Semester - II

Biofertilizers, Biofuels and Biopesticides (NMEC)

Sub. Code: BNM202

Modules

Unit	Section	Topics	Lecture hours	Learning outcome	Pedagogy	Assessment/Evaluation
Biofertilizer						
I	1	Scope and importance of biofertilizers	1	To provide an insight on the importance of biofertilizers	Lecture Group Discussion	Formative assessment Assignment Quiz Short test
	2	Reasons for preference of biofertilizer to chemical fertilizer	1	To compare biofertilizers with chemical fertilizers	Lecture PPT	
	2	Biofertilizers using nitrogen fixing microbes	1	To learn more number of nitrogen fixing microbes	Lecture Video clippings	
	4	Mass Multiplication of *Azolla*	2	To produce Commercially available Biofertilizer using *Azolla*	Hands on training in the field	
Biofuel Production						
II	1	Major algal species for biofuel production	1	To know the important algae involved in biofuel production	Lecture and Hands on training	Assessing their practical knowledge in field work Short test
	2	Downstream processing for the biofuel production	2	To practice the production of biofuel	Lecture with video clippings and Hands on training	

	3	Advantages of biofuel production	1	To understand the need of future fuel	Lecture	
Vesicular Arbuscular Mycorrhizae (VAM) & Vermicomposting						
III	1	Isolation, multiplication,	1	To understand the importance of VAM fungi and its isolation	Lecture	Classroom quiz CIA
	2	Application Carrier-based inoculants, Quality control, agronomic importance.	2	To utilise the theory knowledge in the field by applying Carrier-based inoculants to crops	Lecture with hands on training in field	
	3	Methods and preparation of vermicomposting and its application.	3	To provide students with the knowledge and skills of preparation of vermicompost	Lecture with hands on training in field	
Biopesticides:						
IV	1	Advantages and disadvantages of biopesticides	1	To know the advantages and disadvantages of biopesticides	Lecture	Formative assessment Quiz
	2	Biological methods of pest control	1	To be aware of the biological methods to control pest	Lecture PPT	

	3	**Mode of action of *Bacillus thuringiensis*.**	2	To learn how the bacterium *Bacillus thuringiensis* works as a pest biocontrol	Lecture, Video clippings and Hands on Training	
Biological Control						
V	1	Microbial control of plant pathogens- *Trichoderma*	1	To understand the importance of Microbial control of plant pathogens	Lecture with Hands on Training	Formative assessment Assignment Quiz Short test
	2	Use of Baculovirus and protozoa in biological control.	2	To know the use of Baculovirus and protozoa in biological control measures	Lecture with Hands on Training	
	3	Use of fungi in biological control	2	To realise the importance of fungi as biocontrol	Lecture	

Course Instructor: Dr. C. Anitha HoD: C. Jespin Ida

Major Core III - Archegoniate
Course. Code: BC2031

Modules

Total contact hours: 60 (Including lectures, assignments and tests)

Unit	Section	Topics	Lecture hours	Learning outcome	Pedagogy	Assessment/ Evaluation
Bryophytes						

I	1	Unifying features of Bryophytes, transition to land habit	2	To analyse the unifying factors of bryophytes	Lecture PPT	Short test Assignment

				and its transition to land		Quiz Open Book Test
	2	Classification by Rothmaler (1951).	1	To understand the basics of classification of bryophytes	Lecture Group Discussion	
	3	Distribution, systematic position, morphology, anatomy, reproduction and life cycle of *Marchantia*	2	To learn about the *Marchantia*	Lecture, Demonstration with live specimen	
	4	Distribution, systematic position, morphology, anatomy, reproduction and life cycle of *Polytrichum*	2	To understand a type specimen of bryophyte- *Polytrichum*	Lecture Slides and Specimen of *Polytrichum*	
	5	Ecological and economic importance of Bryophytes.	2	To analyse the importance of bryophytes to ecology and economy	Lecture PPT	
Pteridophytes						
II	1	General characteristics of Pteridophytes	2	To understand the characteristics of Pteridophyta	Lecture	Class test Assignment Formative assessment Quiz Open Book Test
	2	Classification by Smith (1955) and life cycle patterns.	4	To analyze the classification of Pteridophyta and its life cycle patterns	Lecture PPT	

	3	Distribution, systematic position, morphology, anatomy, reproduction and life cycle of *Psilotum*	3	To learn about *Psilotum*	Lecture Video Specimen of *Psilotum*	
Pteridophytes						
III	1	Distribution, systematic position, morphology, anatomy, reproduction and life cycle of *Selaginella*	3	To understand a type specimen of Pteridophyte - *Selaginella*	Lecture Demonstration with *Selaginella*	Class test Assignment Formative assessment Quiz Open Book Test CIA-I
	2	Distribution, systematic position, morphology, anatomy, reproduction and life cycle of *Marsilea*	3	To be familiarize with Marsilea	Lecture With slides and specimen of *Marsilea*	
	3	Heterospory, seed habit, stelar evolution and types of stele.	1	To learn about Heterospory, seed habit, stelar evolution and types of stele.	Lecture Group Discussion	
	4	Ecological and economical importance of Pteridophytes.	3	To understand the importance of Pteridophytes to ecology and economy.	Lecture PPT	
Gymnosperms						
IV	1	General characteristics of Gymnosperms	1	To learn about general characteristics of Gymnosperms	Lecture PPT	Class test Assignment

	2	Classification by Chamberlain (1935).	2	To understand the classification of Gymnosperms	Lecture Group Discussion	Formative assessment Quiz Open Book Test
	3	Distribution, systematic position, morphology, anatomy and reproduction of *Pinus*	3	To understand a type specimen of gymnosperms - *Pinus*	Lecture Field Visit	
	4	Ecological and economical importance of Gymnosperms.	3	To understand the importance of Gymnospermsto ecology and economy.	Lecture Video	
	Fossils					
V	1	Geological time scale.	1	To introduce the students to geological time scale	Lecture Video	Class test Assignment Formative assessment Quiz Open Book Test CIA-II
	2	Fossils –Types and methods of fossilization and importance of fossils.	3	To understand the importance and types of fossils and its methods	Lecture PPT	
	3	Distribution, systematic position, morphology, anatomy and reproduction of *Rhynia*	2	To understand fossil with the study of*Rhynia*	Lecture PPT	

	4	Distribution, systematic position, morphology, anatomy and reproduction of *Lyginopteris*.	3	To analyze about a fossil *Lyginopteris*.	Lecture with slide of *Lyginopteris*.	
	2	Fossils –Types and methods of fossilization and importance of fossils.	3	To understand the importance and types of fossils and its methods	Lecture PPT	

Course Instructor: Dr.A. Anami Augustus Arul **HOD: Dr. C. Jespin Ida**

Major – Elective I (a) Herbal Botany
Subject code:BC2032

Modules
Total contact hours: 60 (Including lectures, assignments and tests)

Unit	Section	Topics	Lecture hours	Learning outcome	Pedagogy	Assessment/Evaluation
knowledge on Ethnomedicine						
I	1	History and scope of Herbal medicines, Brief Knowledge on-Ayurveda, Siddha, Unani and Homeopathy.	5	Tohave an insight into the herbal medicine and the underlying principles and practices	Lecture Group Discussion	Classroom quiz Short test Formative assessment Quiz Evaluation through find out the ethnomedicinal plants
	2	Brief knowledge on Ethnomedicine	4	To provide a thorough	Lecture with PPT	

		, Most commonly used Ethnomedicinal plants of Kanyakumari District.		understanding of ethnomedicine.		
Folk medicines						
II	1	Folk medicines including grandmother medicinal practices for common ailments like cold, fever, cough, diarrhoea	3	To practice the grandmother medicinal practices	Lecture Demonstration and Hands on training	Assignment Quiz Practical knowledge Formative Assessment
	2	Introduction to Ayurvedic formulations with methods of preparation: Churna, Arishta, Taila and Lehyam.	3	To produceAyurvedic formulations	Lecture Demonstration and Hands on training	
	3	Skin and hair care: Herbal preparation of oils, shampoos and powders.	2	To produce herbal products of skin and hair care	Lecturing with PPT	
Drug yielding plants						
III	1	Botanical name, family, morphology of medicinally importance of useful parts, active principles	4	To identify medicinal plants and understand the effects of plant chemical constituents on humans.	Lecture with presentation	Class test Quiz Formative assessment Short test Formative assessment

		and utilization of *Catharanthus roseus, Ocimum sanctum,Curcuma longa*and *Centella asiatica*.				CIA-I
	2	Drug yielding plants: therapeutic and habit forming drugs with special reference to *Cinchona officinalis, Withaniasomnifera*, and *Cannabissativus*	5	To understand the therapeutic and habit forming drugs	Lecture cum demonstration using live specimen	
IV Physio chemical properties of herbal drugs.						
	1	Evaluation and standardization of herbal drugs. Physio chemical properties - Ash, Flurosence analysis.	3	To provide students with the knowledge and skills concerning authentication and quality assurance of medicinal plants	Lecture Group Discussion	Short test Assignment Formative assessment Quiz Assessing their practical knowledge Mini Projects
	2	Analytical pharmacognosy: Drug adulterationand detection.	2	To identify some of the common food adulterants	Lecture PPT Demonstration	

	3	Phytochemical screening tests for secondary metabolites (alkaloids, flavonoids, steroids, terpenoids and phenolic compounds).	4	To identify the secondary metabolites through simple tests.	Lecture Hands on Training	
Cultivation and utilization of medicinal plants						
V	1	Cultivation, harvesting, processing, storage, marketing and utilization of medicinal plants - *Trigonella foenum-graecum*(Seed),*Adathodavasica*(Stem)	4	To understand the cultivation methods, collection, storage and uses of *Trigonella foenum-graecum* and *Adathodavasica*	Lecturing Field Visit	Multiple choice questions Formative assessment Evaluation through short test Assignment CIA-II
	2	Cultivation, harvesting, processing, storage, marketing and utilization of medicinal plants Rhizome – *Zingiber officinale*	2	To understand the cultivation methods, collection, storage and uses of *Zingiber officinale*		
	3	Conservation of medicinal plants: *in situ* and *ex situ.*	3	To distinguish between*in situ* and *ex situ..*	Lecturing with PPT	

Course Instructor: Dr. A.R. Florence **H.O.D: C. Jespin Ida**

Semester - IV

Major Elective – II (a) Biological Resources

Sub. Code: BC2042

Unit	Section	Topics	Lecture hours	Learning outcome	Pedagogy	Assessment/ Evaluation

Biofertilizer						
I	1	Brief introduction of biological resources and types. Biofertilizers: Scope and importance.	2	To Know the scope and importance of biofertilizers.	Lecture	Formative assessment Assignment Short test Assessing their creative knowledge Assessing their practical knowledge Quiz
	2	Bacteria –*Rhizobium* – mass production and uses.	1	To understand the methods of Mass production of *Rhizobium*	Lecture Video clippings,	
	3	Algae- *Nostoc* - mass production and application.	2	To be familiarize with various methods and application of Mass production of *Nostoc*	Lecture Illustrations	
	4	Pteridophyte *Azolla*- mass production and application.	2	To know the novel methods of mass production of	Lecture PPT presentation	
	5	Vermicompost – Mass production and application.	2	To know the importance of vermicompost	Lecture, PPT, demonstration	
Mass Cultivation						
II	1.	Single Cell Protein and Mycoprotein: Sources of single cell protein, Nutritive value of single cell protein.	2	To understand the sources and Nutritive value of single cell protein.	Lecture' Images	Formative assessment Assignment Short test Assessing their creative knowledge Assessing their practical knowledge Quiz Field Visit
	2.	Mass Cultivation of *Spirulina*.	2	To distinguish the Mass production of *Spirulina*.	demonstration	
	3.	Mushroom Cultivation-*Pleurotus* and *Agaricus*,	3	To develop the Mass cultivation of *Pleurotus* and *Agaricus* mushroom	demonstration	
	4.	Nutritional values and value-added products.	2	To realize the Nutritional values and value-added products.	Lecture with images	

Forest Cover, Management and Conservation						
III	1	Forest cover, forest resources – Utility (Major and Minor Products) and Values of forests:	3	To recall the Forest cover and forest resources	Video clippings	Formative assessment Assignment Short test Assessing their creative knowledge Assessing their practical knowledge Quiz
	2	Commercial benefits, ecological benefits and aesthetic benefits.	3	To know to value the uses of forests	Lecture, PPT	
	3	Forest management and conservation - Regeneration - Tending operations - Sustainable utilization of forest resources.	3	To realize the various benefits of forests	Lecture	
Biofuels						
IV	1.	Biofuels: Importance of biofuel	2	To understand Importance of biofuels	Lecture	Formative assessment Assignment Short test Assessing their creative knowledge Assessing their practical knowledge Quiz
	2.	Biodiesel Production – *Pongamia* and *Jatropha*.	2	To extract the production of Biodiesel from plants	Lecture with PPT	
	3.	Alcohols – liquid fuel- bioethanol production.	2	To know the liquid fuel produced from ethanol	Lecture with Video clippings	
	4.	Gaseous fuels: Biogas production and Hydrogen fuel.	3	To develop biogas fuel from organic wastes and study the hydrogen fuel.	Lecture with demonstration	
Biopesticides						
V	1	Biopesticides: Introduction, desirable qualities of biopesticides.	2	To realize the importance of biopesticides	Lecture	Formative assessment Assignment Short test

	2	Microbial Pesticides – fungi, viruses and bacteria.	2	To understand the activity of Microbial Pesticides	Lecture, PPT,	Assessing their creative knowledge Assessing their practical knowledge Quiz
	3	Advantages and disadvantages of Microbial Pesticides,	3	To analyze the advantage and disadvantage of Microbial Pesticides	Lecture, PPT,	
	4	Application of Biopesticides.	2	To apply biopesticides to various plants	Lecture, group discussion	

Elective - II (b) Food Science

Sub. Code: BC2043

Module

Total contact hours: 60 (Including lectures, assignments and tests)

Unit	Section	Topics	Lecture hours	Learning outcome	Pedagogy	Assessment/ Evaluation
Food science						
I	1	Definition, aim, constituents of food and their value.	1	To understand the constituents of food and their value.	Lecture	Short test Assignment Formative assessment Quiz Open Book Test
	2	Energy value ofbalanced diet, carbohydrates, proteins, lipids, enzymes and vitamins.	3	To analyse the Energy value ofbalanced diet	Lecture, PPT	
	3	Cooking- Objectives of cooking, Preliminary	2	To be familiarize with objectives of	Lecture, PPT	

		preparations		cooking		

	4	Cooking methods, (Moist heatmethods, Dry heat methods, Microwave cooking, Solar cooking).	3	To learn about cooking methods	Lecture Video	
Food colourants and Food additives						
II	1	Food colourants - Natural, Artificial and Safety measures of food additives.	2	To study the different types of food colourants	Lecture Video	Class test Assignment Formative assessment Quiz Open Book Test
	2	Special flavours: Spices and Condiments.	2	To understand about spices and condiments	Lecture PPT	
	3	Food additives – Sweeteners, Emulsifiers and Stabilisers, Antioxidants, Flavour improvers	2	To learn about different types of condiments	Lecture Video	
	4	Fermented Food Products: Milk (butter and cheese), Vegetable (sauerkraut and cucumber).	2	To analyse the fermented products of milk	Lecture Group Discussion	
	5	Food Enrichment - Fortification.	1	To be familiar with fortification	Lecture with chart	
Preparation of Jam, Jelly, Squash and Pickle						
III	1	Preparation of Jam: Tomato and Pineapple	2	To understand about the preparation of jam	Lecture PPT	Class test Assignment Formative assessment Quiz
	2	Preparation of Jelly: Grapes and Plums	3	To be familiarize with the process of	Lecture PPT	

				preparation of jelly		Open Book Test CIA-I
	3	Preparation of Squash: Grapes and Mango	2	To understand the science behind squash preparation	Lecture Group Discussion	
	4	Preparation of Pickle: Gooseberry and Lemon	3	To learn the preservation gooseberry and lemon by pickling.	Lecture Practical Preparation	
Food Preservation						
IV	1	Food preservation: Aims and objectives of preservation & processing of foods, Foodspoilage	2	To learn the process of food preservation	Lecture PPT	Class test Assignment Formative assessment Quiz Open Book Test
	2	Methods of food preservation – preservation by low (freezing, types of freezing i.e.slow freezing, quick freezing, introduction to thawing, changes during thawing and its effecton food).	3	To understand method of preservation by low temperature	Lecture PPT	
	3	Methods of food preservation – preservation by high temperature (Sterilization, Pasteurization, and Blanching).	3	To realize the method of preservation by high temperature	Lecture PPT	

	4	Canned food.	1	To learn the process of canning food	Lecture Group Discussion	
	Beneficial microorganisms in Agriculture					
V	1	Industrial production of the following:Alcoholic beverages –Beer and Wine	5	To introduce the students with alcoholic beverages	Lecture Video	Class test Assignment Formative assessment Quiz Open Book Test CIA-II
	2	Industrial production of the following:Non-alcoholic beverages - Coffee and Tea.	4	To understand the industrial production of coffee and tea	Lecture PPT	

Course Instructor: Dr. A. Anami Augustus Arul **H.O.D: C. Jespin Ida**

Elective – II (c) Biodiversity and Human Welfare
Sub. Code: BC2044

Modules

Total contact hours: 60 (Including lectures, assignments and tests)

Unit	Section	Topics	Lecture hours	Learning outcome	Pedagogy	Assessment/ Evaluation
Biodiversity						
I	1	scope and types of Genetic diversity	2	To understand the different types of genetic diversity	Lecture Group discussion	Short test Quiz Formative assessment Assignment
	2	species diversity and ecosystem biodiversity.	2	To know the types of species and ecosystem biodiversity	Lecture	

	3	Agro biodiversity and cultivated plant taxa, wild taxa.	3	To learn about the agrobiodiversity and cultivated and wild taxa	Lecture PPT,	
	4	Values of biodiversity; Ethical and aesthetic values of biodiversity	2	To understand the ethical and aesthetic values of biodiversity	Lecture video	
Biodiversity Hot spots						
II	1	History and origin of hotspots.	1	To learn the history and origin of hotspots	Lecture Group discussion	Group discussion Formative assessment Short test Assignment
	2	Critical role of hotspots in species richness and endemism.	2	To understand the role of hotspots	Lecture PPT	
	3	Biodiversity in tropics, National biodiversity hotspots, hottest biospots of Western Ghats,	3	To be familiarize with the biodiversity hotspots and hottest biospots	Lecture	
	4	Biodiversity of Tamilnadu.	3	To realize the biodiversity of Tamilnadu	Lecture video	
Economical values of biodiversity						
III	1	Economical values of biodiversity-plants, animals and microbes.	3	To study the values of biodiversity	Lecture	Class test Formative assessment Quiz Short test CIA-I
	2	Loss of genetic diversity, loss of species diversity, loss of ecosystem diversity, loss of agro biodiversity,	3	To realize the loss of different biodiversity.	Lecture PPT	
	3	Consequences and implications;	1	To learn the consequences and implications of biodiversity	Lecture PPT	
	4	projected scenario for biodiversity loss.	2	To understand the projected scenario for biodiversity loss.	Lecture	

Organizations associated with Biodiversity management						
IV	1	IUCN, UNEP, UNESCO, WWF, NBPGR, CITES and CBD;	4	To study about the various organizations associated with biodiversity management	Lecture, PPT	Quiz Class test Assignment Formative Assessment
	2	National Biodiversity Authority,	2	To understand about the National Biodiversity Authority	Lecture	
	3	Nature Conservation Foundation. Rio de Janeiro, 2012	3	To know about the Nature Conservation Foundation	Lecture, PPT	
Conservation of Biodiversity						
V	1	Role of NGOs in biodiversity conversation,	2	To understand the Role of NGOs	Lecture	Quiz Assignment Group discussion Class test CIA-II
	2	Conservation of genetic diversity, species diversity and ecosystem diversity,	3	To study the conservation of diversity	Lecture, PPT	
	3	in situ and ex situ conservation, social approaches for conservation,	2	To learn about the conservation of biociversity	Lecture, PPT Video	
	4	biodiversity awareness programmes, sustainable development.	2	To realise the importance of awareness programmes	Lecture	

Course Instructor: Dr. A.R. Florence **H.O.D: C. Jespin Ida**

Allied II- Theory

Plant Diversity – II (Gymnosperms, Angiosperms) and Plant Physiology

Subject Code: BA2041

Unit	Module	Topics	Lecture hours	Learning outcome	Pedagogy	Assessment / Evaluation
Gymnosperms						

I	1	General characteristics of Gymnosperms.	1	To analyse the General characteristics of Gymnosperms	Lecture	Formative assessment Assignment Short test Assessing their creative knowledge Quiz
	2	Distribution, Systematic Position, Morphology, Anatomy of *Pinus*.	3	To understand the morphology and anatomy of *Pinus*	Lecture Video clippings	
	3	Reproduction and Life History of *Pinus*.	3	To be familiar with reproduction and life history of *Pinus*	Lecture Illustrations	
	4	Economic importance of Gymnosperms.	2	To be familiarize with the importance of gymnosperms	Lecture PPT presentation	
Morphology						
II	1	Morphology of root, stem,	3	To compare the different types of root and stem and its modification	Lecture with PPT	Formative assessment Assignment Short test Assessing their creative knowledge Quiz
	2	Morphology of leaf, inflorescence,	3	To realize the morphology of leaf and inflorescence	Lecture with Video clippings	
	3	Morphology of flower and fruit – their modifications.	3	To understand the morphology of flower and fruit	Lecture with live specimen	
Taxonomy						
III	1	Study of the following families and their economic	3	To compare the difference between	Lecture, PPT, demonstrati on	Formative assessment Assignment Short test

		importance- Brassicaceae, Rutaceae,		Brassicaceae and Rutaceae		Assessing their creative knowledge Quiz
	2	Study of the following families and their economic importance - Lamiaceae, and Arecaceae	3	To recall the importance of Lamiaceae and Arecaceae	Lecture, PPT, demonstration	
	3	Study of the following families and their economic importance - Euphorbiaceae	3	To know the family details of Euphorbiaceae	Lecture, PPT, demonstration	
Photosynthesis						
IV	1	Pigment systems	2	To understand the structure and uses of pigment systems	Lecture	Formative assessment Group discussion Short test Quiz
	2	Light dependent (cyclic and non-cyclic photophosphorylation)	3	To understand the light dependent photosynthesis	Lecture with PPT	
	3	Light independent (C_3cycle).	3	To corelate light independent photosynthesis	Lecture with Video clippings	
	4	Factors affecting photosynthesis.	1	To know the factors affecting photosynthesis	Lecture with demonstration	
Respiration and Phyto hormones						
V	1	Anaerobic (Fermentation), Glycolysis	2	To understand the different types of anaerobic respiration	Lecture PPT,	Group discussion Formative assessment, Quiz Short test
	2	Aerobic (Kreb's cycle)	2	To realize the importance of Kerb's cycle	Lecture, video	

	3	Electron Transport System and Oxidative phosphorylation.	2	To analyze electron Transport System and Oxidative phosphorylation.	Lecture with Video clippings	
	4	Factors affecting respiration.	1	To understand the factors affecting respiration	Lecture, Group discussion	
	5	Physiological role of auxins, gibberellins and ethylene.	2	To learn about the physiological role of auxins, gibberellins and ethylene.	Lecture PPT	

Course Instructor: Dr. A. Anami Augustus Arul **HoD: Dr. C. Jespin Ida**

Major Core VIII - Genetics, Biostatistics and Bioinformatics
Sub. Code: BC2061

Number of Hours Per week	Number of Credits	Total Number of Hours	Marks
6	6	90	100

Objectives: 1. To have knowledge of Mendelian and non-Mendelian inheritance.

2. Develop skills in data tabulation, its treatment, analysis and interpretation of data.

3. Introduce the vast repositories of biological data knowledge.

CO	Upon completion of this course the students will be able to :	PSO addressed	CL
CO – 1	understand Mendelian principle and predict genetic inheritance patterns.	PSO - 1	U
CO – 2	analyze the facts of non-Mendelian inheritance and have conceptual knowledge on alleles and their linkage.	PSO - 3	Ap
CO – 3	examine the various stages of cell division and also a clear knowledge on DNA structure.	PSO - 3	U
CO – 4	generate biological interpretations and conclusions from data of scientific research.	PSO -3	C
CO – 5	develop skills to become employable as professionals in biochemical industries.	PSO - 5	C

Unit	Module	Topics	Lecture hours	Learning outcome	Pedagogy	Assessment/ Evaluation
I GENETICS AS A SCIENCE						
	1	History, Experiments of Mendel with *Pisum sativum*, Principles of inheritance, Mendelian laws-monohybrid	3	To differentiate monohybrid and dihybrid	Lecture, Problem based learning	Class test, Group Discussion, Quiz.

		and dihybrid cross, test cross and back cross (Assignment)		crosses and solving the related problems		
	2	Modification of Mendelian ratio: Incomplete dominance – *Mirabilis jalapa,*Co-dominance – MN blood group in man	3	Able to solve the problems in incomplete dominance and co-dominance	Lecture, Problem based learning	
	3	Lethal genes: Dominant lethality - Coat colour in Mice, Recessive lethality – Chlorophyll content in Maize. (Seminar)	3	To distinguish dominant and lethal genes	Lecture, PPT, Problem based learning	
	4	Genetic interaction: Dominant Epistasis – fruit colour in summer squashes, Recessive epistasis – coat colour in mice;Complementary genes – flower colour in sweet pea.Non-epistasis - comb pattern in Fowls	2	To learn about interaction of genes and solve the problems	Lecture, PPT, Problem based learning	
II LINKAGE AND CROSSING OVER						
	1	Sex Linked inheritance (eye colour in *Drosophila*) Polygenic inheritance with reference to (ear length in maize)		To understand the basics of inheritance and solve the problems	Lecture, Charts, problem solving	Diagrammatic representation, Short test.

	2	Multiple alleles -ABO blood group in man, Rh factor. Non-Mendelian inheritance		To distinguish mendelian and non-mendelian inheritance	Lecture, Models	
	3	Extra-chromosomal inheritance: chloroplast mutation –variegation in 4 O'clock plant; mitochondrial mutations in yeast. Maternal effects – shell coiling in snail		To evaluate the mutation patterns in chloroplast and mitochondria	Lecture, PPT	
	4	Linkage: Morgan's views on linkage, crossing over – types, mechanism of crossing over and its significance		To understand and differentiate linkage and crossing over	Lecture, Video Clippings, Problem solving	
	5	Holliday model for genetic recombination.		To analyse the recombination patterns	Lecture, Video clippings	
CELL CYCLE AND NUCLEIC ACIDS						
	1	Cell division (mitosis and meiosis), Significance of mitosis and meiosis.	3	To understand and differentiate the mechanisms of	Lecture, PPT, Chart	Short test, Question – Answer session, Group discussion, Continuou

				mitosis and meiosis		s Internal Assessment I (CIA - I).
	2	Chromosomes: Chromosome morphology – (metacentric, submetacentric, acrocentric and telocentric) and Chromosome. Structure, Special type of chromosomes: giant chromosomes (salivary gland chromosomes, Lamp brush chromosomes), supernumerary chromosomes (B chromosome).	3	To analyse the different patterns of chromosome with special reference to giant chromosomes	Lecture, Models	
	3	Brief account on Nucleic acids; DNA as the genetic material: Griffith's and Avery's transformation experiment, Hershey – Chase bacteriophage experiment,RNA as the carrier of genetic information (Fraenkel-Conrat). DNA Structure (Watson and Crick) Salient features of double helix	3	To understand the basics of nucleic acids with experiments	Lecture, PPT	
	4	,Types of RNA: structure and functions of mRNA, rRNA and tRNA.	3	To differentiate the different forms of RNA	Lecture, Charts, PPT	
IV BIOSTATISTICS						
	1	Importance of statistics in Biology, sampling - random sampling, collection and interpretation of data,	3	To know and practice the basics of	Lecture, Problem solving	Quiz, Group discussio

		tabulation		biostatistics		ns
	2	Presentation of data - frequency distribution, frequency curve, frequency polygon, histogram and bar diagrams	3	To understand the data presentation with graphical representation	Lecture, PPT, Problem solving	
	3	Measures of central tendencies -mean, median and mode. Measures of dispersion – standard deviation, standard error (Seminar)	3	To acquire skills to solve probems based on measures of central tendencies and dispersion	Lecture, Problem solving	
	4	Null hypothesis - Chi - square test.	3	To evaluate the test of significance in various data	Lecture, PPT, Problem solving	
V BIOINFORMATICS						
	1	Aims and scope and applications- Virtual library, e-books and e- journals	3	To understand the concepts of bioinformatics	Lecture, PPT	Multiple Choice Questions, Group discussions, Computer analysis, Continuous Internal
	2	Major areas of biological data bases- classification; primary, secondary, specialized	3	To differentiate the different forms of of biological data bases	Lecture, PPT	

	3	Importance data bases- NCBI, SWISS-PROT, DDBJ	3	To construct the databases in computers	Lecture, Video clipping, Compute r teaching practices	Assessment II (CIA -II).
	4	Tools and softwares in Bioinformatics – similarity search – BLAST – FASTA sequence alignment tools. Application of Bioinformatics.	3	To evaluate and practice the softwares of bioinformatics	Lecture, Video clipping, software analysis	

Course Instructor: Dr. J. Albino Wins HOD: Dr. Anami Augustus Arul

Major Core IX - Biotechnology and Molecular Biology

Sub. Code: BC2062

Number of Hours Per week	Number of Credits	Total Number of Hours	Marks
6	6	90	100

Objectives: 1. To learn and apply the general principles of biotechnology and ensure adequate training in modern biotechnology.

2. To understand the various steps in DNA replication, protein synthesis and gene regulation in prokaryotes.

3. To gain knowledge on different types of IPR.

CO	Upon completion of this course the students will be able to:	PSO addressed	CL
CO – 1	acquaint the core concepts and fundamentals of plant biotechnology.	PSO – 1	U
CO – 2	develop competency on different types of plant tissue culture.	PSO – 3	Ap
CO – 3	understand the mechanisms of genetic information.	PSO –1	U
CO – 4	get an insight of chromosome abnormalities and related human syndromes.	PSO –7	An
CO – 5	develop skills to become employable as professionals in Biotechnology Industries.	PSO –7	C

Unit	Section	Topics	Lecture hours	Learning outcome	Pedagogy	Assessment/Evaluation
Unit I						
	1	Definition and scope of biotechnology, Principles of recombinant DNA technology, Steps and Applications of rDNA technology;	3	To understand the importance of recombinant molecules	Lecture with PPT	Group discuss ion Assignment Quiz Continuous Internal Assessment Class test
	2	Restriction Enzymes – Nomenclature and	3	To learn and categorize different types of restriction	Lecture with PPT	

		Classification; Cloning Vectors - Plasmids,Cosmids , Phagemidsand shuttle vectors;		enzymes and cloning vectors		
	3	DNA cloning - Steps and Applications;	3	To understand the steps and importance of DNA cloning	Lecture with PPT	
	4	Basic techniques – Agarose gel electrophoresis, Northern blotting, Southern blotting and RFLP.	3	To know the different separation techniques	Lecture with PPT	
Unit II						
	1	Scope and importance of plant tissue culture, Totipotency of cells, Tissue culture laboratory-organization and requirements,	3	To practice the plant tissue culture, Sterilization techniques and Culture media preparation in laboratory	Lecture Demonstration and Hands on training	Group discuss ion Assignment Quiz Continuous Internal Assessment Class test Slip test
	2	MS medium composition and preparation;	3	To know the preparation of MS medium.	Lecture, demonstration Demonstration and Hands-on training	
	3	Sterilization techniques; Types of tissue culture - Callus culture, apical meristem culture, Micropropagation and Protoplast culture;	3	To provide students with the knowledge and skills of sterilization and propagation of explants.	Lecture Demonstration and Hands-on training	
	4	Artificial seed: production, applications and limitations; Cryopreservation techniques.	3	To understand artificial seed production and cryopreservation techniques	Lecture PPT	
Unit III						
	1	General Features of DNA Replication: General principles –semi-	4	To learn different methods of DNA replication.	Lecture PPT	Group discuss ion Assignment Quiz Continuous

		conservative and semi discontinuous replication; Semi conservative model of replication – Watson and Crick,				Internal Assessment Class test Short test
	2	DNA damage; DNA repair mechanism. Photoreactivation, Mismatch repair;	3	To learn DNA damage and different repair mechanisms.	Lecture PPT	
	3	Mutations – Gene mutation and Chromosomal mutation; Mutagens; Chromosomal abnormalities- Down Syndrome and Klinefelter Syndrome.	5	To know about mutations and its effects.	Lecture and PPT	
Unit IV						
	1	Genetic code and wobble hypothesis;	2	To learn the characteristics of genetic code and wobble hypothesis.	Lecture and PPT	Group discuss ion Assignment Quiz Continuous Internal Assessment Class test Short test
	2	Transcription in prokaryotes and eukaryotes;	3	To understand the transcription in prokaryotes and eukaryotes	Lecture and video clippings	
	3	Assembly of ribosomes; Protein synthesis - initiation, elongation, and termination	3	To acquire knowledge on Protein Synthesis	Lecture and video clippings	
	4	Gene regulation in Prokayotes- Operon concept, Lac Operon; Transposons in Prokaryotes and Eukaryotes.	4	To understand gene regulation and transposons.	Lecture, PPT and video	
Unit V						
	1	DNA transfer techniques: Physical method (Microinjection), Chemical method (Calcium phosphate method), Electrical	4	To understand the Gene regulation, mutation and characteristics of codons	Lecturing With PPT	Group discuss ion Assignment Quiz Continuous Internal Assessment

		method (Electroporation);				Class test Multiple Choice Question
	2	Gene transfer in plants – Agrobacterium transformation;	2	To understand the Gene transfer methods	Lecturing with PPT	
	3	GM plants –Bt Brinjal, Bt Cotton,; Transgenic crops with improved quality traits in major crops (FlavrSavr tomato, Golden rice).	4	To learn about GM plants.	Lecture, PPT, and video	
	4	IPR – Scope and different kinds of IPR.	2	To get a brief knowledge of IPR.	Lecture and PPT	

Course Instructor: Dr. Bojaxa A. Rosy HOD: Dr. A. Anami Augustus Arul

Major Core X - Plant Physiology and Metabolism

Sub. Code: BC2063

Number of Hours Per week	Number of Credits	Total Number of Hours	Marks
6	5	90	100

Objectives: 1. Comprehend the fundamental concepts of plant physiology.

2. Describe the physiological mechanisms of plant growth, function, and development.
3. Recognize and describe how plants respond to their environment.

CO	Upon completion of this course the students will be able to:	PSO addressed	CL
CO – 1	understand water relation of plants with respect to various physiological processes.	PSO - 1	U
CO – 2	explaindeficiency symptoms of macro and micro nutrients in plants.	PSO –2	U
CO – 3	relate complementary metabolic pathways such as photosynthesis and respiration in energy acquisition.	PSO –1	An
CO – 4	analyse nitrogen metabolism and its significance.	PSO –1	An
CO – 5	assess dormancy and germination in plants.	PSO –1	An

Unit	Module	Topics	Lecture hours	Learning outcome	Pedagogy	Assessment/ Evaluation
I Plant and cell architecture						
	1	Importance of water to plant life.	3	To know about the basics and importance of water to plant life	Lecture PPT, Chart	Class test, Group Discussion, Slip test Quiz, Internal Assessment
	2	Physical properties of water; Imbibition, diffusion, osmosis and plasmolysis.	3	To understand the physical properties of water	Lecture Problem based learning	
	3	Concepts of water potential and its components. The Concept of the Soil Plant Atmosphere Continuum	3	To evaluate the concepts	Lecture PPT, Video clipping	

		(SPAC).		of water potential and the concept of SPAC	s	
	4	Transpiration –Definition, types of transpiration, structure and opening and closing mechanism of stomata; guttation and anti-transpirants. Factors affecting transpiration.	3	To analyze the process of transpiration and the factors influencing it.	Lecture, PPT	
II Mineral nutrition						
	1	Essential elements, micro and macronutrients; Criteria of essentiality of elements;	3	To understand the essentiality of elements to plants	Lecture Demonstration	Quiz, Class test, Short test, Internal Assessment Group Discussion Slip test
	2	General functions, specific role and deficiency symptoms of macronutrients (Nitrogen, Phosphorus, and Potassium) and micronutrients (Iron, Magnesium, Molybdenum and zinc)	3	To learn about the specific role and deficiency symptoms of micro and macronutrients	Lecture, PPT, Video clipping, Live specimen	
	3	Absorption and translocation of solutes (organic and inorganic) – active & passive uptake.	3	To analyze the absorption and translocation of solutes	PPT, Lecture, Video clipping	
	4	Hydroponics, types, aquaponics and significance.	3	To evaluate the mechanism and significance of hydroponics	Lecture, PPT, Demonstration	
III Photosynthesis						
	1	Photosynthesis: Importance of photosynthesis for food security and environment	2	To understand the importanc	Lecture PPT, Videos	Short test, Question – Answer session,

				e of photosynthesis		Group discussion, Continuous Internal Assessment Quiz
	2	Ultrastructure of chloroplast	1	To know the ultrastructure of chloroplast	Chart, PPT Models	
	3	Light reaction: Radiant energy, photosynthetic apparatus, light harvesting complex; light absorption, composition and characteristics of pigment systems, photosynthetic electron transport,	3	To know about the light reaction in photosynthesis	Lecture PPT Video clipping	
	4	Dark reaction: Carbon dioxide fixation in C3, C4 and CAM plants,	4	To understand the different types of dark reaction and its significance	Lecture Charts, PPT	
		Photorespiration and its significance, factors affecting photosynthesis.	2	To learn about photorespiration and the factors affecting respiration	Lecture, PPT, Video clippings	
IV Respiration						
	1	Ultrastructure of mitochondria, Aerobic and anaerobic respiration, cyanide independent respiration, Fermentation	3	To differentiate the different forms of respiration	Lecture, PPT	Short test, Question – Answer session, Group discussion, Continuous Internal Assessment Quiz
	2	Glycoysis, Krebs cycle and generation of ATP synthesis through oxidative electron transfer chain (cytochrome system)	3	To learn the generation of ATP through different process	Lecture, PPT, Charts	
	3	Chemiosmotic regeneration of ATP, Guconeogenesis, Factors affecting respiration	3	To know about chemiosmotic processes with	Lecture, PPT, Video clippings	

				exampes		
	4	Nitrogen nutrition, organic nitrogen, nitrogen fixation in microbes / legumes, nif genes and NOD factors, nitrate and ammonia assimilation, nitrogenase	**3**	To analyze the mechaniam of biological nitrogen fixation	Lecture, PPT, Video clippings	
V Plant Growth Regulators						
	1	Growth, Growth curve, Growth and development, phytochrome and light control, role of phytochrome in tropism, flowering and fruiting	3	To know the growth pattern of plants and the role of phytochromes	Lecture, PPT	Short test, Question – Answer session, Group discussion, Continuous Internal Assessment Quiz
	2	Physiological role of auxins, gibberellins, abscisic acid and ethylene	3	To understand the role of plant hormones with suitable examples	Lecture, Charts, PPT	
	3	Vernalization – dormancy of seeds, methods of breaking dormancy, mechanism of seed germination	3	To evaluate seed dormancy and seed germination process	Lecture, PPT	
	4	Plant response to environmental stresses – Polyamines, brassinosteroids and their functions	3	To analyse the response of plants to environmental stresses	Lecture, PPT	

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Semester - VI

Elective –IV (a) Marine Botany

Sub. Code: BC2064

Number of Hours Per week	Number of Credits	Total Number of Hours	Marks
4	3	60	100

Objectives: 1. Understand the diversity of marine organisms.

2. Learn about the marine plants and their medicinal property.

3. Acquire knowledge on marine pollution and conservation methods.

CO	Upon completion of this course the students will be able to:	PSO addressed	CL
CO – 1	describe the types of marine habitat and their relationship with environment	PSO - 1	R
CO – 2	compare the threats and conservation of seaweeds and sea grasses	PSO –4	An
CO – 3	evaluate how natural events and human activities affect coastal habitats	PSO – 4	Ev
CO – 4	create a broad knowledge about themarine products and their economic value	PSO – 5	C
CO – 5	describe the role of mangroves in conservation of marine flora and fauna.	PSO –4	U

Unit	Section	Topics	Lecture hours	Learning outcome	Pedagogy	Assessment/ Evaluation
I.	**Classification of Marine habitat**					
	1	Classification of marine habitat – pelagic, neritic and oceanic province, benthic – zonation	2	To classify the types of marine habitats	Lecture Video	Group discussion Assignment Quiz Continuous Internal Assessment Class test
	2	– shore environment – muddy, rocky and sandy, waves and tides deep sea bottom – pelagic deposits.	3	To understand the shore environment	Lecture	
	3	physical and chemical properties of sea water.	2	To learn the properties of sea water	Lecture PPT	
	4	Salt marshes and sand dune vegetation.	2	To be able to understand the	Lecturing with PPT	

				salt marshes and sand dunes.		
II. Marine biodiversity						
	1	phytoplankton- Nekton, Benthos. Marine Phytoplankton- Dino - flagellates, Nano-plankton, Ultra-plankton, marine bacteria, marine fungi, marine Lichens.	5	To study the marine organisms	Lecture PPT	Group discussion Assignment Quiz Continuous Internal Assessment Class test
	2	Threats and conservation of seaweeds and sea grasses.	4	To realize the importance of seaweeds and sea grasses	Lecture PPT Video	
III. Marine products						
	1	traditional uses - human food and agriculture.	4	To learn about the traditional uses of marine products	Lecture	Group discussion Assignment Quiz Continuous Internal Assessment Class test
	2	Isolation of agar–agar. Scope of the seaweed industry: Brown seaweeds as food, Red seaweeds as food.	4	To study the marine products	Lecture PPT Video	
	3	Medicinal uses of marine seaweeds and sea grasses.	1	To assess the medicinal importance of seaweeds and sea grasses	Lecture with PPT	
IV. Marine pollution:						
	1	Pollution due to heavy metals - radioactive wastes, thermal, sewage, algal blooms and oil spills –	5	To analyse the impact of marine pollution	Lecture, PPT	Group discussion Assignment Quiz Continuous Internal Assessment Class test
	2	possible remedies – oil eating bacteria – GMO and pollution abatement	4	To understand the remedies for marine pollution	Lecture. PPT	
V. Mangroves						
	1	Salient features of Rhizophora and Avicennia.	3	To know the salient features of selected mangroves	Lecture	Group discussion Assignment Quiz Continuous Internal Assessment
	2	Definition, distribution, stresses on mangroves, regeneration of mangroves,	3	To study the stress and	Lecture, PPT	

				regeneration of mangroves		Class t
	3	coral reefs – ecology, species interaction, economic importance and conservations.	3	To learn about the coral reefs	Lecture, PPT Video	

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HOD: Dr. A. Anami