2026
BOTANY UNDERGRADUATE 4th YEAR HONOURS SYLLABUS, 2026
BOTANY POST GRADUATE FIRST YEAR SYLLABUS OF 2-YEARS PG COURSE, 2026

Department of Botany
Rabindranath Thakur Vishwavidyalaya
Sir J. C. Bose Campus
Sagar Basti, Hojai, Assam, Pin-782435

Common syllabus for Undergraduate 4th Year Honours (Semester-VII and VIII) and 1st Years of 2-years PG Course (Semester-I and II)
Minor Revised Syllabus, 2026

FRAMED ACCORDING TO THE NATIONAL EDUCATION POLICY (NEP), 2020
Date of effect: 17th August, 2026

Composition of Post Graduate Board of Studies (PG-BOS)
Rabindranath Thakur Vishwavidyalaya, Hojai, Assam
Meeting held on 17th August, 2026 at 2.00PM
Department of Botany

Sl. No.	Name & Designation	Deptt. & Institution	Address	Members	Signature
1.	Dr. Sushil Das Associate Professor & HOD	Botany Deptt. RTV	Hojai	Chairman	17/8/26
2.	Dr. Faristha Yasmin Associate Professor & HOD	Botany Deptt. NU	Nagaon	External Member	
3.	Dr. Bhaben Tanti Professor& Ex HOD	Botany Deptt. GU	Guwahati	External Member	
4.	Dr. MonjitSaikia Associate Professor	Botany Deptt. RTV	Hojai	Member	17/8/26
5.	Dr. UtpalPhukan Associate Professor	Botany Deptt. RTV	Hojai	Member	17/8/26
6.	Dr. NazimForid Islam Associate Professor	Botany Deptt. RTV	Hojai	Member	
7.	Dr. Pranjal Morang Associate Professor	Botany Deptt. RTV	Hojai	Member	
8.	Dr. Dhanwantari L. Singha Asstt. Professor	Botany Deptt. RTV	Hojai	Member	17/8/26

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Minor Revised Syllabus, 2026

Common Syllabus of Undergraduate 4th Year honours (Semester-VII And VIII) and 1st Year of PG 2-YEARS Course (Semester-I and II)

Course structure of B.Sc.(Hons.)-FYUGP-Semester-VII / PG-Semester-I

Coursecode	Papers	CourseTitle	Credit	Hours	Classes
BOT-MAJOR-DSC-401	7.1/1.1	PlantBiotechnology	4	60	60
BOT-MAJOR-DSC-402	7.2/1.2	HorticulturalPracticesandPost-Harvest Technology	4	60	60
BOT-MAJOR-DSC-403	7.3/1.3	ConservationBiology	4	60	60
BOT-MAJOR-DSC-404	7.4/1.4	Natural History and Evolution	4	60	60
*** BOT-MAJOR-RM-401**	7.4/1.4	Research Methodology	4	60	60
BOT-DSM-401	7.1/1.1	Cell Biology,Genetics and Plant Breeding	4	60	60
		Total credit	**20**		

RM-401 is mandatory requirement for those students who are selected for honours with research

Course structure of B.Sc.(Hons.)-FYUGP-Semester-VIII / PG-Semester-II

Coursecode	Papers	CourseTitle	Credit	Hours	Classes
BOT-MAJOR-DSC-451	8.1/2.1	AnalyticalTechniquesinPlant Sciences	4	60	60
***BOT-MAJOR-DSC-452**	8.2/2.2	MolecularBiology/ **Research Project-Dissertation**	4	60	60
***BOT-MAJOR-DSC-453**	8.3/2.3	IndustrialandEnvironmental Microbiologyor **ResearchProject-Dissertation**	4	60	60
***BOT-MAJOR-DSC-454**	8.4/2.4	BioinformaticsandBiostatistics or **Research Project-Dissertation**	4	60	60
BOT-MINOR-DSM-451	8.1/2.1	EconomicBotanyandPlant Biotechnology	4	60	60
		Total credit	**20**		
****BOT-DSR-452**		Dissertation in lieu of Paper-452,453, 454	**12**		

***Dissertation Papers**

****Only for those students who are selected for Honours with research. They will study only 451 and DSM 451 theory papers**

DETAILED SYLLABUS OF INTEGRATED B.Sc.-M.Sc. Integrated 7th SEMESTER

Title of the Course:Plant Biotechnology
Course Code: BOT-MAJOR-DSC-401
Nature of the Course: MAJOR/CORE-7.1
Total Credits: 04
Distribution of Marks:100: Theory-45, Practical-25, Internal assessment-30

Course Objectives: The objective of the Plant Biotechnology course is to introduce undergraduate students to the fundamental concepts and applications of biotechnology in plants. It aims to develop an understanding of plant tissue culture, genetic engineering, transgenic and their roles in crop improvement and sustainable agriculture.

UNITS	CONTENTS	L	T	P	Total hours
Unit-I Marks: 10	**Introduction to Plant Biotechnology** Definition and understanding of Plant Biotechnology; Scope of Plant Biotechnology; Historical Background in Plant Biotechnology; Branches of Plant Biotechnology; Importance of Plant Biotechnology	**6**	**1**		**7**
Unit-II Marks: 20	**Plant Tissue Culture** Historical perspective; Composition of media; Nutrient and hormone requirements (role of vitamins and hormones); Totipotency; Organogenesis; Embryogenesis (somatic and zygotic); Protoplast isolation, culture and fusion; Tissue culture applications (micropropagation, androgenesis, virus elimination, secondary metabolite production, Cryopreservation, Germplasm Conservation).	**14**	**1**		**15**
Unit-III Marks:15	**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); M13 phagemid, Cosmid, Shuttle vector; Eukaryotic Vectors (YAC).	**7**	**1**		**8**
Unit-IV Marks:15	**Gene Cloning & Method of Gene Transfer: -** Recombinant DNA, PCR-mediated gene cloning; Gene Construct; construction of genomic and cDNA libraries, screening DNA libraries to obtain gene of interest by genetic selection; colony hybridization **Method of gene transfer** *Agrobacterium*-mediated, Direct gene transfer by Electroporation, Microprojectile bombardment; Selection of transgenics- selectable marker and reporter genes (Luciferase, GUS, GFP). **Applications of Plant Biotechnology** Pest resistant (Bt-cotton); herbicide resistant plants (Round Up Ready soybean); Transgenic crops with improved quality traits (Golden rice); edible vaccines; Industrial enzymes (Aspergillase, Protease); Genome editing through CRISPR/Cas; Ethical considerations and Biosafety concerns related to Plant Biotechnology	**15**			**15**
Practical Marks: 25	1. Preparation of MS medium 2. Demonstration of in vitro sterilization and inoculation methods using leaf and nodal explants of tobacco, Datura, Brassica etc.			**15**	**15**

	3. Isolation of genomic DNA. 4. Isolation of plasmid DNA 5. Quantification of Plant DNA Using a Spectrophotometer / Nanodrop Spectrophotometer 6. Gel Electrophoresis of Genomic DNA from Plants 7. Study of anther, embryo culture, micropropagation, somatic embryogenesis & artificial seeds through photographs. 8. Construction of restriction map of circular and linear DNA from the data provided. 9. Study of methods of gene transfer through photographs:*Agrobacterium*-mediated and microprojectile bombardment. 10. Study of steps of genetic engineering for production of Bt-Cotton and Golden rice through photographs.				

Total=60 classes

Mode of Internal Assessment: -1. Sessional examination-15 marks

2. Field trip, Excursion Tour, Seminar, quiz, Home assignment- 15 marks

DETAILED SYLLABUS OF INTEGRATED B.Sc.-M.Sc. Integrated 7th SEMESTER

Title of the Course: Horticultural technique and Post-Harvest Technology

Course code: BOT-MAJOR-DSC-402

Nature of the Course: MAJOR/ CORE-7.2

Total Credits: 04

Distribution of Marks:100: Theory-45, Practical-25, Internal assessment-30

Course objectives: - The objective of this course is to provide knowledge to the students on various aspect of types, classification of crop plants, horticultural techniques, landscaping, garden design, floriculture, post-harvest technology, diseases control and management, conservation and management of crop plants.

UNITS	CONTENTS	L	T	P	Total Hours
Unit-I Marks:15	**Introduction:-** Scope and importance, Branches of horticulture; Role in rural economy and employment generation; Importance in food and nutritional security; Urban horticulture and ecotourism. **Plants:-** Types, classification (annuals, perennials, climbers and trees); Identification and salient features of some ornamental plants [rose, marigold, gladiolus, carnations, orchids, poppies, gerberas, tuberose, sages, cacti and succulents (opuntia, agave and spurges)] Ornamental flowering trees (Indian laburnum, Gulmohar, Jacaranda, Lagerstroemia, fishtail and areca palms, Samul, coral tree).	11	1		12
Unit- II Marks: 15	**Horticultural techniques :-** Application of manure, fertilizers, nutrients and PGRs; Weed control; Bio-fertilizers, bio-pesticides; Irrigation methods (drip irrigation, surface irrigation, furrow and border irrigation); Hydroponics; Propagation Methods: asexual (grafting, cutting, layering, budding), sexual (seed propagation), Scope and limitations **Landscaping and garden design :-** Planning and layout (parks and avenues); gardening traditions - Ancient Indian, European, Mughal and Japanese Gardens; Urban forestry; policies and practices **Floriculture:-** Cut flowers, bonsai, commerce (market demand and supply); Importance of flower shows and exhibitions	11	1		12
Unit-III Marks:15	**Post-harvest technology :-** Importance of post-harvest technology in horticultural crops; Evaluation of quality traits; Harvesting and handling of fruits, vegetables and cut flowers; Principles, methods of preservation and processing; Methods of minimizing loses during storage and transportation; Food irradiation - advantages and disadvantages; food safety. **Disease control and management :-** Field and post-harvest diseases; Identification of deficiency symptoms; remedial measures and nutritional management practices; Crop sanitation; IPM strategies (genetic, biological and chemical methods for pest control); Quarantine practices; Identification of common diseases and pests of ornamentals, fruits and vegetable crops.	11	1		12

Unit-IV Marks:15	**<u>Fruit and vegetable crops: -</u>** Production, origin and distribution; Description of plants and their economic products; Management and marketing of vegetable and fruit crops; Identification of some fruits and vegetable varieties (citrus, banana, mango, chillies and cucurbits). **<u>Horticultural crops - conservation and management: -</u>** Documentation and conservation of germplasm; Role of micropropagation and tissue culture techniques; Varieties and cultivars of various horticultural crops; IPR issues; National, international and professional societies and sources of information on horticulture.	8	1		9
Practicals: Marks:25	**1.** To study methods of commercial production of Bio-fertilizers. 2. To study the methods of control of fungal and bacterial diseases. 3. To study the properties of some fungicides and bactericides 4. To study the methods of grafting, cutting, layering, Budding. 5. Field trip Field visits to gardens, standing crop sites, nurseries, vegetable gardens and horticultural fields at suitable locations.			15	15

Total=60 classes

Mode of Internal Assessment: -1. Sessional examination-15 marks

2. Field trip, Excursion Tour, Seminar, quiz, Home assignment- 15 marks

DETAILED SYLLABUS OF INTEGRATED B.Sc.-M.Sc. Integrated 7th SEMESTER

Title of theCourse:Conservation Biology
Course Code: BOT-MAJOR-DSC-403
NatureoftheCourse:MAJOR/CORE-7.3 Total
Credit: 04
DistributionofMarks:100:Theory-45,Practical-25,Internalassessment-30

Course of Objectives: The objectives of the course is to provide knowledge to the students on variousaspectsofbiodiversityanditsvalue,causesandconsequencesofbiodiversityloss,habitat loss, conservation strategies, soil, forests and water conservation, national and international policies, organization involved in conservation of nature and natural resources.

UNITS	CONTENTS	L	T	P	Total Hours
Unit-I Marks:12	**Introduction**: conservation biology, Basic concept of conservation, history and significance of conservation biology. Biodiversity and Hotspots, Genetics and ecosystem diversity, Phytogeographic regions of India and world.	**7**	**1**		**8**
Unit-II Marks:16	**Values and threats:** values of biodiversity, causes and consequences of biodiversity loss, impacts of pollution, global climate change, causes and consequences of species extinction, endangered and endemic species, red-list of threatened species. Eco-tourism, importance of wetlands.	**8**	**2**		**10**
Unit-III Marks:16	**Conservation strategies: E**x-situ and In-situ conservation, Protected area networks: Biosphere reserves, National parks, Sanctuaries, Gene bank, Botanical garden. Principles and methods of soil and water conservation, Bioremediation. World conservation strategies, JFM.	**11**	**2**		**13**
Unit-IV Marks:16	**Policies and Organizations:** Forest Conservation Act 1980, Wildlife Protection Act 1972, Biological Diversity Act 2002. Goals of conservation policies. National Wetland Conservation Programme, Ramsar Convention, Swachh Bharat Abhiyan. Roles and function of IUCN, BSI, WWF, CITES.	**12**	**2**		**14**
Practicals Marks:25	**1.** Field studies in nearby reserve forest to study plant diversity, Listing of Endangered, Endemic, Threatened and Indegenous rare plants. **2.** Ex-situconservation of plant species using In-vitro techniques. **3.** Mass propagation and production of seedlings of important plant species. **4.** Rainwaterharvestingandmanagement. **5.** Conservation of Plant genetic resources available in Local areas.			**15**	**15**

Total Classes=60

ModeofInternalAssessment: 1.SessionalExam-Marks=15
2. Field Trip /Excursion to any ecologically important place.Marks-15

DETAILED SYLLABUS OF INTEGRATED B.Sc.-M.Sc. Integrated 7th SEMESTER

Title of the Course: Natural History and Evolution
Course code: BOT-MAJOR-DSC-404
Nature of the Course: MAJOR/ CORE-7.4
Total Credits: 04
Distribution of Marks:100: Theory-60 and Internal assessment-40

Course objectives: The course will focus on the enigma of origin of life and the evolution of life from the prehistoric times.The students will be taught about the contribution of various naturalists in biological sciences and theimportance of natural history societies and museums.
COURSE LEARNING OUTCOMES: Students will get detailed study of concept of origin of life and the recent advances in theunderstanding of life**.**

UNITS	CONTENTS	L	T	P	Total Hours
Unit-I Marks:15	**Origin of life:** Spontaneous generation versus biogenesis; fermentation; germ theory of disease. **Lamarck & Darwin**: The Lamarckian heritage; Charles Darwin; Theories of Darwin; Darwinian, their merits and demerits Evolution and religious attack; Support for Darwin.	14	1		15
Unit- II Marks:10	**Noted Naturalists:** George Charles Wallich, Theodosius Dobzhansky, BirbalSahni, Alfred Russel Wallace, David Attenborough, E. O. Wilson, Edward Forbes, J.C. Bose, R.L. Brahmachari and others.	12	1		13
Unit-III Marks:20	**Natural History Societies and museums:** Bombay Natural History Society; Bengal Natural History Museum, Darjeeling; Indian Museum, Kolkata; Asiatic Society of Bengal, Kolkata; British NaturalHistory Society and Museum, London; Musée des Confluences (Lyon); Muséum national d'histoire naturelle (Paris); American Museum of Natural History, New York City etc.	15	1		16
Unit-IV Marks:15	**Theories of Evolution:** History of Life; Evolution theory; Darwin and natural selection, coevolution; Adaptation;Gradualistic model of evolution or phyletic gradualism, Germ plasm theory (A. Weismann). Phylogenetics; Mapping evolution; Sexual selection and life history; Species concept and macroevolution; Behavioral evolution.	15	1		16

Mode of Internal Assessment: -1. Sessional examination-20 marks
2. Field trip, Excursion Tour, Seminar, quiz, Home assignment- 20 Marks

DETAILED SYLLABUS OF INTEGRATED B.Sc.-M.Sc. Integrated 7th SEMESTER

Title of the Course: Research Methodology

Course code: BOT-MAJOR-RM-401

Nature of the Course: Major-7.4

Total Credits: 04

Distribution of Marks: 100: Theory-60 and Internal assessment-40

Course objectives: -The objective of this course is to provide knowledge to the students on various aspects research methodology**.**

UNITS	CONTENTS	L	T	P	Total Hours
Unit-I Marks:20	**Basic concept of research: -**Research-definition and types of research (descriptive vs analytical; applied vs fundamental; quantitative vs qualitative; conceptual vs empirical). Research methods vs methodology. Literature review and its consolidation; Library research; field research; laboratory research **General laboratory practices: -**Common calculations in botany laboratories, understanding the details on the label of reagent bottles. Molarity and normality of common acids and bases, preparation of solutions, Dilution, percentage solutions. Molar and normal solutions. Technique of handling micropipettes. Knowledge about common toxic chemicals and safety measures in their handling.	16	1		17
Unit- II Marks:15	**Data collection and documentation of observations;-** Maintaining a laboratory records; Tabulation and generation of graph. Imaging of tissue specimens and application of scale bars. The art of field photography. **Overview of biological problems:**- History; key biology research areas, Model organisms in biology (a brief overview);Genetics, physiology,Biochemistry, Molecular Biology, cell biology, genomics, proteomics-Transcriptional regulatory network.	14	1		15
Unit-III Marks:10	**Methods to study plant cell / tissue structure:-**whole mounts, peel mounts, squash preparations, cleaning, maceration and sectioning; Tissue preparation; living vs fixed, physical vs chemical fixation, coagulating fixatives, non-coagulant fixatives, tissue dehydration using graded solvent series, paraffin and plastic infiltration; preparation of thin and ultra- thin section	12	1		13
Unit-IV Marks:15	**Plant microtechniques**:- Staining procedure, classification and chemistry of stains. Staining equipments. Reactive dyes and fluorochromes (including genetically engineered protein labelling with GPF and other tags). Cytogenetic techniques with squashed plant materials. **The art of scientific writing and its presentation:**- Numbers, units, abbreviations and nomenclature used in scientific writing. Writing references. Power point presentation. Poster presentation. Scientific writing and ethics, introduction to copyright-academic misconduct/ plagiarism	14	1		15

Total Classes=60

Mode of Internal Assessment: -1. Sessional examination-20 marks

2. Field trip, Excursion Tour, Seminar, quiz, Home assignment- 20 marks

DETAILED SYLLABUS OF INTEGRATED B.Sc.-M.Sc. Integrated 7th SEMESTER

Title of the Course: Cell Biology, Genetics and Plant Breeding

Course code: BOT-DSM-401

Nature of the Course: Minor-7.1

Total Credits: 04

Distribution of Marks: 100: Theory-45, Practical-25, Internal assessment-30

Course objectives: The objective of this course is to provide knowledge to the students on various aspect of microscopes, cell cycle, cell organelles, cell membrane, principles of inheritance, chromosome, nucleic acids, fine structure of gene, genetic code, transcription, regulation of gene expression and plant breeding.

UNITS	CONTENTS	L	T	P	Total Hours
Unit- I Marks:15	**Techniques in cell Biology:-** **Principles of microscopy**: - Light Microscopy; Phase contrast microscopy; Fluorescence microscopy; Sample Preparation for light microscopy. **Cell as a unit of Life :-** The Cell Theory; Prokaryotic and eukaryotic cells; Cell size and shape; Eukaryotic Cell components. **Cell Cycle:-** Overview of Cell cycle, Mitosis and Meiosis and their significance	7	1		8
Unit-II Marks:12	**Cell Organelles:-** **Morphology, ultrastructure, chemical composition and functions of cell organelles:** - Mitochondria, Chloroplast, Nucleus, Golgi body, Endoplasmic Reticulum (ER), Ribosomes, Endosomes, Lysosomes, Peroxysomes, hydrogenosomes and Centrosomes **Cell Membrane and Cell Wall :-** The functions of membranes; Models of membrane structure; (Fluid-mosaic model); Selective permeability of the membranes; ultrastructure and functions of Cell wall	8	1		9
Unit-III Marks:18	**Principles of inheritance**: -Mendel's Laws of inheritance, incomplete dominance, codominance **Chromosome:** - Chromosome morphology and its chemical composition and functions. Chromatin- euchromatin and heterochromatin. Nucleosome concept **Genetic material :-**, Griffith's and Avery's transformation experiments DNA as genetic materials, Fraenkel-Conrat and Singer experiment RNA as genetic material DNA structure, types of DNA, types of genetic material **Nucleic acids: -** Forms of DNA, Chemical structure of DNA. Watson and Crick model of DNA double helix. Chemical structure of RNA molecules, Types of RNA	14	1		15

Unit-IV Marks:15	**Transcription**: - Generalized model of prokaryotic transcription **Regulation of gene expression: -** Process of gene expression in prokaryotes **Plant breeding: -** Objectives of plant breeding, plant introduction, domestication and acclimatization. Hybridization technique, heterosis and inbreeding depression and its commercial application, distant hybridization technique. Barrier to the production of distant hybridization, limitations	12	1		13
Practicals Marks:25	1. To study the mitotic and meiotic cell division in onion root/ garlic tip using acetocarmine stain and prepare temporary and permanent slides. 2. To study of the photomicrographs of cell organelles. 3. To study the structure of plant cell through temporary mounts. 4. To Study the plasmolysis and deplasmolysis of cell on Tradescantia leaf peel. 5. To measure the cell size (either length or breadth/diameter) by micrometer. 6. To study the structure of nuclear pore complex by photograph. 7. Isolation of DNA from plant materials by CTAB method 8. To study the hand emasculation technique for hybridization of crop plants.			15	15

Total-60 Classes

Mode of Internal Assessment: -1. Sessional examination-15 marks

2.Field trip, Excursion Tour, Seminar, quiz, Home assignment- 15 marks

DETAILED SYLLABUS OF INTEGRATED B.Sc.-M.Sc. Integrated 8thSEMESTER

Title of the Course: Analytical Techniques in Plant Sciences

Course code: BOT-MAJOR-DSC-451

Nature of the Course: MAJOR/ CORE-8.1

Total Credits: 04

Distribution of Marks: 100: Theory-45, Practical-25, Internal assessment-30

Course objectives: The objective of this course is to provide knowledge to the students on various aspect of principles of microscopy, cell fractionation, radioisotopes, spectrophotometry, x-ray diffraction, AGE, PAGE and biostatistics

UNITS	CONTENTS	L	T	P	Total Hours
Unit- I Marks:20	**Imaging and related techniques :-** Principles of microscopy; Light microscopy; Fluorescence microscopy; Confocal microscopy; Use of fluorochromes: (a) Flow cytometry (FACS); (b) Applications of fluorescence microscopy: Chromosome banding, FISH, chromosome painting; Transmission and Scanning electron microscopy – sample preparation for electron microscopy, cryofixation, negative staining, shadow casting, freeze fracture, freeze etching.	13	2		15
Unit- II Marks:10	**Cell fractionation:-** Centrifugation: Differential and density gradient centrifugation, sucrose density gradient, $Cscl_2$ gradient, analytical centrifugation, ultracentrifugation, marker enzymes.	6	1		7
Unit- III Marks:10	**Radioisotopes :-** Use in biological research, auto-radiography, pulse chase experiment. **Spectrophotometry:-** Principle and its application in biological research. **Chromatography:-** Principle; Paper chromatography; Column chromatography, TLC, GLC, HPLC, Ion-exchange chromatography; Molecular sieve chromatography; Affinity chromatography.	7	1		8
Unit-IV Marks:20	**Characterization of proteins and nucleic acids :-** Mass spectrometry; X-ray diffraction; X-ray crystallography; Characterization of proteins and nucleic acids; Electrophoresis: AGE, PAGE, SDS-PAGE **Biostatistics :-** Statistics, data, population, samples, parameters; Representation of Data: Tabular, Graphical; Measures of central tendency: Arithmetic mean, mode, median; Measures of dispersion: Range, 55 mean deviation, variation, standard deviation; Chi-square test for goodness of fit.	12	3		15

Practical Marks:25	1. Study of Blotting techniques: Southern, Northern and Western, DNA fingerprinting, DNA sequencing, PCR through photographs. 2. Demonstration of ELISA. 3. To separate sugars by thin layer chromatography. 4. Isolation of chloroplasts by differential centrifugation. 5. To separate chloroplast pigments by column chromatography. 6. To estimate protein concentration through Lowry's methods. 7. To separate proteins using PAGE. 8. Study of different microscopic techniques using photographs/micrographs (freeze fracture, freeze etching, negative staining, positive staining, fluorescence and FISH). 9. Educational tour to research station			15	15

Total-60 classes

Mode of Internal Assessment: -1. Sessional examination-15 marks

2. Field trip, Excursion Tour, Seminar, quiz, Home assignment- 15 marks

DETAILED SYLLABUS OF INTEGRATED B.Sc.-M.Sc. Integrated 8th SEMESTER

Title of the Course: Molecular Biology
Course code: BOT-MAJOR-DSC-452
Nature of the Course: MAJOR/CORE-8.2
Total Credits:04
Distribution of Marks: 100: Theory-45, Practical-25, Internal assessment-30

Course objectives: The objective of this course is to provide knowledge to the students on various aspect of cytogenetics, DNA structure, central dogma, genetic code, transcription, translation, processing and modification of RNA.

UNITS	CONTENTS	L	T	P	Total Hours
Unit-I Marks:25	**Chromosome and Chromatin:-** Introduction, Chromosome number, Chromosome size, Chromosome morphology, types of chromosomes, Karyotype, Chemical composition, Organisation of chromatin fibers. The Nucleosome concept, Chromatin structure- Euchromatin, Heterochromatin- Constitutive and Facultative heterochromatin. **Concept of gene**:-Cistron, muton, recon etc. **The Structures of DNA :-** Historic prespective, Occurance,Chemical structure of DNA, Watson and Crick structural model of DNA, Salient features of double helix, denaturation and renaturation of DNA, cot curves; Organization of Prokaryotic and Viral DNA and cell free DNA. **Organelle DNA** -- mitochondria (mt DNA) and chloroplast (cp DNA), **Structure of RNA**:- Structure of RNA, Types of non-genetic RNA and Clover leaf model of tRNA	15	3		18
Unit-II Marks:15	**Central dogma and genetic code :-** Key experiments establishing-The Central Dogma (Adaptor hypothesis and discovery of mRNA template), **Genetic code: -** Basis of cryptoanalysis, codon assignment (deciphering the code) & salient features of genetic code **Transcription:** **Transcription in prokaryotes and eukaryotes.** A generalized model of prokaryotic transcription **Operon concept: -** Regulation of lactose metabolism and tryptophan synthesis in E. coli. **Eukaryotes:** Eukaryotic transcription factors.	11	1		12
Unit-III Marks:10	**Processing and modification of RNA :-** Split genes-concept of introns and exons, removal of introns, spliceosome machinery, splicing pathways, group I and group II intron splicing, alternative splicing eukaryotic mRNA processing (5' cap, 3' poly A tail); Ribozymes; RNA editing and mRNA transport.	8			8
Unit-IV Marks:10	**Translation :-** Ribosome structure and assembly, mRNA; Charging of tRNA, aminoacyl tRNAsynthetases; Various steps in protein synthesis, proteins involved in initiation, elongation and termination of polypeptides; Fidelity of translation; Inhibitors of protein synthesis; Post-translational modifications of proteins	7			7

Practicals Marks:25	1. DNA isolation, purification, and quantification from plant materials (CTAB method). 2. DNA isolation and Gel electrophoresis 3. Chromosome counting and Karyotype in garlic root tip 4. Calculate the average chromosome length (ACL) and total chromosome length (TCL) in garlic root tip 5. Study of structures of prokaryotic RNA polymerase and eukaryotic RNA polymerase II through photographs. 6. Study of the following through photographs: - (i) Assembly of Spliceosome machinery; (ii) Splicing mechanism in group I & group II introns; (iii) Ribozyme and Alternative splicing.			15	15

Total-60 classes

Mode of Internal Assessment: -1. Sessional examination-15 marks

2. Field trip, Excursion Tour, Seminar, quiz, Home assignment- 15 marks

DETAILED SYLLABUS OF INTEGRATED B.Sc.-M.Sc. Integrated 8th SEMESTER

Title of the Course: Industrial & Environmental Microbiology
Course code: BOT-MAJOR-DSC-453
Nature of the Course: MAJOR/ CORE-8.3
Total Credits: 04
Distribution of Marks: 100: Theory-45, Practical-25, Internal assessment-30

Course objectives: The objective of this course is to provide knowledge to the students on various aspect of industrial and environmental microbiology such as bioreactor, fermentation process, microbial production of industrial products, microbial enzymes, microbes in water and agriculture.

UNITS	CONTENTS	L	T	P	Total Hours
Unit-I Marks:15	Scope of microbes in industry and environment **Bioreactors/Fermenters and fermentation processes:-** Solid-state and liquid-state (stationary and submerged) fermentations; Batch and continuous fermentations. Components of a typical bioreactor, Types of bioreactors-laboratory, pilot scale and production fermenters; Constantly stirred tank fermenter, tower fermenter, fixed bed and fluidized bed bioreactors and air-lift fermenter. A visit to any educational institute/ industry to see an industrial fermenter, and other downstream processing operations.	10	1		11
Unit-II Marks:15	**Microbial production of industrial products :-** Microorganisms involved, media, fermentation conditions, downstream processing and uses; Filtration, centrifugation, cell disruption, solvent extraction, precipitation and ultrafiltration, lyophilization, spray drying; Hands on microbial fermentations for the production and estimation (qualitative and quantitative) of Enzyme: amylase or lipase activity, Organic acid (citric acid or glutamic acid), alcohol (Ethanol) and antibiotic (Penicillin)	10	2		12
Unit- III Marks:15	**Microbial enzymes of industrial interest and enzyme immobilization:** Microorganisms for industrial applications and hands on screening microorganisms for casein hydrolysis; starch hydrolysis; cellulose hydrolysis. Methods of immobilization, advantages and applications of immobilization, large scale applications of immobilized enzymes (glucose 53 isomerase and penicillin amylase). **Microbes and quality of environment:-** Distribution of microbes in air; Isolation of microorganisms from soil, air and water.	10	2		12

Unit-IV Marks:15	**Microbial flora of water:-** Water pollution, role of microbes in sewage and domestic waste water treatment systems. Determination of BOD, COD, TDS and TOC of water samples; Microorganisms as indicators of water quality, check coliform and fecal coliform in water samples. **Microbes in agriculture and remediation of contaminated soils**:- Biological fixation; Mycorrhizae; Bioremediation of contaminated soils. Isolation of root nodulating bacteria, arbuscularmycorrhizal colonization in plant roots. **Microbiology of waste water treatment: -** Aerobic process - activated sludge, oxidation ponds, trickling filter, towers, rotating discs, rotating drums, oxidation ditch. Anaerobic process - anaerobic digestion, anaerobic filters, up-flow anaerobic sludge blanket reactors. Treatment schemes for waste waters of dairy, distillery, tannery, sugar and antibiotic	9	1		10
Practical Marks:25	1. Principles and functioning of instruments in microbiology laboratory. 2. Hands on sterilization techniques and preparation of culture media. 3. Preparation of culture media for growing bacteria/yeast 4. Pure culture techniques. 5. Isolation of soil micro-flora by serial dilution method. 6. Isolation of microflora by sticky slide methods from air 7. To study the method of fermentation process of carbohydrates and its product			15	15

Total-60 Classes

Mode of Internal Assessment: -1. Sessional examination-15 marks

2. Field trip/ Excursion Tour/Seminar/quiz/Home assignment- 15 marks

DETAILED SYLLABUS OF INTEGRATED B.Sc.-M.Sc. Integrated 8th SEMESTER

Title of the Course: Bioinformatics and Biostatistics

Course code: BOT-MAJOR-DSC-454

Nature of the Course: Major-8.4

Total Credits: 04

Distribution of Marks: 100: Theory-45, Practical-25, Internal assessment-30

Course objectives:-The objective of this course is to provide knowledge to the students on various aspects Bioinformatics and Biostatistics.

UNITS	CONTENTS	L	T	P	Total Hours
Unit-I Marks:10	1. **Introduction to Bioinformatics:-** Introduction, branches of Bioinformatics, Aim, scope and research area of Bioinformatics. 2. **Databases in Bioinformatics:-**Introduction, Biological databases, classification format of Biological Databases, Biological databases retrieval system.	7	1		8
Unit- II Marks:20	1. **Biological sequence databases:-** National Center for Biotechnological Information (NCBI), Tools and Databases of NCBI, Databases retrieval Tool, Sequence submission to NCBI, Basic Local Alignment Search Tool (BLAST), Nucleotide database, Protein Database, Gene Expression database. 2. **EMBL nucleotide Sequence Database EMBL-Bank):-** Introduction, sequence Retrieval, Sequence Submission to EMBL, Sequence analysis Tool. 3. **DNA Data Bank of Japan (DDBJ):-**Introduction, Resources at DDBJ, Data submission at DDBJ. 4. **Protein Information Resources (PIR):-** About PIR, Resources of PIR, Databases of PIR, Data Retrieval in PIR. 5. **Swiss- Prot:-** Introduction and salient features	12	1		13
Unit-III Marks:15	1. **Sequence alignments: -**Introduction, Concept of Alignment, Multiple sequence Alignment (MSA), MSA by CLUSTALW, Scoring, Matrices, Percent Accepted Mutation (PAM), Block of Amino Acid Substitution Matrix (BLOSUM). 2. **Molecular Phylogeny:-**Methods of phylogeny, Software of Phylogenetic Analyses, Consistency of Molecular phylogenetic Prediction. 3. **Applications of Bioinformatics:-** Structural bioinformatics in drug discovery, quantitative structure-activity relationship (QSAR) techniques in drug design, Microbial genome applications, Crop improvement.	11	1		12

Unit-IV Marks:15	**1. Biostatistics:-**Statistics, data, population, samples, parameters, representation of data: Tabular, Graphical, Measure of central tendency,: Arithmetic mean,, mode, median, Measure of dispersion: Range, mean deviation, Variation, standard deviation, Chi-square test for goodness of fit. Correlation- types and methods of correlation, regression, simple regression equation, fitting prediction, similarities and dissimilarities of correlation and regression. Analysis of variance (ANOVA).	11	1		12
Practicals Marks:25	1. Nucleic acid and protein databases 2. Sequence retrieval from databases 3. Sequence alignment 4. Sequence homology and gene annotation 5. Construction of phylogenetic tree 6. Calculation of mean, standard deviation and standard error 7. Calculation of correlation coefficient values and finding out probability 8. Calculation of 'F' value and finding out the probability value for the 'F' value.			15	15

Total-60 classes

Mode of Internal Assessment: -1. Sessional examination-15 marks

2. Field trip, Excursion Tour, Seminar, quiz, Home assignment- 15 marks

DETAILED SYLLABUS OF INTEGRATED B.Sc.-M.Sc. Integrated 8th SEMESTER

Title of the Course: Economic Botany and Plant Biotechnology

Course code: BOT-DSM-451

Nature of the Course: Minor-8.1

Total Credits: 04

Distribution of Marks: 100: Theory-45, Practical-25, Internal assessment-30

Course objectives: The objective of this course is to provide knowledge to the students on various aspects of economic Botany viz. cereals, legumes etc. and Biotechnology- plant tissue culture, recombinant DNA technology, bioinformatics and applied bioinformatics

UNITS	CONTENTS	L	T	P	Total Hours
Unit-I Marks:10	1. Origin of Cultivated Plants: - Concept of center of origin, their importance with reference to Vavilov' work. 2. **Cereals:** - Wheat- Origin, morphology and uses 3. **Legumes: -** General account with special reference to Gram and Soyabean.	7			7
Unit- II Marks:18	**1. Spices: -** General account with special reference to Clove and Black Piper (Botanical name, Family, parts used, Morphology and uses. **2. Beverages:** - Tea - its morphology, Processing and uses. **3. Oils and fats:** - General description with special reference to Groundnut. **4. Fiber yielding plants:-** General description with special reference to Cotton (Botanical name, family, parts used, morphology and uses.	14	1		15
Unit-III Marks:20	1. ***Introduction to Biotechnology:* -** Principles and techniques 2. ***Plant tissue culture:* -** Micro propagation, haploid production through androgenesis and gynogenesis, brief account of embryo and endosperm culture and their application. 3. ***Recombinant DNA Technology:*** - Blotting techniques: - Northern, Southern and western blotting, DNA Fingerprinting, Molecular DNA Markers (i.e. RAPD,RFLP, SNPs,), DNA sequencing, PCR and Reverse Transcriptage-PCR. Hybridoma and monoclonal antibodies, ELISA and Immmunodetection. Molecular diagonosis of human diseases and Human Gene Therapy	14	1		15
Unit-IV Marks:12	1. **Bioinformatics: -** Introduction, Branches, aim Scope, and Research area. Biological database and retrieval system. 2. **Application of Bioinformatics:-** Molecular phylogeny, Basics of Proteomics and Genomics and their application in crop improvement and Drug discovery.	7	1		8

Practicals Marks:25	1. Study of economically important plants: - Rice, Wheat, Gram, Soybean, Black pepper, Clove Tea, Cotton, Groundnut, Curcuma, through specimens, sections and micro- chemical tests 2. Familiarization with basic equipment in tissue culture. 3. Study through photographs: Anther culture, somatic embryogenesis, endosperm and embryo culture; micro- propagation. 4. Study of molecular techniques: PCR, Blotting techniques, AGE and PAGE. 5. Data base searching, and retrieval of Sequence from databases. 6. Sequence alignment, Homology and construction of Phylogenetic tree.			15	15

Total-60 classes

Mode of Internal Assessment: -1. Sessional examination-15 marks

2. Field trip, Excursion Tour, Seminar, quiz, Home assignment- 15 marks

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