

M.Sc., Botany

Teaching Plan

Department : Botany

Class : I M.Sc. Botany

Title of the Course : CORE COURSE III: TAXONOMY OF ANGIOSPERMS AND ECONOMIC BOTANY

Semester : II

Course Code : BP232CC1

Course Code	L	T	P	Credits	Inst. Hours	Total Hours	Marks		
							CIA	External	Total
BP232CC1	2	3	-	4	5	60	25	75	100

Objectives

- To learn about the basic concepts and principles of plant systematics.
- To gain knowledge about the importance of taxonomic relationships in research of plant systematics.

Course outcomes

CO	Upon completion of this course, the students will be able to:	PSO addressed	Cognitive level
CO - 1	Recollect the basic concepts of morphology of leaves, flowers. Identify the types of compound leaves, inflorescence and fruits. Describe their characteristic features	PSO - 1	K2(U)
CO - 2	Explain the principles of taxonomy. Summarize the taxonomic hierarchy. Define Binomial nomenclature. Group Activity -Construct key preparation	PSO - 2	K3(A)
CO - 3	Explain the various types of classification. Distinguish its advantages and disadvantages. Construction of floral formula and floral diagram.	PSO - 3	K5(E)
CO - 4	Illustrate and explain the characteristic features and list out the economic importance of the families Field trip to	PSO - 3	K5(E)

	local botanical garden and regional botanical garden.		
CO - 5	Illustrate and explain the characteristic features and list out the economic importance of the families.	PSO - 3	K1(R)

Teaching plan

Total Contact hours: 90 (Including lectures, assignments and tests)

Unit	Module	Topic	Teaching Hours	Cognitive level	Pedagogy	Assessment/ Evaluation
I	1	Botanical exploration and contribution with special reference to India by William Roxburgh, J.D. Hooker, Robert Wright, Nathaniel Wallich and Gamble, J.S.	3	K2(U)	Lecture using Chalk and talk Introductory session,	MCQ, Quiz, Essay Short summary MCQ, Quiz, Short Essay, True or false Discussion, Debating or Presentations Essay
	2	Principles of classification as proposed – Artificial – Linnaeus,	3	K2(U)	Interactive PPT, Lecture with videos	
	3	Natural – Bentham and Hooker, Phylogenetic system - Hutchinson, Modern – Takhtajan	3	K1(R)	Discussion forum (google classroom, mentimeter)	
	4	Botanical gardens and herbaria of world	3	K3(Ap)	E- content , Lecture with M.s word & external links	
	5	preparation and maintenance of Herbarium	3	K4(An)	Demonstration, Integrative teaching	
II	1	Modern trends in taxonomy, chemotaxonomy, numerical taxonomy, biosystemics	3	K1(U)	Inquiry based approach	Definitions, MCQ, Essay, Discriminating the concepts Explain, Concept with examples, short essay Seminar,
	2	ICBN uninominal systems- genesis binomial nomenclature, importance and principle.	3	K2(R)	Lecture using you tube videos, Group discussion	
	3	Important articles, typification, principles of priority.	3	K3(An)	Discussion forum (google classroom, mentimeter)	
	4	Effective and valid publication, author citation, recommendations and amendments of code.	3	K3(Ap)	Discussion forum (google classroom, mentimeter, Whatsapp poll)	
	5	Glossories and dictionaries, Taxonomic	3	K4(An)	Group discussion, Experimental	

		literature (Index Kewensis)			demonstration	
III	1	Nympheaceae, Sterculiaceae	2	K1 (U)	Flipped classroom, Group discussion	MCQ, Concepts, short essay Diagrammatic representation, Essays
	2	Portulacaceae, Rhamnaceae, Vitaceae	2	K4(An)	PPT & you tube Videos, Computational techniques	
	3	Sapindaceae, Combretaceae, Turneraceae.	2		Interactive PPT presentation,	
IV	1	Sapotaceae, Oleaceae, Boraginaceae	3	K1(U)	Lecture using Chalk and talk , E-content(M.s-word	MCQ, Quiz, Group discussion, Differentiating the characters, short essays Summarize, Essays, diagrammatic representations Essays,
	2	Bignoniaceae, Convolvulaceae, Acanthaceae, Verbenaceae.	5	K2(R)	Discussion forum (google classroom, mentimeter)	
	3	Nyctaginaceae, Aristolochiaceae, Casuarinaceae	4	K3(Ap)	Review, Lecture using Interactive PPT Videos	
	4	Orchidaceae, Amarylidaceae, Lilliacae, Commelinaceae, Cyperaceae	3	K4(An)	Lecture using PPT & you tube Videos, Computational techniques	
V	1	Cereals (rice and wheat) – (ii) Pulses (red gram and black gram), (iii) Drug yielding plants (<i>Withaniasomnifera</i> and <i>Coleus aromaticus</i>) (iv) Oil yielding plants	5	K3(Ap)	Group Discussion,	Short essays, MCQ, Quiz, True or false, Assignments Short essays, MCQ, Summarize, Slip test
	2	Sugar yielding plants (sugarcane and sugar beet), (vi) Spices and condiments (cardamom, cinnamon). (vii) Commercial crops - fibre (jute), (viii) Timber	5	K4(Ap)	Group Discussion	
	3	Resins and gums (Asafoetida and gum arabic) – (x) Essential oils (lemon grass and menthol), (xi) Beverages (tea, coffee), (xii) Plants used as avenue trees for shade,	5	K5(Ev)	Group Discussion,	

		pollution control and aesthetics (xiii) Energy plantation - uses of Casuarina				
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Course Focussing on Employability/ Entrepreneurship/ Skill Development : Skill Development

Activities (Em/ En/SD):

Course Focussing on Cross Cutting Issues (Professional Ethics/ Human Values/Environment Sustainability/ Gender Equity): Environment Sustainability

Activities related to Cross Cutting Issues:-

Assignment: Taxonomic literature (Index Kewensis).

Seminar Topic: General account on utilization of selected crop plants: (i) Cereals

Sample questions (minimum one question from each unit)

Part A

- _____ is the system which is responsible for giving name to an organism.
- This system of classification was used by Linnaeus
 - Phylogenetic system
 - Natural system
 - Artificial system
 - asexual system
- The substitute for the newly collected specimen when the original type material is missing in a herbarium is entitled as
 - Holotype
 - Neotype
 - Lectotype
 - Isotype
- Expand ICN
- Fruit in family Polygalaceae is _____.

Part B

- List out the merits and demerits of APG System of classification.
- Describe the steps of Herbarium techniques?
- Interpret the short notes on botanical nomenclature.
- Explain typification designated by ICBN.
- Use and the economic importance of Capparidaceae

Part C

- Enumerate the Bentham & Hooker System of Classification and mentions its merits and demerits.

2. Describe in detail about the Flora, Monographs and Check lists.
3. Explain the rules of ICN with relation to Taxonomy.
4. Explain the importance of Numerical Taxonomy
5. Evaluate the floral characters of Caryophyllaceae and mention its economic usages.

Head of the Department

Dr. A. Anami Augustus Arul

Course Instructor

Dr.W.Vincy

Teaching Plan

Department : Botany

Class : I M.Sc. Botany

Title of the Course : CORE COURSE IV: PLANT ANATOMY AND EMBRYOLOGY OF ANGIOSPERMS

Semester : II

Course Code : BP232CC2

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CI A	External	Total
BP232CC2	2	3	-	-	4	5	75	25	75	100

Objectives

1. Learn the importance of plant anatomy in plant production systems (Knowledge).
2. Classify meristem and identify their structures, functions and roles in monocot and dicot plants growth and secondary growth of woody plants (Skill).

Course outcomes

Course outcomes: CO	On completion of this course, the students will be able to:	
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CO1	Learn the structures, functions and roles of apical vs lateral meristems in monocot and dicot plant growth.	K1& K2
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Unit	Module	Topic	Teaching Hours	Cognitive level	Pedagogy	Assessment/ Evaluation
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CO2	Study the function and organization of woody stems derived from secondary growth in dicot and monocot plants.	K1&K4
CO3	Apply their idea on sectioning and dissection of plants to demonstrate various stages of plant development.	K2& K6
CO4	Understand the various concepts of plant development and reproduction.	K3& K6
CO5	Profitably manipulate the process of reproduction in plants with a professional and entrepreneurial mindset.	K5

Teaching plan

Total Contact hours: 90 (Including lectures, assignments and tests)

I						
	1	Morphological and physico-chemical changes; Plasmodesmata - types of pits – growth of cell wall – formation of intercellular spaces.	3	K2(U)	Lecture using Chalk and talk ,Introductory session,	Brainstorming questions, MCQ, Online Quiz, Essay Short summary, Quiz, Peer Teaching Discussion, Debating / Presentations Formative assessments, Online assignment, Oral Presentation, Slip Test
	2	Meristems: Classifications: Theories of shoot and root apices, Cytological zonation in shoot apex.	3	K2(U)	Interactive PPT, Lecture with videos	
	3	Vascular Cambium: Composition and organization – multiplicative and additive divisions.	3	K1(R)	Discussion forum (google classroom, mentimeter)	
	4.	Xylem: Primary and secondary xylem – tracheary elements and vessels – vesselless dicots – xylem rays and axial parenchyma of angiosperm	2	K2(U)	E- content , Lecture with point sessions	
	5.	Dendrochronology – grain, texture and figure in wood; reaction wood; ring porous and diffuse porous wood	2	K3(Ap)	Demonstration, Integrative teaching	
	6.	Phloem: Ultra structure and ontogeny of sieve tube elements and companion cell. Evolution of tracheary elements.	2	K4(An)	Inquiry based approach	
II	1	Structure, organization and activity of phellogen. Polyderm and Rhytiderm – wound periderm.	3	K1(U)	Lecture using you tube videos, Group discussion	Edpuzzle, Key points Essay, Observation notes, Peer review, short essay, Handing the techniques, Individual demonstration, Online Assignments, Formative
	2	Normal secondary thickening in Dicots; Anomalous secondary growth in Dicots (Amaranthaceae, Aristolochiaceae, Bignoniaceae, Piperaceae, Nyctaginaceae) and	3	K3(Ap)	Discussion forum (google classroom, mentimeter)	

		arborescent				assessments, JAM, Student Presentation.
	3	Monocots. Primary thickening in palms; Ontogeny of leaf, Structure and types of Stomata; Leaf abscission; Major nodal types; Kranz anatomy and its significance.	3	K4(An)	Discussion forum (google classroom, mentimeter)	
	4	Microtechnique: Principle of killing and fixation, dehydration and rehydration of botanical specimens. Stains: Principle of double staining (fast-green and light green) of free hand sections;	3	K5(Ev)	Group discussion, Experimental demonstration	
	5	Protocol for serial sectioning of paraffin wax impregnated specimens; Mounting and mounting media.	3	K6(Cr)	Flipped classroom, Group discussion	
III	1	Structure and development of Anther; Ultrastructure and physiology of anther tapetum; Male gametophyte;	7	K1 (U)	Lecture using Chalk and talk ,Introductory session,	Online Quiz, Short summary, Quiziz, Peer Teaching Formative assessments, Online assignment, Oral Presentation, Slip Test
	2	Palynology: Morphology and ultrastructure of pollen wall, pollen kitt, pollen analysis, pollen storage, pollen sterility and pollen physiology.	8	K4(An)	PPT presentation, Group discussion	
IV	1	Structure and development of Megasporangium; Types of ovules, Endothelium, obturator and nucellus..	4	K1(U)	Lecture using Chalk and talk , E- content(M.s-word	Brainstorming questions, MCQ, Online Quiz, Essay Quizz, Peer Teaching Discussion, Debating / Presentations Formative assessments, Online assignment, Oral
	2	Megasporogenesis: Female gametophyte: Structure, types, haustorial behavior and Nutrition of embryo sacs	4	K2(R)	Discussion forum (google classroom, mentimeter)	
	3	Fertilization: Double fertilization and triple	4	K3(Ap)	Review, Lecture using	

		fusion; Endosperm: Development of endosperm, types, physiological efficiency of endosperm haustoria and functions; Ruminant endosperm.			Interactive PPT Videos	Presentation, Slip Test
	4	Embryogeny: Development of monocot (Grass) and dicot (Crucifer) embryos.	3	K4(An)	Lecture using PPT Videos	
V	1	Causes of Polyembryony, classification, induction and practical application.	5	K3(Ap)	Nearpod, Group Discussion,	Observation notes, Peer review, short essay, Individual demonstration, Online Assignments, Formative assessments, JAM, Student Presentation
	2	Apomixis and its significance. Seed and Fruit development and role of growth substances.	5	K4(An)	E- content , Lecture with point sessions	
	3	Parthenocarpy and its importance.	5	K5(Ev)	Discussion forum (google classroom, mentimeter)	

Course Focussing on Employability/ Entrepreneurship/ Skill Development : Skill Development

Activities (Em/ En/SD): Preparation of Permanent Slide, Model making of secondary thickening in dicots.

Course Focussing on Cross Cutting Issues (Professional Ethics/ Human Values/Environment Sustainability/ Gender Equity): Environment Sustainability

Activities related to Cross Cutting Issues :-

Assignment : Structure and development of Anther / online (Google classroom, Nearpod)

Seminar Topic: Causes of Polyembryony, classification, induction and practical application

Sample questions (minimum one question from each unit)

Part A

1. What are the fibres that are associated with phloem?
 - a. Surface Fibres b. Wood Fibres c. Hard Fibres d. Bast Fibres
2. The tree's age may be established using the ----- methods.
3. What causes the cork tissue to form?

a. Periderm b. Periblem c. Phelloderm d. Phellogen

4. Pits with a border can be located in-----.

5. Exine is made up of _____.

a. vascular strands b. sporopollenin c. parenchyma d. meristematic cells

6. The point of attachment between Ovule body and funicle is called_____.

7. In _____ type of Ovule embryo sac become horse shoe shaped

8. Polyembryony was 1st reported by _____ in _____.

Part B

1. Draw and describe the different types of stele which you have studied
2. Write a note on the different stomatal types according to Metcalfe and Chalk.
3. Describe the structure and development of anther in a flower?
4. Role of sporopollenin in pollination - justify
5. Sketch the types of endosperm formation.

Part C

1. Write a note on the structure of 'Plasmodesmata'. State its important functions. Differentiate between Apoplast and Symplast.
2. Describe the anomalous secondary growth in *Tecoma* sp, *Bignonia* sp, *Boerhavia* sp, *Dracaena* sp with diagrams.
3. Write in detail the physical, chemical, and mechanical properties of wood.
4. Give an account of structure and organization of a typical embryo sac of angiosperm?
5. What is Polyembryony? Write a brief account on Classification of Polyembryony and its significance.

Head of the Department

Dr. A. Anami Augustus Arul

Course Instructor

Dr.S.Kala Vethakumari

Teaching Plan

Department : Botany

Class : I M.Sc. Botany

Title of the Course : CORE COURSE V: ECOLOGY, PHYTOGEOGRAPHY, CONSERVATION BIOLOGY & INTELLECTUAL PROPERTY RIGHTS

Semester : II

Course Code : BP232CC3

Course Code	L	T	P	S	Credits	Inst.Hours	Total Hours	Marks		
								CIA	External	Total
BP232CC3	2	3	-	-	4	5	75	25	75	100

Objectives

- 1.To analyze and comprehend the fundamental ideas of plant ecology as a scientific study of environment..
- 2.To study the plant communities and plant succession stages..

Course outcomes

On completion of this course, the students will be able to:		
1	understand the scope and importance of population ecology, plant communities and ecosystem ecology.	K1& K2
2	understand the applied aspect of environmental botany.	K1&K4

3	students will spot the sources and pollution and seek remedies to mitigate and rectify them.	K2& K6
4	identify different plant communities, categorize plant biomes and identify threatened, endangered plant species and create awareness program in protection of biodiversity.	K3& K6
5	analyze insight into the vegetation types, species interaction and their importance and the factors influencing the environmental conditions.	K5

Teaching plan

Total Contact hours: 90 (Including lectures, assignments and tests)

Unit	Module	Topic	Teaching Hours	Cognitive level	Pedagogy	Assessment/ Evaluation
I						
	1	Ecological principles: Introduction – History, scope, concepts. Diversity of plant life; growth form, life form.	3	K2(U)	Brainstorming sessions, Introductory session	Edpuzzle, Short Essay, oral test, online assignment, student presentations Summarize, debate, observation note, class test
	2	Basic concepts of population ecology– population dynamics	3	K2(U)	PPT, Lecture with point sessions	
	3	Regulation of population density.	3	K1(R)	Lecture using slido	
	4	Basics concepts of community– characteristics, composition, structure, origin and development	3	K3(Ap)	Demonstration using charts	
	5	Community dynamics– trends of succession	3	K4(An)	Econtent	
II	1	Ecosystem ecology and resource ecology: Introduction – kinds – major types – functional aspects of ecosystem: Food chain and food web, energy flow, laws of thermodynamics. Productivity – primary and secondary productivity – GPP & BPP.	3	K1(U)	Lecture using gamma PPT, online videos, blended learning	Oral test, questioning in classroom class test, Mentimeter Slip test, Seminar presentation, open book test
	2	Resource Ecology: Energy resources; renewable and non-renewable.	3	K2(R)	Interactive PPT	
	3	Soil: Formation, types and profile-erosion and conservation, Water resources– conservation and management.	3	K3(An)	Lecture using slido	
	4	Environment	3	K3(Ap)	Role play	

		Deterioration: Climate change –Green house effect and global warming, ozone depletion and acid rain.				
	5	Waste management- Solid and e-waste, recycling of wastes. Eco-restoration/remediation ecological foot prints - carbon foot print - ecolabeling - environmental auditing	3	K4(An)	Flipped classroom, Group discussion	
III	1	Phytogeography: Phytogeographical Zones - Vegetation types of India and Tamil Nadu,	2	K1 (U)	Lecture using slido, google classroom	Quiziz, album preparation, open book test, online assignment, Home work, oral test, observation note
	2	Distribution: Continuous, Discontinuous and Endemism. Theories of discontinuous distribution: Continental drift, Agean dare hypothesis.	2	K4(An)	Nearpod, Group discussion	
	3	Geographical Information System (GIS) Principles of remote sensing and its applications.	2	K3(Ap)	Lecture using Youtube videos	
IV	1	Biodiversity and conservation ecology: Definition, types of biodiversity – values of biodiversity – Hot spots	3	K1(U)	Introductory session, Lecture using nearpod	Mentimeter, surprise test, oral test, Group discussion, student presentations, questioning in classroom,
	2	Threats to biodiversity: habitat loss. Poaching of wild life – Invasion of exotic species, man and wild life conflicts- endangered and endemic plant species of India	5	K2(R)	Role play, Group discussion	
	3	Red list categories of IUCN,	4	K3(Ap)		
	4	Biotechnology assisted plant conservation- <i>insitu</i> and <i>exsitu</i>	3	K4(An)	Lecture using PPT Videos	

		methods.				
V	1	Intellectual Property Rights – Introduction, Kinds of Intellectual Property Rights- Patents, Trademarks, Copyrights, Trade Secrets.	5	K3(Ap)	Nearpod class, blended learning	Google forms, oral test, Assignments, student presentations, online assignment, surprise test, class test, album preparation
	2	Need for intellectual property right, Advantages and Disadvantages of IPR. International Regime Relating to IPR – TRIPS, WIPO, WTO, GATTs. IPR in India genesis and development..	5	K4(Ap)	Flipped classroom	
	3	Geographical Indication – introduction, types. Patent filing procedure for ordinary application	5	K5(Ev)	Integrative learning	

Course Focussing on Employability/ Entrepreneurship/ Skill Development : Skill Development

Activities (Em/ En/SD): Visit to Science center, Nature walk

Course Focussing on Cross Cutting Issues (Professional Ethics/ Human Values/Environment Sustainability/ Gender Equity): Environment Sustainability

Activities related to Cross Cutting Issues :-

Assignment : Intellectual Property Rights./ online

Seminar Topic: Tamilnadu vegetation types.

Sample questions (minimum one question from each unit)

Part A

1. Who is the father of Ecology?
2. One of the ex situ conservation methods for endangered species is
 - a) Wild life sanctuaries
 - b) Biosphere reserves
 - c) Cryopreservation
 - d) National parks
3. Which is a perennial weed?
 - a). *Cyperus rotundas*
 - b). *Cynodon* sp.
 - c). *Convolvulus*.
 - d). All of the above.

4. Abbreviate IPR.

Part B

1. Write short note on the trends in succession.
2. List out the water conservation strategies.
3. Categorize population distribution
4. Organize the Red list categories of IUCN.
5. Criticize the International Regime Relating to IPR.

Part C

1. Elaborate community structure , composition and its function.
2. Explain green house effect and its effect in environment.
3. Compile the vegetation types of Tamilnadu.
4. Explain the biotechnology assisted plant conservation techniques.
5. Summarize patent filling process.

Head of the Department

Dr. A. Anami Augustus Arul

Course Instructor

Dr.J.Celin Pappa Rani

Teaching Plan

Department : Botany

Class : I M.Sc. Botany

Title of the Course : ELECTIVE COURSE IV: a)- RESEARCH METHODOLOGY, COMPUTER APPLICATIONS & BIOINFORMATICS

Semester : II

Course Code : BP232EC4

CourseCode	L	T	P	S	Credits	Inst.Hours	Total Hours	Marks		
								CIA	External	Total
BP232EC4	2	2	-	-	2	4	60	25	75	100

Objectives

1. To equip students to collect, analyze and evaluate data generated by their own inquiries in a scientific manner (Knowledge).

2. To provide an overview on modern equipments that they would help students gain confidence to instantly commence research careers and/or start entrepreneurial ventures (Skill).

Course outcomes: CO	On completion of this course, the students will be able to:	
CO1	Realize the need of centrifuges and chromatography and their uses in research	K1 & K2
CO2	Learn the principles and applications of electrophoresis.	K2 & K3
CO3	Construct the phylogenetic trees for similar characteristic feature of plant genomes and study <i>de novo</i> drug design through synthetic biology.	K5 & K6
CO4	Understand the concept of pairwise alignment of DNA sequences using algorithms.	K3 & K4
CO5	Interpret the features of local and multiple alignments.	K4 & K5

Teaching plan

Total Contact hours: 90 (Including lectures, assignments and tests)

Unit	Module	Topic	Teaching Hours	Cognitive level	Pedagogy	Assessment/ Evaluation
I						
	1	Literature collection and citation: bibliography — bibliometrics (scientometrics): definition-laws — citations and bibliography .	4	K2(U)	Lecture using Chalk and talk Introductory session,	Edpuzzle, Observation notes, Peer review, short essay, Online Assignments, Formative assessments, JAM, Student Presentation. Review of research projects, peer review
	2	*biblioscape— plagiarism— project proposal writing — dissertation writing – paper presentation (oral/poster)	4	K2(U)	Interactive PPT, Lecture with videos	
	3	E-learning tools— monograph — introduction and writing-Standard operating procedure (SOP) – introduction and preparation.	4	K3(Ap)	Discussion forum (google classroom, mentimeter)	
	4.	Research Institutions - National and International.		K4(An)	E- content , Lecture with M.s word & external links	
II	1	Basic principles and applications of pH meter, UV-visible spectrophotometer, centrifuge, lyophilizer,	3	K1(U)	Demonstration, Integrative teaching	Brainstorming questions, MCQ, Online Quiz, Quiziz, Peer Teaching, Debating / Presentations Formative assessments, Online assignment, Oral Presentation, Slip Test, CIA
	2	chromatography- TLC, Gas chromatography with mass spectrum (GC/MS), and HPLC-	3	K3(Ap)	Inquiry based approach	
	3	Scanning Electron microscopy-Agarose gel Electrophoresis —	3	K4(An)	Lecture using you tube videos, Group discussion	
	4	Polyacrylamide Gel Electrophoresis – Polymerase chain reaction	3	K4(An)	Discussion forum (google classroom, mentimeter)	
III	1	Introduction to computers and Bioinformatics. Types of hardware and software operating	4	K2 (U)	Discussion forum (google classroom, mentimeter, Whatsapp poll)	Online Quiz, Short summary, Quiziz, Peer Teaching, Formative

		systems.				assessments,
	2	Fundamentals of networking, operation of networks, telnet, ftp, www, Internet.	4	K4(An)	Group discussion, Experimental demonstration	Online assignment, Student Presentation,
	3.	Biological Research on the web: Using search engines, finding scientific articles.	4	K5 (Ev)	Flipped classroom, Group discussion	Slip Test, Assessment tools- google forms
IV	1	Public biological databases,	4	K5(Ev)	PPT & you tube Videos, Computational techniques	Peer Teaching, Formative assessments, CIA, Online assignment, Student Presentation, Slip Test, Debate
	2	Searching biological databases.	4	K4(An)	Interactive PPT presentation,	
	3	Use of nucleic acid and protein data banks.	4	K3(Ap)	Lecture using Chalk and talk , E- content(M.s-word	
V	1	NCBI, EMBL, DDBJ, SWISSPORT,	4	K3(Ap)	Discussion forum (google classroom, mentimeter)	Observation notes, Peer review, short essay, Home work Online Assignments, Formative assessments, JAM, Student Presentation
	2	Protein prediction and Gene finding tools.	4	K4(An)	Review, Lecture using Interactive PPT Videos	
	3	Techniques in Bioinformatics- BLAST, FASTA, Multiple Sequence Analysis .	4	K5(Ev)	Lecture using PPT & you tube Videos, Computational techniques	

Course Focussing on Employability/ Entrepreneurship/ Skill Development : Skill Development

Activities (Em/ En/SD): Compare different nucleotide sequence using gen bank, Bioinformatics tools, Visit Library for Literature collection .

Course Focussing on Cross Cutting Issues (Professional Ethics/ Human Values/Environment Sustainability/ Gender Equity): Professional Ethics

Activities related to Cross Cutting Issues :-

Assignment : chromatography- TLC, Gas chromatography with mass spectrum (GC/MS), and HPLC (online)

Seminar Topic: NCBI, EMBL, DDBJ, SWISSPORT

Sample questions (minimum one question from each unit)

Part A

6. Why literature collection is important in research?(R)
 7. State the difference between index card and abstract card in literature collection of research.(U)
 8. Electron microscope can give a magnification up to -----(U)
 - a. 400,000X
 - b. 100,000X
 - c. 15,000X
 - d. 100X.
 9. An UV-Vis spectrophotometer measures the intensity of light transmitted through a sample compared to a reference measurement of the incident light source –
State True or False.
 10. Abbreviate : Taq enzyme.(R)
 11. 9. Name any two best search engines.
7. PSI BLAST is better than BLAST – State True or False

Part B

1. Evaluate the importance of e-journal and e – book in research
2. Justify the role of supervisors towards research scholars, while performing research.
3. .Write notes on the principle and uses of Affinity chromatography.
4. List out the applications of lyophilization.
5. Deduct the protocol for performing pair wise alignment.
6. How DDBJ acts as biological database in collecting DNA sequences?

Part C

1. Consider that you are doing research in a science field. Explain how you will prepare a research report.
2. Explain your own view and perspective opinion about research.
3. Justify the role of agarose gel electrophoresis in separating DNA fragments.
4. Evaluate the role of PCR in making million copies of specific DNA.
5. Explain the Protein sequence databases with suitable examples.(U)

Head of the Department

Dr. A. Anami Augustus Arul

Course Instructor

Dr.S.Kala Vethakumari

Teaching Plan

Department : Botany
Class : I M.Sc. Botany
Title of the Course : ELECTIVE COURSE III: a) BIostatistics
Semester : II
Course Code : BP232EC1

CourseCode	L	T	P	S	Credits	Inst.Hours	Total Hours	Marks		
								CIA	External	Total
BP232EC1	2	2	-	-	2	4	60	25	75	100

Objectives

1. To provide the student with a conceptual overview of statistical methods (Knowledge).
2. To emphasis on usefulness of commonly used statistical software for analysis, research, and experimentation

Unit	Module	Topic	Teaching Hours	Cognitive level	Pedagogy	Assessment/ Evaluation
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Course outcomes

Course outcomes: CO	On completion of this course, the students will be able to:	
1	Create and interpret visual representations of quantitative information, such as graphs or charts.	K1& K2
2	Solve problems quantitatively using appropriate arithmetical, algebraic, or statistical methods	K1&K4
3	Know the latest version using in statistical tools and apply the tools to interpret the results	K2& K6
4	To develop their competence in hypothesis testing and interpretation	K3& K6
5	Understand why biologists need a background in statistics.	K5

Teaching plan

Total Contact hours: 90 (Including lectures, assignments and tests)

I						
	1	Introduction to biostatistics	3	K2(U)	Lecture using Chalk and talk ,Introductory session,	,MCQ, Quiz, Essay Short summary MCQ, Quiz,Short Essay, True or false Discussion, Debating or Presentations Essay
	2	basic principles, variables - Collection of data, sample collection and representation of Data	3	K2(U)	Interactive PPT, Lecture with videos	
	3	Primary and Secondary	3	K1(R)	Discussion forum (google classroom, mentimeter)	
	4	Classification and tabulation	3	K3(Ap)	E- content , Lecture with point sessions	
	5	Data – Diagrams, graphs and presentation	3	K4(An)	Demonstration, Integrative teaching	
II	1	Mean, median and mode	3	K1(U)	Inquiry based approach	Definitions, MCQ, Essay, Discriminating the concepts Explain, Concept with examples, short essay Seminar,
	2	Measures of dispersion:	3	K2(R)	Lecture using you tube videos, Group discussion	
	3	Range of variation, standard deviation	3	K3(An)	Discussion forum (google classroom, mentimeter)	
	4	Standard error and coefficient variation.	3	K3(Ap)	Discussion forum (google classroom, mentimeter)	
	5	continuous and discontinuous variables.	3	K4(An)	Group discussion, Experimental demonstration	
III	1	Basic principles - types	2	K1 (U)	Flipped classroom, Group discussion	MCQ, Concepts, short essay Diagrammatic representation, Essays
	2	Rules of probability - addition and multiplication rules	2	K4(An)	Lecture using Chalk and talk ,Introductory session,	
	3	Patterns of probability distribution; binomial - Poisson and normal.	2		PPT presentation, Group discussion	

IV	1	Chi-square test for goodness of fit; Null hypothesis, level of Significance - Degrees of Freedom.	3	K1(U)	Lecture using Chalk and talk , E- content(M.s-word	MCQ, Quiz, Group discussion, Differentiating the characters, short essays Summarize, Essays, diagrammatic representations Essays,
	2	Student't' test – paired sample and mean differences't' tests	5	K2(R)	Discussion forum (google classroom, mentimeter)	
	3	ANOVA	4	K3(Ap)	Review, Lecture using Interactive PPT Videos	
	4	Basic introduction to Multivariate Analysis of Variance (MANOVA).	3	K4(An)	Lecture using PPT Videos	
V	1	Correlation - types of correlation, methods of study of correlation	5	K3(Ap)	Nearpod, Group Discussion,	Short essays, MCQ, Quiz, True or false, Assignments Short essays, MCQ, Summarize, Slip test
	2	Testing the significance of the coefficients of correlation. Regression and types	5	K4(Ap)	E- content , Lecture with point sessions	
	3	Sampling and experimental designs of research-Randomized block design and split plot design	5	K5(Ev)	Discussion forum (google classroom, mentimeter)	

Course Focussing on Employability/ Entrepreneurship/ Skill Development : Skill Development

Activities (Em/ En/SD):

Course Focussing on Cross Cutting Issues (Professional Ethics/ Human Values/Environment Sustainability/ Gender Equity):

Activities related to Cross Cutting Issues :-

Assignment : Intellectual Property Rights./ o

Seminar Topic:

Sample questions (minimum one question from each unit)

Part A

- 1. In which case statistical approach of variance can be applied**
 - a. Productivity of lake is not significantly different from other five lakes**
 - b. Body weight is dependent on person height**
 - c. Diabetes dependent on concentration of insulin in body**

d. Seed weight is influenced by calcium in soil

2. Write the formulae to calculate Standard Deviation.
3. Find the mode for the following data.
Given data: 13, 18, 13, 14, 13, 16, 14, 21, 13.
4. Calculate the mean, median, and mode for the following dataset: [10, 15, 20, 25, 30, 35, 40, 45, 50, 55]
5. Explain the circumstances in which the mean might not be the best measure of central tendency to use

Part B

1. Why Student t test is performed?
2. Highlight the reason for doing Chi square test?
3. Calculate the range of variation for the following dataset: [12, 18, 25, 30, 45, 60, 75]
4. Compare and contrast the usefulness of range and standard deviation as measures of dispersion
5. A dataset has a mean of 50 and a standard deviation of 10. Another dataset has a mean of 50 and a standard deviation of 5. Which dataset has more variability, and why

Part C

1. SPSS package is an important statistical tool in research – Justify your answer.
2. A group of psychiatric patients are trying three different therapies: counseling, medication and biofeedback. You want to see if one therapy is better than other. Find out whether ANOVA can be used to test these different groups. Justify your answer.
3. Define standard deviation and explain its significance in statistical analysis
4. A set of data has a mean of 75 and a standard deviation of 15. Calculate the coefficient of variation and interpret its value
5. Calculate the standard error for a sample with a standard deviation of 8 and a sample size of 100

Head of the Department

Dr. A. Anami Augustus Arul

Course Instructor

W.Vincy

Teaching Plan

Department : Botany

Class : I M.Sc. Botany

Title of the Course : SKILL ENHANCEMENT (SE1)- Nursery and Gardening

Semester : II

Course Code : BP232SE1

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
BP232SE1	2		-	-	2	2	30	25	75	100

Learning Objectives

- 1.To recognize the importance of nursery and gardening (Knowledge).
2. To gain an understanding of nursery management(Skill).

Course outcomes

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

1	recognize the basic process required for growing and maintaining plants in nurseries.	K1
2	explain the different methods of plant propagation and various gardening styles.	K2
3	apply techniques for effective hardening of plants and computer applications for creative gardening.	K3& K6
4	compare and contrast cultivation of different vegetables and growth of plants in nursery and gardening.	K4
5	develop new strategies to enhance growth and quality of nursery plants.	K5 & K6

Unit	Module	Topic	Teaching Hours	Cognitive level	Pedagogy	Assessment/ Evaluation
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Teaching plan

Total Contact hours: 30 (Including lectures, assignments and tests)

I						
	1	NURSERY: Definition, objectives and scope and building up of infrastructure for nursery.	2	K2(U)	Introductory session	Brainstorming questions Short summary Quiz using google forms, Short Essay
	2	Planning and seasonal activities	2	K2(U)	PPT	
	3	Planting - direct seeding and transplants.	2	K1(R)	Lecture	
II	1	SEED: Structure and types - Seed dormancy;	2	K1(U)	Lecture using videos	Ed puzzle Discriminating the concepts Mentimeter Short essay
	2	causes and methods of breaking dormancy - Seed storage:	2	K2(R)	Lecture using slido	
	3	Seed banks, factors affecting seed viability, genetic erosion -	2	K3(An)	Lecture using Chalk and talk	
	4	Seed production technology - seed testing and certification.	2	K3(Ap)	Group discussion	
III	1	VEGETATIVE PROPAGATION: Air-layering, cutting, selection of cutting, collecting season, treatment of cutting,	2	K1 (U)	Lecture using slido	MCQ, Kahoot, seminars, observation notes
	2	Rooting medium and planting of cuttings - Hardening of plants -	2	K4(An)	Nearpod	
	3	Green house - mist chamber, shed root, shade house and glasshouse.	2	K3(Ap)	PPT	
IV	1	GARDENING: definition, objectives and scope - different types of gardening - landscape and home gardening - parks and its components	2	K1(U)	Introductory session, Lecture using nearpod	Mentimeter Edpuzzle, class test, oral test
	2	Plant materials and design	1	K2(R)	Role play, Group discussion	
	3	computer applications in landscaping.	1	K3(Ap)	Lecture using slido	
V	1	GARDENING OPERATIONS: Soil laying, manuring,	2	K3(Ap)	Nearpod class	Online Assignments MCQ using

		watering, management of pests and diseases and harvesting.				google forms
	2	Sowing/raising of seeds and seedlings: Transplanting of seedling	2	K4(Ap)	Group Discussion	
	3	Study of cultivation of different vegetables: cabbage, brinjal, lady's finger, onion, garlic, tomatoes, and carrots - Storage and marketing procedures.	2	K5(Ev)	Lecture using nearpod	

Course Focussing on Employability/ Entrepreneurship/ Skill Development : Skill Development

Activities (Em/ En/SD): Visit to horticulture station

Course Focussing on Cross Cutting Issues (Professional Ethics/ Human Values/Environment Sustainability/ Gender Equity): Environment Sustainability

Activities related to Cross Cutting Issues :-

Assignment : Cultivation of different vegetables/ online

Seminar Topic: Rooting medium and planting of cuttings

Sample questions (minimum one question from each unit)

Part A

1. The art of making animal shapes in plants is_____.

a.Topiary b.Pinching off c. Edging d.Hardening

2. Seed viability test is otherwise called

- a. Ragdoll test
- b. Tetrazolium test
- c. Vigour test
- d. Germination test

3.Example of plant in which vegetative propagation is occurred by leaves is called

a. Cannabism b. Chrysanthemum c. Cryophyllum d. Brassica

4. Air layering is common in..

- a. Dracaena.
- b. Croton.
- c. Aglaonema.
- d. All of the above.

5. Which is suitable for porches?

- a. Clerodendron.
- b. Ipomoea.
- c. Pyrostegia.
- d. All of the above.

Part B

- 6. Write short note on nursery development.
- 7. List out the Planning and seasonal activities .
- 8. Categorize Green house gases.
- 9. Organize computer applications in landscaping.
- 10. Criticize the Sowing/raising of seeds .

Part C

- 1. Summarize nursery construction.
- 2. Explain Seed production technology.
- 3. Elaborate the vegetative propagation methods employed in nursery.
- 4. Write an essay on home gardening and its components
- 5. Explain gardening operations.

Head of the Department

Dr. A. Anami Augustus Arul

Course Instructor

Dr.Kala Vethakumari

Dr.W.Vincy

Teaching Plan

Department : Botany

Class : II M.Sc. Botany
Title of the Course : Major Core IX – Plant Physiology
Semester : IV
Course Code : PB2041

CourseCode	L	T	P	S	Credits	Inst.Hours	Total Hours	Marks		
								CIA	External	Total
PB2041	2	3	-	-	4	5	75	25	75	100

Objectives

1. To facilitate the study of integrated activities in plants.
2. To evaluate the stress related mechanism of plants.

Course outcomes

Course outcomes: CO	On completion of this course, the students will be able to:	
1	relate the physical and chemical process occurring in plants	K1& K2
2	understand the molecular and metabolic mechanisms of plants	K1&K4
3	generalize a minor research using their theory knowledge	K2& K6
4	examine, compare and conclude the stressed and stress free plants	K3& K6
5	measure the biological mechanisms that takes place inside the plants	K5

Teaching plan

Total Contact hours: 90 (Including lectures, assignments and tests)

Unit	Module	Topic	Teaching Hours	Cognitive level	Pedagogy	Assessment/Evaluation
I	1	Physico-chemical properties of water - water potential	3	K2(U)	Lecture using Chalk and talk Introductory session,	MCQ, Quiz, Essay Short summary Quiz, Short Essay, True or false Discussion, Debating or Presentations Essay
	2	Mechanism of absorption of water - active and passive transport - Apoplast and symplast concept	3	K2(U)	Interactive PPT, Lecture with videos	
	3	Transpiration - Stomatal mechanism. Antitranspirants. Ascent of sap – SPAC	3	K1(R)	Discussion forum (google classroom, mentimeter)	
	4	Mineral nutrition - criteria for essentiality. Macro and micro nutrients, their role and deficiency symptoms	3	K3(Ap)	E- content , Lecture with M.s word & external links	
	5	Absorption of solutes - passive, active diffusion and facilitated diffusion. Hydroponics – Nutrient Film Technique (NFT).	3	K4(An)	Demonstration, Integrative teaching	
II	1	Properties of light - Interaction between radiant energy and phosphorescence	3	K1(U)	Inquiry based approach	Definitions, MCQ, Essay, Discriminating the concepts Explain, Concept with examples, short essay Seminar,
	2	Photosynthetic apparatus and thylakoid organization; Two pigment systems - Light harvesting systems	3	K2(R)	Lecture using you tube videos, Group discussion	
	3	Reaction center, P680, P700, water oxidation complex, electron transport system - cyclic - non cyclic – photophosphorylation	3	K3(An)	Discussion forum (google classroom, mentimeter)	
	4	photosynthetic carbon reduction pathways in C3, C4 and CAM plants	3	K3(Ap)	Discussion forum (google classroom, mentimeter, Whatsapp poll)	
	5	Photorespiration and its significance.	3	K4(An)	Group discussion, Experimental	

					demonstration	
III	1	Respiration - Glycolysis – Anaerobic (Fermentation) and Aerobic (Kreb's cycle)	2	K1 (U)	Flipped classroom, Group discussion	MCQ, Concepts, short essay Diagrammatic representation, Essays Seminar, MCQ, Concepts, short essay
	2	Electron transport system and oxidative phosphorylation - mechanism - Energetics	2	K4(An)	PPT & you tube Videos, Computational techniques	
	3	Respiratory inhibitors - Cyanide resistant respiration; Integration of metabolic pathways.	2	K4(An)	Interactive PPT presentation,	
	4	Nitrogen Metabolism – Sources of nitrogen. Biological nitrogen fixation – symbiotic and asymbiotic; Nitrate and Ammonia assimilation (GS-GOGAT pathway).		K1 (U)	Lecture using Chalk and talk , E- content(M.s-word	
IV	1	Plant growth regulators and elicitors	3	K1(U)	Discussion forum (google classroom, mentimeter)	MCQ, Quiz, Group discussion, Differentiating the characters, short essays Summarize, Essays, diagrammatic representations Essays,
	2	Physiological effect and mechanism of action of auxin, gibberellins, cytokinins, ethylene, abscissic acid, morphactins, brassinosteroids	5	K2(R)	Review, Lecture using Interactive PPT Videos	
	3	Photomorphogenesis – phytochrome mediated photoresponses	4	K3(Ap)	Lecture using PPT & you tube Videos, Computational techniques	
	4	Physiology of flowering; Fruit ripening.	3	K4(An)	Lecture using PPT Videos	
V	1	Physiology of senescence and abscission; Biological clock	5	K3(Ap)	Group Discussion,	MCQ, Quiz, True or false, Assignments Short essays, MCQ, Summarize, Slip test
	2	Stress physiology – biotic and abiotic stress-salinity stress, drought stress, water stress, freezing stress, radiation	5	K4(Ap)	Group Discussion	

		stress, and heavy metal stress				
	3	Stress proteins in plants – stress resistance mechanism	5	K5(Ev)	Group Discussion,	

Course Focussing on Employability/ Entrepreneurship/ Skill Development: Skill Development

Activities (Em/ En/SD):

Course Focussing on Cross Cutting Issues (Professional Ethics/ Human Values/Environment Sustainability/ Gender Equity): Environment Sustainability

Activities related to Cross Cutting Issues:-

Assignment: Stress resistance mechanism

Seminar Topic: Biological clock

Sample questions (minimum one question from each unit)

Part A

1. Imbibition is the first step in absorption of water by root hair – State True or False.
2. Ascent of sap in higher plant takes place through _____.
3. In photosynthesis, the ultimate source of electron is _____.
 - a. chlorophyll a
 - b. water
 - c. antenna pigments
 - d. pheophytin
4. Rate of photosynthesis is higher in blue light – state True or False.
5. The process of glycolysis occurs in _____.
6. The enzyme nitrate reductase converts nitrate into _____.
 - a. ammonia
 - b. nitrite
 - c. antenna pigments
 - d. pheophytin

Part B

1. Explain NFT
2. Outline cohesion theory of water.
3. Differentiate cyclic and non-cyclic photophosphorylation.
4. Summarize the properties of light.
5. Analyze the Anaerobic Fermentation

Part C

1. Elaborate macro and micro nutrients
2. Illustrate the various forces concerned in the ascent of sap in plants.
3. Explain the Calvin cycle
4. What is photorespiration? Give the mechanism and significance of this process.
5. Discuss Oxidative phosphorylation

Teaching Plan**Department : Botany****Class : II M.Sc. Botany****Title of the Course : Major Core X – Plant Ecology and Phytogeography****Semester : II****Course Code : PB2042**

CourseCode	L	T	P	S	Credits	Inst.Hours	Total Hours	Marks		
								CIA	External	Total
PB2042	3	3	-	-	4	6	90	25	75	100

Objectives

1. To impart basic knowledge about the environment and its allied problems.
2. To acquire skills to help the concerned individuals in identifying and solving environmental problems.

Course outcomes	On completion of this course, the students will be able to: CO	PSO addressed	Cognitive level
CO - 1	understand the scope and importance of ecosystem	PSO – 3	K2(U)
CO - 2	distinguish the difference between hydrosere and xerosere	PSO – 2	K4(An)
CO - 3	list out the various food chains in ecosystem	PSO – 1	K1(R))
CO - 4	implement the mode of studying vegetation	PSO – 4	K3(Ap)
CO - 5	understand the importance of conservation strategies	PSO – 5	K2(U)

Unit	Module	Topic	Teaching Hours	Cognitive level	Pedagogy	Assessment/ Evaluation
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Teaching plan

Total Contact hours: 90 (Including lectures, assignments and tests)

I	1	Habitat Ecology - Freshwater and Marine water ecosystems	3	K2(U)	Lecture using Chalk and talk, Introductory session	Quiziz, oral test, Essay, Short essay, observation notes, Presentations using ppt
	2	Wetlands and their Characteristics – Classification of Wetlands and Examples	3	K2(U)	PPT, Lecture	
	3	Succession - Causes of succession, Types of succession; Process of succession;	3	K1(R)	Lecture using slido	
	4	Concept of Climatic Climax; Hydrosere; Xerosere.	3	K3(Ap)	Role play	
II	1	Structure of Ecosystem; Productivity of ecosystem; Food chains in ecosystem.	3	K1(U)	Lecture using nearpod,	Edpuzzle, MCQ using google forms, Essay, album preparation, Discriminating the concepts, Diagrammatic representation, Demonstration using models Short essay
	2	Ecological Pyramids; Energy flow in ecosystem.	3	K2(R)	Lecture using videos	
	3	Biogeochemical cycle – Water cycle, Carbon cycle, Oxygen cycle, Nitrogen cycle, Sedimentary cycle.	33	K3(An)	Lecture using Charts	
	4	Ecological Genetics of Population – Ecads, Ecotypes, Ecoclines, Ecospecies; Population Ecology	3	K3(Ap)	Group discussion	
	5	Characteristics of a population; Population Structure – Population Dispersal and interactions among population.	3	K4(An)	Lecture using gamma ppt	
III	1	Phytogeography: Definition and Principles of Phytogeography; Distribution – Wides, Endemics and Discontinuous species; Theories of Discontinuous	2	K1 (U)	Lecture using Chalk and talk , Introductory session, Brainstorming	Brainstorming, Mentimeter, Surprise test, Observation notes, seminar presentation, short essay Essays, Mentimeter,

		distribution; Factors affecting distribution of species.				Assignments using ppts
	2	Climate of India; Vegetation of India;	2	K4(An)	Group discussion, Near pod class	
	3	Global environment changes – Global warming and Ozone depletion; Bioremediation	2	K3(Ap)	Lecture using slido	
	4	Biofueling, Biofilm and Biocorrosion, Carbon sequestration method, Carbon trading.	2	K3(Ap)	Lecture using flowcharts	
IV	1	Current practices in conservation: Habitat or Ecosystem Approaches - Species-based Approaches - Social Approaches: Chipko Movement	3	K1(U)	Lecture using Chalk and talk ,Introductory session	MCQ, Ed Puzzle Differentiating the characters, short essays Summarize, Essays, quiz questioning in the classroom
	2	In-situ conservation: Afforestation, Social Forestry, Agroforestry, Botanical gardens, Zoos, Biosphere Reserves, National Parks, Sanctuaries, Protected Area Network, Sacred Groves and Sthalavrikshas	5	K2(R)	Lecture using virtual images and models	
	3	Ex-situ conservation: Cryopreservation, Gene Banks, Seed Banks, Pollen Banks, Sperm Banks, DNA Banks.	4	K3(Ap)	Lecture using gamma ppt, analyse problem situations	
V	1	Status and protection of species in National and International levels – Role of CITES and IUCN	5	K4(An)	E- Content	Kahoot, MCQ using Google Forms, Short essays, True or false, Assignments Short essays,
	2	Convention on Biological Diversity (CBD) – Nagoya Protocol – Man and	5	K3(Ap)	Role play	

		Biosphere Programme (MAB) –				
	3	Policies implemented by MoEF for biodiversity conservation – Salient features of Biological Diversity Act 2002 – Ecosystem restoration.	5	K5(Ev)	Interaction in classroom, near pod lecture class	

Course Focussing on Employability/ Entrepreneurship/ Skill Development : Skill Development

Activities (Em/ En/SD): Visit to Eco park

Course Focussing on Cross Cutting Issues (Professional Ethics/ Human Values/Environment Sustainability/ Gender Equity): Environment Sustainability

Activities related to Cross Cutting Issues :-

Assignment : Exsitu conservation of biodiversity/ online

Seminar Topic: Globalwarmingvegetation types.

Sample questions (minimum one question from each unit)

Part A

1. Who is the father of Ecology?
2. One of the ex situ conservation methods for endangered species is
 - a) Wild life sanctuaries b) Biosphere reserves
 - c) Cryopreservation d) National parks
3. Which is a perennial weed?
 - a). *Cyperus rotundas* b). *Cynodon* sp. c). *Convolvulus*.d). All of the above.
5. Abbreviate MAP.

Part B

1. Write short note on wetlands.
2. Comment on nitrogen cycle. .
3. Categorize population distribution
4. Organize the policies implemented by MoEF for biodiversity conservation.
5. Criticize the International Regime Relating to IPR.

Part C

1. Elaborate fresh water ecosystem .
2. Explain biogeochemical cycle in reference to carbon and oxygen cycle..
3. Compile the vegetation types of Tamilnadu.
4. Explain the exsitu and insitu plant conservation techniques.
5. Summarize the status and protection of species in National and International levels.

Head of the Department

Dr. A. Anami Augustus Arul

Course Instructor

Dr.J.Celin Pappa Rani

Teaching Plan

Department : Botany

Class : II M.Sc. Botany

Title of the Course : CORE COURSE XI: BIOTECHNOLOGY & BIOINFORMATICS

Semester : IV

Course Code : PB2043

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CI A	External	Total
PB2043	3	3	-	-	4	6	90	40	60	100

Objectives

1. To apply the knowledge of biotechnology in different fields to produce high value products.
2. To develop skill and get employment in biotechnology and bioinformatics laboratories and industries.

Course outcomes

CO	Upon completion of this course the students will be able to :	PSO addressed	CL
CO - 1	understand the importance of biotechnology and design plant tissue culture laboratory	PSO-3	U
CO - 2	differentiate batch, continuous and fed batch culture	PSO-4	An

CO - 3	evaluatetheprosandconsofTransgenic plants	PSO-6	E
CO - 4	recall the different aspects of pharmaceuticals	PSO-5	R
CO - 5	applydifferentdatabasesinbiological sciences	PSO-1	Ap

Teaching plan

Total Contact hours: 90 (Including lectures, assignments and tests)

Unit	Module	Topic	Teaching Hours	Cognitive level	Pedagogy	Assessment/ Evaluation
I						
	1	Nomenclature, classification and properties of restriction enzymes	4	K2(U)	Lecture using Chalk and talk ,Introductory session,	Brainstorming questions, MCQ, Online Quiz, Essay Short summary, Quiziz, Peer Teaching Formative assessments, Online assignment, Oral Presentation, Slip Test
	2	Types of cloning vectors – Plasmids, Cosmids, ssDNA phages, Ti plasmid	4	K2(U)	Interactive PPT, Lecture with videos	
	3	Yeast vectors –YIP, YEP, YRP and YAC ; shuttle vectors	5	K1(R)	Discussion forum (google classroom, mentimeter)	
	4.	Construction of genomic library; Construction of cDNA library	5	K2(U)	E- content , Lecture with point sessions	
II	1	Plant tissue culture – laboratory organization; sterilization of explants; MS media composition and preparation of media	5	K1(U)	Lecture using you tube videos, Group discussion	Edpuzzle, Key points Essay, Observation notes, Peer review, short essay, Handing the techniques, Individual demonstration, Online Assignments, Formative assessments, JAM, Student Presentation.
	2	Meristem culture; suspension culture; protoplast culture and somatic hybridization	5	K3(Ap)	Discussion forum (google classroom, mentimeter)	
	3	Production of haploid plants, Somatic embryogenesis	4	K4(An)	Discussion forum (google classroom, mentimeter)	
	4	Synthetic seed production Transgenic plants – Bt cotton, Golden rice	4	K5(Ev)	Group discussion, Experimental demonstration	
III	1	Industrial Biotechnology – Fermentor design	5	K1(U)	Lecture using Chalk and talk , E- content(M.s-word	Brainstorming questions, MCQ, Online Quiz, Essay Quizz, Peer Teaching Discussion, Debating / Presentations Formative assessments, Online
	2	Immobilization of enzymes; Production of ethanol, acetic acid	5	K2(R)	Discussion forum (google classroom, mentimeter)	
	3	Production of citric acid, Vitamin B ₁₂	4	K3(Ap)	Review, Lecture using Interactive PPT Videos	

	4	Biosafety – possible dangers of GEOs; biosafety guidelines; physical and biological containments, Process of patenting application	4	K4(An)	Lecture using PPT Videos	assignment, Oral Presentation, Slip Test
IV	1	Edible vaccines, Plantibodies; Gene therapy – types of gene therapy,	5	K3(Ap)	Nearpod, Group Discussion,	Observation notes, Peer review, short essay, Individual demonstration, Online Assignments, Formative assessments, JAM, Student Presentation
	2	Production of monoclonal antibodies and its application	5	K4(An)	E- content , Lecture with point sessions	
	3	Production of DNA vaccine; Production of subunit vaccine	5	K5(Ev)	Discussion forum (google classroom, mentimeter)	
	4	Nanotechnology – nanomaterials, Synthesis of nanodrugs	3	K4(An)	Lecture using PPT Videos	
V	1.	The internet, World Wide Web, search engines	5	K3(Ap)	Interactive PPT, Lecture with videos	Peer review, short essay, Handing the techniques, Individual demonstration, Online Assignments, Formative assessments, JAM, Student Presentation.
	2.	Primary nucleotide sequencedatabases- Genbank,DDBJ;	4	K4(An)	Discussion forum (google classroom, mentimeter)	
	3	Primaryproteinsequence databases- NCBI,PIR,EMBL;Sequence Analysis - Pair-wise alignment	4	K5(Ev)	E- content , Lecture with point sessions	
	4	BLAST & FASTA types; Multiple sequencealignment;CADD.	5	K5(Ev)	Lecture using you tube videos, Group discussion	

Course Focussing on Employability/ Entrepreneurship/ Skill Development : Skill Development

Activities (Em/ En/SD): Interactive PPT prepared by students, Poster Presentation, visit Lab

Course Focussing on Cross Cutting Issues (Professional Ethics/ Human Values/Environment Sustainability/ Gender Equity): Environment Sustainability

Activities related to Cross Cutting Issues :-

Assignment : Types of cloning vectors – Plasmids, Cosmids, ssDNA phages, online (Google classroom, Nearpod)

Seminar Topic: Primary nucleotide sequencedatabases-Genbank,DDBJ

Sample questions (minimum one question from each unit)

Part A

1. Difference between plasmids and cosmids, in relation to its structure .
2. Interpret the possible restriction site, when a gene is cut with ECOR1 .
- 3.What enzyme is most commonly used in Protoplast isolation?.
- 4.Vinegar is otherwise known as Acetic acid. – State True or False .
5. Who is the father of Tissue culture -----

Part B

1. Assume and draw the structure of Ti plasmid and mention its parts .
2. Difference between YEP and YRP vector .
- 3.Interpret the results of Meristem culture with diagram .
4. Relate the production of haploid plants through androgenesis mode .
5. Interpret the sequential steps for immobilizing the enzyme? .
6. Shuttle vector can propagate in two different host species – Justify your answer .

Part C

1. Formulate the construction of cDNA library, with the starting source as mRNA .
2. Compile the nomenclature, classification and properties of Restriction enzymes .
3. Plan a model for the production of Bt cotton, in order to resist the bollworms with suitable diagram
4. Construct and interpret the events of protoplast culture with a suitable diagram .
5. Demonstrate the different parts of fermentor .
- 6.Summarize the process of ethanol production with sugarcane baggase as a main substrate. Diagram compulsory .

Course Instructor : Dr. S. Kala Vetha Kumari HOD : Dr. A. Anami Augustus Arul

Teaching Plan

Department : Botany
Class : II M.Sc. Botany
Title of the Course : Elective IV b – Entrepreneurial Botany
Semester : II
Course Code : PB2045

Course Code	L	T	P	Credits	Inst. Hours	Total Hours	Marks		
							CIA	External	Total
PB2045	3	3	-	5	6	90	25	75	100

Objectives

1. To enable the students to become self-employable.
2. To introduce the students about the funding agencies.

Course outcomes

Course outcomes :	On completion of this course, the students will be able to: CO	PSO addressed	Cognitive level
CO 1	create protocol for the production of mushroom	PSO – 1	K1(R)
CO2	understand the nutritive value of SCP	PSO –4	K2(U)
CO 3	justify the impact of organic fertilizers over synthetic fertilizers	PSO –5	K5(Ev)
CO4	summarize the aesthetic sense of gardening	PSO – 6	K4(Ap)
CO5	know the different funding agencies	PSO – 3	K3(An)

Teaching plan

Total Contact hours: 90 (Including lectures, assignments and tests)

Unit	Module	Topic	Teaching Hours	Cognitive level	Pedagogy	Assessment/ Evaluation
I	1	Mushroom Cultivation - Introduction to mushroom fungi, nutritional value, edible and poisonous type.	3	K2(U)	Brainstorming, Introductory session	Surprise test, Mentimeter, Short essays, Quiz, Short Essay, True or false, online assignments
	2	Medicinal value of mushrooms, Spawn Production; Cultivation techniques	3	K2(U)	Lecture using gamma ppt	
	3	Problems in cultivation – disease and pest management strategies; harvesting, packing and storage.	3	K1(R)	Lateral thinking	
II	1	Single Cell Protein Production – Introduction, Importance of SCP	3	K1(U)	Lecture using slido	Flipgrid, observation note, seminars, oral test, open book tests,
	2	Nutritive value, production process, properties.	3	K2(R)	Lecture using videos,	
	3	Microbes employed in the production of SCP. Biomass production of SCP from <i>Spirulina</i> . Advantages of SCP.	33	K3(An)	Blended learning, demo using virtual images	
III	1	Organic Farming – Introduction, advantages and importance of organic farming,	2	K1 (U)	Lecture using Chalk and talk ,Introductory session,	MCQ using google forms, short essay Diagrammatic representation, Essays, mentimeter
	2	Biofertilizers – production of biofertilizers – <i>Azolla</i>	2	K4(An)	Group discussion	
		Large scale production and applications of humic acid and panchagavya.	2	K3(Ap)	Group discussion, Nearpod class	
IV	1	Gardening – Indoor – Green House, Hydroponics, Terrarium, Bonsai, Hanging pots, Miniature Rockery.	3	K1(U)	Lecture using Chalk and talk, Using visual images and models	Quiziz, seminar presentation, oral test, observation note, Short essays
	2	Orchidarium and water	5	K3(Ap)		

		garden. Outdoor – Kitchen Garden and roof top garden.				
V	1	Entrepreneurship –Role of funding agencies(NABARD)	5	K3(Ap)	Flipped classroom	Kahoot, google forms, Short essays, Summarize, Slip test , debate
	2	Rural Banking, FAO, STEP (Science & Technology Entrepreneurship Programme) - Govt and NGO's.	5	K4(Ap)	Blended learning	
	3	Yojana Schemes. Entrepreneurship Development Programme (EDP).	5	K5(Ev)	Discussion forum	

Course Focussing on Employability/ Entrepreneurship/ Skill Development : Skill Development

Activities (Em/ En/SD): Organic farming- demonstration

Course Focussing on Cross Cutting Issues (Professional Ethics/ Human Values/Environment Sustainability/ Gender Equity): Environment Sustainability

Activities related to Cross Cutting Issues :-

Assignment : Cultivation of mushroom/ online

Seminar Topic: Indoor gardening.

Sample questions (minimum one question from each unit)

Part A

6. Which one is the poisonous mushroom?
a.Amanita b. Pleurotus c.Shitake d. Oyster
7. Abbreviate SCP.
8. Azolla is a aquatic fern- State true or false
9. _____is the place were orchids are reared and grown.
10. Abbreviate EDP.

Part B

11. Enlist the nutritive values of mushroom..
12. List out the nutritive values of SCP .
13. Writeshort note on *Azolla* biofertilizer.
14. Comment on orchidarium.
15. Criticize on ruralbanking.

Part C

6. Explain mushroom cultivation process.
7. Summarize biomass production of SCP from *Spirulina*..
8. Discuss the production process of Panchakavya.
9. Explain the Kitchen Garden and roof top garden.
10. Critique on role of funding agencies in Entrepreneurship.

Head of the Department

Dr. A. Anami Augustus Arul

Course Instructor

Dr.J.Celin Pappa Rani

