity on data collection, data summarization and analysis to obtain desired output.
(c) To make students familiar with various statistical tools and techniques for performing various statistical investigations in solving various problems.
(d) To make students familiar in developing statistical hypothesis for various specific investigations.
(e) To introduce the students to process and techniques in identifying areas of experimentation and investigations.

Course contents

Units	Course content	No. of Lectures
1: Definition and scope of biostatistics	Variables, random variables, discrete and continuous variables, population, samples, random samples, statistic and parameter.	**02**
2: Organization and presentation of data	Qualitative and quantitative data, frequency distribution. Tabulation and graphical presentation, histogram, frequency polygon, bar diagram, pie chart, scatter diagram .	**03**
3: Types of distributions	Symmetrical and asymmetrical distributions, skewness and kurtosis	**02**
4: Measures of central value and dispersion	Mean, mode, median; measures of dispersion, range, mean deviation, variance, standard deviation, standard error, coefficient of variation, confidence limit.	**04**
5: Probability	Concept of probability, some elementary probability, probability rules. Probability distributions: normal, binomial and poisson distributions and their applications .	**02**
6 : Test of significance	Hypothesis testing, null hypothesis, alternative hypothesis, level of significance.	**01**
7: Comparison of two means	Student's t-test, unpaired and paired t-test, t-test for large and small samples.	**03**
8 : Chi-square test	Goodness of fit test, test of independence, test of homogeneity, association of attributes, 2 x 2 contingency table .	**03**
9:Interrelationships of quantitative variables	Correlation, correlation coefficient; linear regression: regression coefficient, regression equation	**03**
10: Analysis of variance:	One way and two way classifications of variance, comparison of three or more samples, F-test, significance test for F.	**03**
11: Experimental design	Concepts of experimental design, experiment, experimental unit, treatment, principles of experimental design, analysis of variance for completely randomized design (CRD), randomized block design (RBD) and Latin square design.	**04**
12: Multiple comparisons	Least significant difference (LSD) test, Duncan's multiple range test (DMRT).	**02**

Unit wise learning outcome

Units	Learning outcomes
1	• Know the importance of biostatistics in various branches of biological sciences. • Know the different types of variables including random variables, nature of discrete and continuous variables. • Know the genetic nature of qualitative and quantitative variables. • Know the concept of population, sample and random samples.
2	• Know the various ways of presentation of qualitative and quantitative data, • Know the techniques of summarization and tabulation of data, various graphical presentation of qualitative and quantitative data,
3	• Know the nature of distribution, symmetrical and asymmetrical distributions. • Know the significance of symmetrical and asymmetrical distributions. • Know the nature of skewness and kurtosis.
4	• Know the various measures of central value including mean, mode and median. • Know the various measures of dispersion including range, mean deviation, variance, standard deviation, standard error and coefficient of variation. • Know the significance of estimating variance for biological materials. • Know the significance of estimating confidence limit.
5	• Know the concept of probability, probability rules applicable for biological materials • Know Probability distributions: normal, binomial and poisson distributions and their applications
6	• Know the concept of hypothesis and hypothesis testing. • Know the application of null and alternative hypothesis for statistical tests. • Know the method of finding out probability levels in various statistical significance tests.
7	• Know the methods of comparison of means from two populations and samples. • Know the methods of t-test for unpaired and paired samples. • Know the method for t-test large and small samples. • Know the significance of t-test in biological materials
8	• Know concept and importance of Chi-square test. • Know goodness of fit test, test of independence, test of homogeneity. • Know the idea of association of attributes and application of contingency table.
9	• regression coefficient, regression equation • Know the concept interrelationships of quantitative variables. • Know the method of estimating correlation and correlation coefficient, preparation of scatter diagrams and test of significance of correlation coefficient. • Know the technique of estimation linear regression, development of regression equation, preparation of regression line and significance test for regression.

10	• Know the methods for comparison of three or more samples, F-test, significance of F-test in biological investigations.
11	• Know the concepts and principles of experimental design. • Know the types of experimental design used in various biological investigations including completely randomized design (CRD), randomized block design (RBD) and Latin square design. • Know the methods of analysis of variance following different experimental designs, variance ratio test and interpretation of obtained results.
12	• Know the concepts for multiple comparisons of treatments following F-test. • Know the methods used for multiple comparison using Least significance difference test (LSD), Duncans's multiple range test (DMRT),

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Instructional strategies/ Learning experiences

- Lecture followed by Question-answer
- Group discussion
- Project discussion
- Practical demonstration

Assignment: Students will be given assignment on particular unit.

Assessment: Incourse examination will be held after completion unit 1 to 5.

Practical

Units	Title	Learning outcomes
1	Acquisition of random samples from a population, recording of data about continuous variables. Presentation of qualitative and quantitative data	• Students will learn the techniques of collecting random samples from small and large populations. • Students will learn the process of summarizing and presenting qualitative and quantitative data using frequency distribution, frequency curve, bar graph, histogram, frequency polygon etc.
2	Analysis of data with the help of scientific pocket- and desk top electronic calculators.	• Students will learn the technique of analyzing various collected data using scientific calculators.
3	Estimation of central value and dispersion using various samples and populations.	• Students will carry out experiments to estimate central value from various large and small samples. • Students will also perform experiments to estimate the various measures of dispersion including variance, standard deviation, standard error, coefficient of variation. .
4	Comparison of two samples and populations through t-test.	• Learn the technique of for the comparison of means from two small and large samples using t-test
5	Chi-square test for goodness of fit, test of independence and test of homogeneity.	• Perform chi-square test to estimate goodness of fit, to test the fix ratio hypothesis, as well as to test the heterogeneity and homogeneity of various materials.
6	Estimation of correlation coefficient, preparation of scatter diagram, test of significance for correlation coefficient.	• Learn to estimate correlation coefficient and to test its significance. • Learn to prepare scatter diagram to represent correlation between variables,
7	Estimation of regression coefficient from various experiments and their interpretations.	• Students will estimate regression coefficient from experimental materials, develop regression equation, preparation of regression line and significance test for regression.
8	Comparison of three or more samples through F-test.	• Students will learn to carry out experiments for the comparison of three or more samples through F-test. • They will learn the technique in interpreting the results obtained from the variance analysis.
9	Designing and performing experiments with CRD, RBD, Latin square designs.	• Students will learn to prepare lay out for different experimental designs. • Students will also perform analysis of variance following various experimental designs. • They will learn the technique in interpreting the results obtained from the variance analysis. • Learn to estimate the best treatment following F-test using LSD test.

BOT 2001: Genetics and Cytogenetics Credit hour: 04

(For the Students of Department of Zoology)

Introduction

This is an extra Departmental course in 4 –years integrated B. S. (honors) in Botany program. It will be very helpful to the students for developing clear knowledge about Mendelism, exceptions of Mendelism, Multiple allele, Pseudo allele, cytoplasmic inheritance and chromosome mapping. In addition, the students will get detail information regarding cell cycle and cell division. The students will able to define and explain the natures of different special type of chromosomes, physical and chemical nature of chromosome, karyotype and ideogram. Students will get clear idea about the identification, kinds, detection, genetic effect and meiotic behavior of different types of structural chromosomal aberration such as deletion, duplication, translocation and inversion and explain different types of numerical aberration of chromosomes. In addition, students will get clear idea about the cytological behaviour and application of trisomy and autopolyploid.

Course objective

Genetics

(a) explain the scope and brief history of Genetics

(b). get clear idea about Mendelism, exceptions of Mendelism, Multiple allele, Pseudo allele, cytoplasmic inheritance and chromosome mapping.

Cytogenetics

(a) define and explain Cell, Cell-cycle, amitosis, mitosis, meiosis and their biological significance,

(b) explain the nature of different special type of chromosome,

(c) define and explain physical and chemical nature of chromosome, karyotype and ideogram,

(d) get clear idea about the identification, kinds, detection, genetic effect and meiotic behavior of different types of structural chromosomal aberration such as deletion, duplication, translocation and inversion,

(e) explain the scope and brief history of Cytogenetics,

(f) define, classify and explain different types of numerical aberration of chromosomes and

(g) get clear idea about the cytological behavior and application of trisomy and autopolyploidy.

Course content

Units	**A. Genetics** **Course content** **No. of lectures**
1:	Definition, brief history and scope of Genetics and Cytogenetics. **(1)**
2:	Different branches of Genetics and their importance. **(1)**
3:	Mendelism: Brief life sketch of Gregor Johann Mendel, rediscovery of Mendelism, 7 pairs of contrasting characters of garden pea, law of segregation, law of independent assortment, reasons for Mendel's success, determination of phenotypic and genotypic ratios by alzebra, statistics and forking method and summary of Mendelism. **(7)**
4:	Exception to Mendelian laws: (i) Apparent (a) 1^{st} law - Incomplete dominance (1:2:1), lethality (1:2), co-dominance; (b) 2^{nd} law - single recessive epistasis (9:3:4), double recessive epistasis (9:7), single dominant epistasis (9:6:1), double dominant epistasis

	(15:1), (b) duplicate gene - one shows incomplete dominance (12:3:1), (ii) Real - linkage, sex linkage, non-disjunction, preferential distribution. **(7)**
5:	Multiple allele and pseudoallele: definition, features and examples. **(2)**
6:	Multiple genes and quantitative inheritance: Multiple genes (polygenes) and quantitative inheritence: features of multiple genes, differences between principal and secondary gene, polygene and pureline selection, examples, transgressive segregation. **(5)**
7:	Chromosome mapping: definition, arrangement of linked genes, mapping of 2- and 3 genes linkage, co-efficient of co-incidence (CI), solving problems.
8:	Cytoplasmic and extranuclear inheritance: different types with example. **(2)**
	B. Cytogenetics
9:	Chromosomes: physical and chemical structure, karyotype and idiograms. **(5)**
10:	Special type of chromosomes: Physical structure, chemical structure and function of (a) Polytene, (b) Lampbrush and (c) B-chromosome. **(6)**
11:	Cell division: (a) Cell cycle, (b) Mitosis and (c) Meiosis with their significance. **(6)**
12:	Chromosomal aberration: i. General classification. ii. Structural aberration-type, origin, detection and meiotic behaviour of- (i) deletion, (ii) duplication, (iii) inversion and (iv) translocation. Numerical aberration-type, origin, detection, meiotic behaviour and segregation of (i) Autopolyploid and (ii) Trisomic. **(13)**

Unit wise learning outcome

Units	Learning outcomes
1	• Students will get a brief idea about the history, base of this branch, importance and scope of cytogenetics and genetics in modern research of Biology.
2	• Students will gather knowledge about different branches of genetics.
3	• Students will learn about brief sketch of Mendelism
4	• Students will obtain clear knowledge about different laws proposed by Mendel with their apparent and real exceptions
5	• Students will get idea about Multiple allele and pseudoallele
6	• Students will able to describe multiple genes and quantitative inheritance
7	• Students will obtain brief idea about chromosome mapping
8	• Students will able to describe cytoplasmic and extranuclear inheritance
9	• Students will get a clear and brief knowledge about chromosomes, structural and chemical composition, nature, nucleosome model and function of chromosomes. • Students will able to prepare karyotype and ideogram, describe symmetric, asymmetric, monomodal and bimodal karyotype, also learn about the significance of karyotype study.
10	• Students will learn about different special types of chromosomes. They also get clear knowledge about the distribution, origin, feature, morphology and biological significance of these special types of chromosomes.
11	• Students will gather a brief and clear knowledge about all kinds of cell divisions.
12	• Students will get general idea about chromosome aberration. • Students will get brief and clear knowledge about all types of structural aberrations of chromosomes such as deletion, inversion, duplication, translocation, etc. and consequences that occurs due to those aberrations. • Students will get overview idea about numerical aberrations of chromosomes. Students will learn about origin, distribution, occurrences, sources, cytological behavior, kinds, phenotypic expressions and consequences of trisomy and autopolyploid.

Instructional strategies

Lecture followed by group discussion (√)
Question-answer (√)
Guided discussion
Project discussion
Demonstration (√)

Assignment : Mid-term and semester final examination, assignment, practical and viva-voce

References

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5. Strickberger MW. Genetics. The Macmillian Co. N.Y. CollievMormillian LIC., London.
6. Sharma A 1985. Chromosomes (2nded.) Oxford and IBH Publication Co.
7. Sumner AT 2003. Chromosome - organization and function. Blackwell Publication, UK.
8. Swanson CP 1965. Cytology and cytogenetics. Prentics, Hall, Engle Wood Chiffs, New Jersy.

BOT 2002: Ecology, Environment and Plants Credit hour: 4

(For the Students of Department of Geography and Environmental Science)

Introduction

This course has been designed for the extra-departmental students of the University where focuses are given to the different aspects of Ecology and Environmental Sciences. Ecology is a multidisciplinary synthetic branch of Biology that deals with studies the interactions between living organisms and the non-living components of the environment. Synecology also known as community ecology studies interactions between and among species as well as communities and focuses on the aspects of adaptation, phytogeography, succession of plant communities, nutrient cycling, ecosystem structure and functions, distribution and diversity of forests and methods for studying vegetation. Autecology focuses on the adaptation, distribution and abundance of individuals and populations of organisms. The environment of plants consists of hydrosphere, lithosphere and atmosphere. But human activities are destroying these components of environment and biological diversity which have developed over a millions of years. Under current global change scenario this course focuses to familiarize the students from other departments about Plant Ecology to make them fit to combat the new challenges of the earth.

Specific objectives

The specific objectives of the course are to teach students the basic concepts of environments of plants, adaptation, ecological processes, phytogeography, biogeochemical cycling of nutrients, current status of forests in Bangladesh and how to conduct vegetation survey and apply statistics on analyzing diversity and other phytosociological variables.

Course content:

A: Synecology (Vegetation Ecology)		
Units	**Course content**	**No. of lectures**
1. Introduction	Definition, History, Scope and sub-divisions of Ecology, environment and plants Hydrophytes, Xerophytes and Halophytes; their ecological features.	5
2. Plant succession	Definition, types and causes of succession	3
3. Methods of studying vegetation	Methods of studying vegetation. Study of communities; Life form classes	6
4. Ecosystem	Classification, structure and components of ecosystems; food chain and food web; Energy and mineral movement in Ecosystem	4

5. Forest Ecology	Plants and Environment of deciduous and Sundarban mangrove forests of Bangladesh	3
6. Phytogeographical regions	Brief account of Phytogeographical regions of the world	2
7. Sampling	Sampling; Tests of comparison and application of quadrat measures and random sampling	2
B: Autecology (Physiological Ecology)		
1. Environment of plants	The hydrosphere and the biosphere	2
2. The role of green plants	The role of green plants in nature with reference to: (i) The Sun-a thermonuclear energy source; (ii) Radiant energy; (iii) Human population and food supply; and (iv) CO_2 and world climate.	5
3. Soil environment	Physical and chemical aspects and distribution of plants	4
4. Energy environment	Energy budget of different climatic zones	2
5. Salinity	Sources of salinity, Classification of saline habitats	3
6. Biogeochemical cycles	Definition, types of biogeochemical cycle; water and carbon cycles	5
7. Biodiversity	Introduction, causes of the loss and degradation of biodiversity, species diversity analysis	4
C: Environment		
1. Water resources	The global picture and the environment	4
2. Greenhouse effects	Greenhouse gases, ozone depletion and CFCs, CFCs use in Bangladesh	3
3. Climate change	Causes and consequences	3

Practical

1. Students will maintain a Field Note Book to study the vegetation types and the habitats of the University Campus and from local excursions.
2. Morphology and anatomy of plants of hydrophytes and xerophytes
3. Determination of pH in water and soil samples.
4. Determination of salinity (Chloride) in water samples.
5. Determination of conductivity in water and soil samples.
6. Vegetation analysis
7. Identification of forest plants from herbarium sheets.

Unit wise learning outcome

Units	Learning outcomes
A: Synecology (Vegetation Ecology)	
1	• students will have the basic idea about different branches of Ecology and adaptive mechanisms of plants growing in different habitats
2	• gain knowledge about the ecological succession in various environmental conditions
3	• students will be acquainted with sampling, vegetation survey methods as well as gain knowledge about the plant community structure.
4	• learn about the structure and function of the ecosystem
5	• learn about the ecological conditions and species composition of different forest types of Bangladesh
6	• gain idea about the distribution of the vegetation throughout the world and the factors that regulate their pattern of distribution
7	• will have the knowledge about how to do statistical analyses of vegetation and as well as in analysis and interpretation of results.
B: Autecology (Physiological Ecology)	
1	• learn about the characteristics of ecospheres

2	• learn about the role of green plants and sun on the energy conversion, production and the supply of foods
3	• know properties of soil and its roles in climatic condition
4	• gain knowledge on the availability and exchange of energy
5	• know extent and sources of salinity and the features of different saline habtats
6	• enhanced knowledge about the nature and functions of the nutrient cycles on Earth and their ecological implications
7	• will be able to know about different levels of biodiversity, causes of biodiversity degradation and how to analysis species diversity in different communities
C: Environment	
1	• will have an idea about the current situation of water resources of the world and crisis faced by different countries of the world
2	• will be able to know about the causes and consequences of greenhouse effects, depletion of ozone layers and its implications
3	• will have the knowledge about climate change

Instructional strategies : White board and black board, multimedia and overhead projector will be used in the classroom.

Assessment: As per the rule of the Department.

References

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2. Chiras DD. 1985. Environmental Science. The Benjamin Publishing Co. Inc.
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5. Gates DM 1993. Climate Change. Sinauer Associates Inc.
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10. Odum EP 1971. Fundamentals of Ecology. Toppan Co. Ltd. Japan.
11. Shimwell DN 1971. Description and Classification of Vegetation. Sidgwick & Jackson. London.
12. Waisel J 1972. Biology of Halophytes. Academic Press.