CHRIST COLLEGE (AUTONOMOUS), IRINJALAKUDA

Programme	B. Sc.				
Course Title	**Aesthetic Botany**				
Type of Course	**Minor**				
Semester	**I**				
Academic Level	100 - 199				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	3	-	2	75
Pre-requisites	Higher secondary level biology course				
Course Summary	This course offers basic idea in gardening, horticulture, photography, illustration, and craft making using botanicals.				

Course Outcomes (CO): After completing the Course, the student should be able to:-

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Demonstrate basic principles of gardening to successfully grow and maintain plants	Ap	C	Assignment/ Quiz
CO2	Demonstrate fundamental knowledge in plant propagation and care and identify the importance of floriculture and its market	Ap	C	Assignments / Practical/ Quiz
CO3	Implement the passion for plants into captivating botanical imagery	Ap	C	Assignments/ Practical
CO4	Implement techniques to plan, plant, and nurture both indoor and outdoor gardens	Ap	C	Assignments/ Practical
CO5	Design art pieces using plant parts	C	P	Observation of Practical Skills

* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C)

- Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)

Detailed Syllabus:

Module	Unit	Content	Hrs (45 +30)
I	**Introduction to Aesthetic Botany**		**15**
	1	Aesthetic characteristics of plants - Shape and outline, Structure and branching pattern, Symmetry of flowers, Geometric arrangements of leaves, Size and scale, Surface texture, Pattern and veining, Colour- flower hues, foliage variations, seasonal shifts.	2
	2	Landscaping - Goals, Types, Planning and layout, Style of gardens (Formal, Informal); Types of gardens (English, Mughal and Japanese)	2
	3	Gardening - definition; Principles of garden design, site selection, Features of a garden (Trees, shrubs and shrubberies, climbers and creepers, Lawn, Garden wall, Fences and gates, Paths and walkways, Borders, Hedge, Edging, Rockery, Flower beds, Pergola, Gazebo, Garden furniture, Solar-electric lights, Sculptures, Water garden)	3
	4	Propagating structures - green house, poly house, mist chamber, net frame	1
	5	Indoor gardening - selection of indoor plants, care and maintenance of indoor plants; Vertical gardens Some Famous gardens of India	3
	6	Bonsai - principle, types, methods & tools	2
	7	Aquascaping & Terrarium - Methods	2
II	**Horticultural techniques**		**15**
	8	Soil - components of soil, types of soil Fertilizers - chemical, organic, biofertilizer, composting systems Pots and Potting - Earthen, fibre, polythene bags Potting mixture, potting, repotting, top dressing. Irrigation - Surface, sprinkle, drip	4
	9	Garden tools and implements	1
	10	Seed propagation - Seed quality, seed treatment, essential conditions for successful propagation, raising of seed beds, transplanting techniques	2
	11	Vegetative propagation: a) Cutting (stem, roots, leaves) b) Grafting (approach, side, tongue)	3

		c) Budding (T-budding, patch) d) Layering (simple, trench, air)	
	12	Protection of horticultural plants - Precautions to avoid pests and diseases, biopesticides	1
	13	Hydroponics - Principle and method	1
	14	Floriculture - Industrial importance of ornamental plants Floriculture in India Cut flower market - Scope and prospects	2
	15	Flower shows and exhibitions - Importance	1
III	**Botanical documentation**		**8**
	16	Digital documentation - Basics	2
	17	Photography - Basics of Botanical Photography, Composition, Lighting and capturing, Editing and Presentation	2
	18	Micro and Macro photography	2
	19	Botanical illustrations - Botanical illustration techniques, Sketching, Water colour, Pen and Ink. Colour theory and Mixing; Significance	2
IV	**Botanical Art and Craft**		**7**
	20	Floral arrangements - Ikebana: Types of arrangements. Contemporary floral design styles.	3
	21	Resin embedding of flowers - techniques, methods and applications.	2
	22	Botanical printing - process and techniques	2
V	**Practical (Mandatory list)**		**30**
	1. Vegetative propagation-cutting, budding, grafting, layering 2. Familiarizing gardening tools and implements 3. Fresh and dry flower arrangements 4. Preparation of potting mixture and Polybag filling 5. Visit to public/institutional/ botanical gardens/nurseries/horticulture station (A brief report may be recorded)		
	Practical (Open ended)		
	1. Preparation of bottle gardens 2. Terrarium making 3. Botanical Photographs		

Suggested Readings

- Andiance and Brison. 1971. Propagation Horticultural Plants.
- Chanda, K.L. and Choudhury, B. Ornamental Horticulture in India.
- George Acquaah. 2005. Horticulture: Principles and Practices. Pearson Education, Delhi.
- Hudson, T. Hartmann, Dale K. Kester, Fred T. Davies, Robert L. Geneve, Plant Propagation, Principles and Practices.
- Kolay, A.K. Basic Concepts of Soil Science. New Age International Publishers, Delhi.
- Nishi Sinha: Gardening in India, Abhinav Publications, New Delhi.
- Prasad, S., and U. Kumar. Green house Management for Horticultural Crops, Agrobios, Jodhpur.
- Sudhir P. 2018. Landscape gardening. Scientific Publishers India.
- Gavino M. 2018. Floriculture and landscaping. Scitus Academics LLC.
- Percy L. 2004. Gardening in India. Oxford & IBH publishers.
- Laeeq F. 2008. Gardens. National book trust India Publishers.
- Ekta Chaudhary 2022. Garden Up. Penguin Random House India publishers.
- Prathap Rao M. 2020. Landscape Design. Standard Publishers and Distributors Pvt.
- Percy L. 2008. Gardening in India. 2nd Edition, Oxford & IBH publishers.

Online Sources

- https://www.georgeweil.com/blog/botanical-printing-an-overview/
- https://www.lostincolours.com/eco-printing-for-beginners/
- https://www.instructables.com/Techniques-to-Embed-Flowers-in-Resin/
- https://www.researchgate.net/publication/341831968_Epoxy_resin_encapsulation_technique

Mapping of COs with POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	-	3	-	1	2	0
CO2	3	-	2	-	1	1	1
CO3	3	-	3	3	-	1	0
CO4	3	-	3	-	2	1	0
CO5	3	-	3	2	1	1	1

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly/Low
2	Moderate/ Medium
3	Substantial/ High

Assessment Rubrics:

- Quiz / Assignment/ Discussion / Seminar
- Internal Exam
- Project/Practical
- Final Exam

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO 1	✓	✓		✓
CO 2	✓	✓		✓
CO 3	✓	✓	✓	✓
CO 4	✓	✓	✓	✓
CO 5	✓			

CHRIST COLLEGE (AUTONOMOUS), IRINJALAKUDA

BOTANICAL DIVERSITY

Programme	B. Sc.				
Course Title	**Plant Ecology, Conservation & Plant Interactions**				
Type of Course	**Minor**				
Semester	**I**				
Academic Level	100-199				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	3	-	2	75
Pre-requisites	-				
Course Summary	This course offers basic knowledge related to the relationships between plants and their environment, the importance of conservation efforts and the interactions between different plant species.				

Course Outcomes (CO): After completing the Course, the student should be able to:

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools
CO1	Explain the ecological relationships between plants and the environment	U	C	Test/Assignments/Field study
CO2	Explain the importance of biodiversity, causes for loss and its consequences	U	F	Test/Assignments/Field study
CO3	Summarize the significance of conservation practices	U	C	Test/Assignments/Group project
CO4	Explain various interactions that occur among plant species	U	C	Test/Assignments/Field study
CO5	Apply conservation strategies suitable for neighbouring ecosystems and develop the skills necessary to contribute to the conservation and sustainable management of plant ecosystems	Ap	P	Case studies/Presentations/Field reports

* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C)
\# - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)

Detailed Syllabus

Module	Unit	Content	Hrs (45 + 30)
I		**Plant Ecology**	**9**
	1	Ecology - Definition, Ecosystem: ecological factors - biotic and abiotic.	2
	2	Ecological adaptations - Morphological and anatomical adaptations of the following types: Hydrophyte (*Vallisnaria*), Xerophyte (*Opuntia*)	2
	3	Halophyte (*Avicennia*), Epiphytes (*Vanda*) and parasites (*Cuscuta*)	2
	4	Ecological succession - Process of succession, types of succession, Hydrosere	3
II		**Biodiversity, Loss and its Consequences**	**18**
	5	Biodiversity - Definition, types of biodiversity - habitat diversity, species diversity and genetic diversity	3
	6	Values of Biodiversity - Economic and aesthetic value, Medicinal values	2
	7	Concept of Biodiversity Hotspots, Biodiversity hot spots of India.	2
	8	Concept of endemism and endemic species. ICUN plant categories with special reference to Western Ghats.	2
	9	Estimates of extinction rates worldwide and in India, causes of extinction/changes in biodiversity	2
	10	Habitat fragmentation and destruction	3
	11	Threats to biodiversity: Overexploitation, Invasive species	2
	12	Consequences: loss of gene pool, loss of ecosystem services, livelihood	2
III		**Biodiversity Conservation**	**8**
	13	Conservation methods - *In-situ* and *ex-situ* methods.	2
	14	*In-situ* methods - Biosphere reserves, National parks, Sanctuaries, Sacred grooves	2
	15	*Ex-situ* methods - Botanical gardens, Seed bank, Gene banks, Pollen banks	2
	16	Cryopreservation	2
IV		**Plant Interactions**	**10**
	17	Plant interactions: overview, Plant - microbe interactions: Mycorrhizae	1
	18	Plant - herbivore interactions, Plant defences against herbivores	2
	19	Plant - pollinator interactions, Pollination syndromes and floral specialization	2
	20	Ant-plant interactions	1
	21	Plant-animal interactions as ecosystem services	2
	22	Conservation aspect of plant-animal interactions	2

V	Practical (Mandatory Experiments)	30
	1. Study the morphological and anatomical adaptations of the hydrophytes, xerophytes, halophytes, epiphytes and parasites mentioned in the syllabus 2. Study of a pond/forest ecosystem and recording the different biotic and abiotic components 3. Field observations of plant-animal interactions in natural environments around campus 4. Field visit: To study different types of local vegetation/ecosystems and the report to be recorded.	
	Practical (Open Ended)	
	5. Case studies: Contemporary Indian wildlife and biodiversity issues 6. Group presentations in an area of conservation biology 7. Discussion on biodiversity (Man-animal conflict, human interference, climate change)	

Suggested Readings

- Rajak, A. 2020. Textbook of Biodiversity. 1st edition, Notion Press, India.
- Mahanty, S. and Srivastava, A. 2016. Biodiversity and It's Conservation. Disha International Publishing House, India.
- Singh, J.S., Singh, S.P. and Gupta, S.R. 2008. Ecology, Environment and Resource Conservation. Anamaya Publications (New Delhi).
- Krishnamurthy, K.V. 2004. An Advanced Text Book of Biodiversity - Principles and Practices. Oxford and IBH Publications Co. Pvt. Ltd. New Delhi.
- Gaston, K J. and Spicer, J. I. 1998. Biodiversity: An Introduction. Blackwell Science, London, UK.
- Primack, R. B. 2002. Essentials of Conservation Biology (3rd edition). Sinauer Associates, Sunderland, USA.
- Chittka, L. and Thompson, J. D. (Eds.). 2001. Cognitive Ecology of Pollination-Animal Behaviour and Floral Evolution. Cambridge University Press.
- Herrera, C. M. and Pellmyr, O. (Eds.). 2002. Plant-Animal Interactions: An Evolutionary Approach. Blackwell Publishing.
- Schaeffer, H.M., and Ruxton, G.D. (Eds). 2011. Plant-Animal Communication. Oxford University Press.

Online Sources

- https://www.igntu.ac.in/eContent/IGNTU-eContent-313628797582-M.Sc-EnvironmentalScience-4-ManojkumarRai-MicrobialEcology-2-3.pdf
- http://www.eagri.org/eagri50/AMBE101/lec29.html
- http://eagri.org/eagri50/AMBE101/pdf/lec29.pdf
- ales.arizona.edu/classes/ento415/LECTURES/ENTO415_PlantInteractions.pdf
- https://entnemdept.ufl.edu/baldwin/webbugs/3005_5006/Docs/notes/notes10.pdf

Mapping of COs with POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	-	-	-	1	3	2
CO2	3	-	2	-	2	3	3
CO3	3	-	2	-	2	3	3
CO4	3	-	1	-	2	3	3
CO5	3	1	2	1	2	3	3

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Discussion
- Assignment/ Seminar
- Project/Practical
- Final Exam

Mapping of Cos to Assessment Rubrics

	Internal Exam	Assignment/Seminar	Practical/Project Evaluation	End Semester Examinations
CO 1	✓	✓	✓	✓
CO 2	✓	✓	✓	✓
CO 3	✓	✓	✓	✓
CO 4	✓	✓	✓	✓
CO 5	✓			

CHRIST COLLEGE (AUTONOMOUS), IRINJALAKUDA

Programme	B. Sc. BOTANY				
Course Title	**Plants in Everyday Life**				
Type of Course	**MDC**				
Semester	**II**				
Academic Level	100-199				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	3	3	-		45
Pre -requisites	-				
Course Summary	This course is designed to give an overview of how plants are indispensable to humans. It gives a broad exposure to the various aspects of plant resources & its utilization.				

Course Outcomes (CO): After completing the Course, the student should be able to:

COs	Statement	Cognitive level*	Knowledge Category#	Evaluation Tools
CO1	Explain the major role of plants in different aspects of life	U	F	Written Assignments/ Quiz/ Exam
CO2	Explain the uses of economically important plants.	U	F	Written Assignments/ Quiz/ Exam
CO3	Explain the uses and processing of various economically important plant parts.	U	F	Written Assignments/ Quiz/ Exam
CO4	Discuss the production of eco-friendly products from plant materials	U	C & P	Written Assignments/ Quiz/ Exam
CO5	Access the quality and content of products used in everyday life	E	P	Analytical reports

* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C)
\# - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)

Detailed Syllabus

Module	Unit	Content	Hrs (36+9)
I		**Role of plants**	**9**
	1	Introduction to Plant resources.	1
	2	Role of plants: Air purifier (photosynthesis); plants used in	2
		rituals/festivals; nutrient source (litter manure, organic manure).	

	3	Pollution removal (phytoremediation and its types), pollution indicator (lichens).	2
	4	Common medicinal plants around us: Tulsi, *Adhatoda*, *Phyllanthus*, *Aloe*, *Andrographis*, *Eclipta*, *Coleus aromaticus* (Botanical source, part of the plant used, and medicinal uses).	3
	5	Plants as biofertilizers – *Azolla* (method of cultivation) *Gliricidia* - Uses and benefits.	1
II	**Plant resources and utilization-I**		**9**
	5	Brief description of plants, parts used and uses. Cereals: Rice, Wheat Millets: Ragi, Jowar	2
	6	Legumes: Bengal gram, Green gram, Black gram Edible oils: Sesame, Coconut	2
	7	Cash crops: Cashew, Cocoa	1
	8	Starch and tuber crops: Tapioca, Sweet potato and Yam	2
	9	Vegetable crops: Red amaranth, Lady‘s finger	2
III	**Plant resources and utilization-II**		**9**
	10	Spices: Clove, Black pepper, Cardamom Beverages: Tea and Coffee (including processing).	2
	11	Oils: Eucalyptus, Clove, Rose and Rosemary	2
	12	Fibres: Coir, Cotton, Jute, Banana and Sisal (Methods of separation of fibre, drying and processing of any two)	4
	13	Timber: Teak, Rose wood	1
IV	**Eco-friendly products from plants**		**9**
	14	Eco friendly alternatives-Introduction and scope	1
	15	Compostable garbage bags and Tableware: Example and preparation method	2
	16	Natural cleaning products and disinfectants: (One example for each and its preparation)	2
	17	Natural fabric dye, hair dye and hair and face wash, face pack, creams and gel	4
	18	Shampoo, Conditioner - (One example for each and its preparation)	
	19	Benefits of eco-friendly lifestyle	1
V	**Open ended (Suggestive list)**		**9**
	1. Field visit in the campus/ nearby localities to identify useful plants 2. Report on eco-friendly products used in your area 3. Demonstration on preparation of various plant-based products		

Suggested Readings

- Billings S. and Collingwood S. 2013. The Big book of home remedies. Lulu.com publisher.
- Buckley, C. 2020. Plant Magic: Herbalism in Real Life. Roost Books Publishers,

New York.

- Chrispeels, M. J. and Sadava, D. E. 1994. Plants, Genes and Agriculture. Jones & Bartlett Publishers.
- Fuller, K.W. and Gallon, J. A. 1985. Plant Products and New Technology. Clarendon Press, Oxford, New York.
- Hill, A. F. 1952. Economic Botany: A Textbook of Useful Plants and Plant Products. McGraw Hill Publishing Company Ltd., New Delhi.
- Kochhar, S. L. 2012. Economic Botany in the Tropics. MacMillan India Ltd., New Delhi.
- Purohit, S. S. and Vyas, S. P. 2008. Medicinal Plant Cultivation: A Scientific Approach. Agrobios, India.
- Rao, R. S. 1985) Everyday Ayurveda: The complete book of Ayurvedic home remedies. Notion Press, India.
- Sambamurty and Subramanyam N. S. 1989. A Textbook of Economic Botany. Wiley Eastern Ltd., New Delhi.
- Sen, S. 2009. Economic Botany. NCBA Publishers, New Delhi.
- Sharma, O. P. 1996. Economic Botany. Tata McGraw Hill Publishing Company Ltd., New Delhi.
- Simpson B. B. and Conner-Ogorzaly M. 1986. Economic Botany - Plants in Our World. McGraw Hill, New York.
- Singh V, Pande P. C. and Jain D. K. 2009. A Text Book of Economic Botany. Rastogi Publications, Uttar Pradesh.
- Trivedi, P. C. 2006. Medicinal Plants: Ethnobotanical Approach. Agrobios, India.
- Upadhyay, R. 2023. Economic Botany: Principles & Practices. Kluwer Academic Publishers, The Netherlands.

Mapping of COs with POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	-	3	1	2	1	2
CO2	2	-	2	1	2	1	2
CO3	2	-	2	1	2	1	2
CO4	3	-	3	1	2	1	2
CO5	2	-	2	1	2	1	2

Correlation Levels:

Level	**Correlation**
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Exam/Discussion
- Assignment/ presentation/Project
- Project/Practical
- Final Exam

Mapping of COs to Assessment Rubrics :

	Quiz/ discussion	Presentation/ Assignment/Project	Theory/Practical Internal exam	End Semester Examinations
CO 1	✓	✓	✓	✓
CO 2	✓	✓	✓	✓
CO 3	✓	✓	✓	✓
CO 4	✓	✓	✓	✓
CO 5		✓		

CHRIST COLLEGE (AUTONOMOUS), IRINJALAKUDA

Aesthetic Botany

Programme	B. Sc.				
Course Title	**Microbial Diversity and Phytopathology**				
Type of Course	**Minor**				
Semester	**II**				
Academic Level	100-199				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	3	-	2	75
Pre-requisites	Higher secondary level biology course				
Course Summary	This course aims to provide students with a comprehensive understanding of the microbiome and its significance in our surroundings. Students will explore the diversity of microflora and critically analyse their impact, both beneficial and harmful, on various aspects of human life and the biosphere.				

Course Outcomes: After completing the Course, the student should be able to:-

COs	Statement	Cognitive level*	Knowledge Category#	Evaluation Tools used
CO1	Explain characteristic features of microbial life and their importance	U	F	Instructor-created exams / Quiz
CO2	Explain characteristic features of bacteria	U	C & P	Seminar Presentation
CO3	Discuss general awareness on the diversity of microorganisms and their applications	U	F	Instructor-created exams / Quiz
CO4	Discuss plant diseases and derive control measures	U	C & P	Seminar presentation
CO5	Assess the different staining technique and isolation of bacteria and significance of plant diseases with respect to crop production is concerned	E	P	In-class discussions/ Practicals

* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C)

- Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)

Detailed Syllabus:

Module	Unit	Content	Hrs (45 + 30)
I	**Introduction to Microbiology and Virology**		**8**
	1	History, diversity of microbial world	1
	2	Whittaker's five kingdom system of classification. Evolutionary significance	1
	3	General characters of Viruses with emphasis on occurrence, architecture and multiplication	3
	4	Structure of Bacteriophages (T4), Virions, Prions, Mycoplasma	2
	5	General account on viral epidemics and pandemics and its pathogens - Covid, H1N1	1
II	**Bacteriology**		**15**
	6	General outline on Eubacteria and Archaebacteria, Thermophiles, Psychrophiles, and Halophiles	1
	7	Bacterial morphology and ultrastructure	3
	8	Cell Wall - Composition and detailed structure of Gram-positive and Gram-negative cell walls Gram and acid fast staining	2
	9	Effect of antibiotics and enzymes on the bacterial cell wall (brief account only).	1
	10	Cell membrane - Structure, function and chemical composition of bacterial cell membranes, mesosomes.	2
	11	Phases of growth (S-curve), Asexual methods of reproduction	1
	12	Gene transfer mechanism in bacteria - Conjugation, Transduction, and Transformation	3
	13	Pure culture isolation - Streaking, Serial dilution and Plating methods	1
	14	Cultivation, maintenance and preservation/stocking of pure cultures	1
III	**Applied Microbiology**		**12**
	15	Microbiology in agriculture - biofertilizer, bioinsecticides, nitrogen fixation, biofuels, Plant Growth Promoting Bacteria, Soil microbes and plant health	3
	16	Microbiology in medicine - Antibiotics, Antimicrobial resistance, Probiotics and Microbial therapeutics -	2

		microbiome.	
	17	Viruses as Tools in Genetic Engineering	2
	18	Biotechnological Applications of extremophiles Bacteria in Industrial Fermentation Bioaugmentation and Biostimulation	5
IV	**Phytopathology**		**10**
	19	Importance, Definition and concepts of diseases, Types of plant pathogens, Symptoms associated with microbial plant diseases.	1
	20	Koch's postulates, Host-parasite interaction Defense strategies in plants to pathogens- Phenolics, phytoalexin, elicitors, enzymes, toxins.	3
	21	Disease management strategies - Cultural, Botanical, Chemical, Biological and Integrated Disease Management. Environmental concern over chemical management - Residues and health hazards, fungicidal resistance in plant pathogens and its managements.	3
	22	Study of some important plant diseases giving emphasis on its etiology, symptoms, epidemiology and management i) Fungal diseases - Grey leaf spot disease of coconut, Quick wilt of pepper ii) Bacterial diseases - Citrus canker, Blast of paddy iii) Viral diseases - Tapioca mosaic disease, Bunchy top of Banana	3
V	**Practical (Mandatory list)**		**30**
	1. Gram staining - Curd, root-nodules 2. Culture and isolation of bacteria using nutrient agar medium (demonstration only) 3. Case study on microbial diseases 4. Identification of the disease, pathogen, symptoms and control measures of the plant diseases mentioned in the syllabus		
Practical (Open ended/Suggestive list)			
	5. Microbiology lab visit 6. Collections and dry preservation of diseased specimens of important crops. 7. Preparation of an assignment of 10 significant plant or human pathogens with the symptoms, epidemiology, life cycle and control measures (Photographs or sketch of stages of infection)		

Suggested Readings

- Agrios, G.N. 1997. Plant Pathology (4th ed) Academic Press.

- Bilgrami K.H. & H.C. Dube. 1976. A text book of Modern Plant Pathology. International
- Book Distributing Co. Lucknow.
- Mehrotra, R.S. 1980. Plant Pathology – TMH, New Delhi.
- Pandey, B.P. 1999. Plant Pathology. Pathogen and Plant diseases. Chand & Co., New Delhi.
- Rangaswami, G. 1999. Disease of Crop plants of India Prentice Hall of India Pvt. Ltd.
- Sharma P.D. 2004. Plant Pathology Rastogi Publishers.
- Gerard, J. T., Berdell, R. F., Christine, L. C. 2019. Microbiology: An Introduction. Pearson India, Noida, Uttar Pradesh.
- Joanne, W., Linda, S., Christopher, J. W. 2018. Prescott's Microbiology. McGraw Hill Education, Noida, Uttar Pradesh
- Trivedi, P.C. 2017. Introduction to Microbiology. S. Chand Publishing, Ram Nagar, New Delhi.
- Dubey, R. C. 2019. Microbiology: Principles and Applications. S. Chand Publishing, Ram Nagar, New Delhi.
- Jacquelyn, G. B., Laura, J. B. 2018. Microbiology: Principles and Explorations. John Wiley & Sons India Pvt. Ltd., Gurgaon, Haryana.
- Baveja, C.P. 2019. Microbiology: A Laboratory Manual. Arya Publications, 4221/1, Ansari Road, Daryaganj, New Delhi.

Mapping of COs with POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	-	3	1	3	1	3
CO2	3	-	2	1	3	1	3
CO3	3	-	3	1	3	1	3
CO4	3	-	2	1	2	1	2
CO5	3	-	2	1	3	1	3

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Discussion / Seminar
- Midterm Exam
- Project/Practical
- Final Exam

Mapping of COs to Assessment Rubrics:

	Internal Exam	Assignment	Practical/Project Evaluation	End Semester Examinations
CO 1	✓	✓		✓
CO 2	✓	✓	✓	✓
CO 3	✓	✓		✓
CO 4	✓	✓	✓	✓
CO 5	✓		✓	

CHRIST COLLEGE (AUTONOMOUS), IRINJALAKUDA

BOTANICAL DIVERSITY

Programme	B. Sc.				
Course Title	**Plant Morphology, Physiology & Plant Resources**				
Type of Course	**Minor**				
Semester	**II**				
Academic Level	100-199				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	3	-	2	75
Pre-requisites	Higher secondary level Biology course				
Course Summary	This course covers a comprehensive study of the structure, function, and utilization of plants. Students will explore the morphology of plants, and the physiological processes that occur within plants. Furthermore, students will learn about the diverse uses of plants as valuable resources for food, medicine, and more.				

Course Outcomes (CO): After completing the Course, the student should be able to:-

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools
CO1	Explain the various morphological characteristics of a plant	U	F	Quiz/ Test/Assignments/ Practical/ Field studies
CO2	Explain the physiological processes that drive plant growth, development and responses to the environment	U	F&C	Assignments/Quiz/Test
CO3	Discus the process of growth in plants	U	C	Presentations
CO4	Explain the importance of plants as valuable resources for food, medicine and more	U	C	Group project/Class discussion
CO5	Apply knowledge of plant morphology and physiology to analyze problems related to plant health and productivity	Ap	C&P	Field work/practicals

* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C)

- Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)

Detailed Syllabus:

Module	Unit	Content	Hrs (45 + 30)
I		**Plant Morphology**	**7**
	1	Morphology of leaf; Structure, simple, compound, venation and phyllotaxy.	2
	2	Inflorescence - Racemose, cymose, special, types with examples	2
	3	Flower - as a modified shoot, structure of flower, symmetry of flower, floral parts - their arrangement, types of aestivation, relative position of parts, cohesion and adhesion of stamens and placentation.	3
II		**Plant Physiology**	**18**
	4	Water relations: Permeability, Imbibition, Diffusion, Osmosis and water potential.	2
	5	Absorption of water: passive mechanism.	1
	6	Ascent of sap: Transpiration pull or cohesion-tension theory.	2
	7	Transpiration: Types, mechanism of stomatal movement: K^+ ion theory.	2
	8	Significance of transpiration, antitranspirants.	2
	9	Photosynthesis: Introduction, significance, Two pigment systems, red drop, Emerson enhancement effect, action and absorption spectra.	3
	10	Mechanism of photosynthesis: Light reaction, cyclic & non-cyclic photo phosphorylation, Dark reactions-Calvin cycle, C_4 cycle, photorespiration (a brief account only). Factors affecting photosynthesis.	6
III		**Plant Growth**	**10**
	11	Plant growth - Definition, phases of growth, Auxins, gibberellins, cytokinin, abscisic acid and ethylene, their physiological roles.	2
	12	Senescence and abscission.	2
	13	Photo-periodism and vernalization.	2
	14	Dormancy of seeds - Factors causing dormancy, photoblasticism, techniques to break dormancy.	2
	15	Physiology of fruit ripening.	2
IV		**Plant Resources**	**10**
	16	Brief account on the various categories of plants based on their economic importance	1
	17	Study the following plants with special reference to their binomial, family, morphology of the useful part and their uses. Cereals: Paddy, Wheat; Pulses: Black gram, Green gram; Oil: Coconut, Gingelly	3

	18	Fibre: Cotton; Latex: Rubber; Beverages: Tea, Coffee	2
	19	Spices: Pepper, Cardamom, Clove	2
	20	Medicinal plants: *Rauvolfia serpentina*, *Justicia adhatoda*, *Santalum album and Curcuma longa.*	2
V	**Practical (Mandatory experiments)**		**30**

4. Identify the types of inflorescences mentioned in the syllabus.
5. Learn the principle and working of the following apparatus/experiments
   - Thistle funnel osmoscope
   - Ganong's potometer
   - Ganong's light-screen
   - Absorbo transpirometer
   - Mohl's half-leaf experiment
   - Experiment to show evolution of O_2 during photosynthesis
6. Identify at sight the economically important plant produces and products mentioned in module IV, and learn the binomial and family of the source plants, morphology of the useful parts and uses

Practical (Open ended)

1. Preparation of dried specimen or photo album of the morphological types studied
2. Setting up and understanding the working of any two physiological experiments and recording the result
3. Group project on the preparation of sample specimens of the economically important plants studied

Suggested Readings

- Sporne K. R. 1974. Morphology of Angiosperms. Hutchinson.
- William G. Hopkins. 1999. Introduction to Plant Physiology, 2nd edition, John Wiley & Sons, Inc.
- Frank B. Salisbury and Cleon W. Ross. 2002. Plant Physiology 3rd edition. CBS publishers and distributers.
- G. Ray Noggle and George J. Fritz. 1983. Introductory Plant Physiology Prentice Hall.
- Pandey B. P. 1987. Economic Botany
- Verma V. 1984. Economic Botany
- Hill A.W. 1981. Economic Botany, McGraw Hill Pub
- Alam, Afroz. 2020. A Textbook of Economic Botany and Ethnobotany. IK International Publishing House.
- Atal C.K. and Kapur B. M. 1982. Cultivation and Utilization of Medicinal Plants. CSIR-RRL, Jammu.
- Sambamurty and Subrahmanyam, N. S. 2008. A Textbook of Modern Economic Botany. CBS Publishers & Distributors Pvt. Ltd.
- Bhutya, R. K. 2021. Medicinal Plants of India Vol. I & II. Scientific Publishers.

Mapping of COs with POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	2	-	1	-	3	1	1
CO2	2	-	1	1	3	1	2
CO3	2	-	2	1	3	1	2
CO4	2	-	2	-	2	1	1
CO5	2	-	2	1	3	1	2

Correlation Levels:

Level	**Correlation**
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Discussion
- Assignment/ Seminar
- Project/Practical
- Final Exam

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment/Seminar	Practical/Project Evaluation	End Semester Examinations
CO 1	✓	✓	✓	✓
CO 2	✓	✓	✓	✓
CO 3	✓	✓		✓
CO 4	✓	✓	✓	✓
CO 5	✓		✓	

CHRIST COLLEGE (AUTONOMOUS), IRINJALAKUDA

BOTANICAL DIVERSITY

Programme	B. Sc. BOTANY				
Course Title	**Plant Diversity & Angiosperm Taxonomy**				
Type of Course	**Minor**				
Semester	**III**				
Academic Level	200-299				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	3	-	2	75
Pre-requisites	Higher secondary level Biology course				
Course Summary	This course covers a wide range of topics related to the classification and identification of plants. Students will learn about the diversity of plant species and the characteristics that define different plant groups. The course will also cover Taxonomy of Angiosperms and the methods and techniques used in it.				

Course Outcomes (CO): After completing the Course, the student should be able to:

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools
CO1	Explain the vegetative, reproductive and economic importance of Cyanobacteria, Algae and Fungi	U	F &P	Quiz/ Tests/ Lab Practical / Field Studies/ Assignments
CO2	Explain the vegetative, reproductive, ecological and economic importance of Bryophytes and Pteridophytes	U	F &P	Quiz/Test/ Assignments/ Lab Practical/ Field studies
CO3	Discus the vegetative, reproductive, ecological significance and economic importance of Gymnosperms	U	F & P	Lab Practical/ Field Work/ Assignments/ Quiz/Tests
CO4	Describe various classification systems and taxonomic principles to categorize and organize plant species.	U	F & P	Quiz/Test/ Assignments/ Lab Practical/ Field work
CO5	Appraise plant diversity and taxonomy in ecological and conservation contexts.	E	C	Lab practical/ Case Studies/ Field Studies/ Presentations

* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C)

- Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)

Detailed Syllabus

Module	Unit	Content	Hrs (45 + 30)
I	**Cyanobacteria, Algae and Fungi**		**15**
	1	Cyanobacteria - General Account, Ecological and Economic importance.	2
	2	*Nostoc* - Structure, life cycle and ecological significance.	2
	3	Algae - General characteristics, Thallus organization & reproduction , Ecological and economic importance.	2
	4	*Spirogya* - Structure and life cycle.	2
	5	Fungi - General characteristics, Nutrition and reproduction. Economic and ecological significance of fungi.	2
	6	Morphology, reproduction and life cycle of *Agaricus* (developmental details not required)	2
	7	Symbiotic Associations - Lichens: General features, reproduction, ecological and economic importance.	2
	8	Mycorrhiza - General account and its significance.	1
II	**Bryophytes & Pteridophytes**		**8**
	9	Bryophytes - General characteristics, Thallus diversity, Ecology and economic importance.	2
	10	Morphology, anatomy and reproduction of *Riccia.*	2
	11	Pteridophytes - General account, Ecological and economical importance of Pteridophytes.	2
	12	Morphology, Anatomy and life cycle of *Pteris.*	2
III	**Gymnosperms**		**5**
	13	Gymnosperm - General account. Ecological and economic importance.	2
	14	Morphology, anatomy and reproduction of *Cycas.*	3
IV	**Angiosperms**		**17**
	15	Angiosperms - General characters, reproduction, life cycle pattern	2
	16	Nomenclature - Binomial system of nomenclature	2
	17	Basic rules of nomenclature	1
	18	Systems of classification - Bentham & Hooker's system	2
	19	Herbarium techniques: collection, drying, poisoning, mounting & labelling	2
	20	Significance of herbaria and botanical gardens	1

	21	Important herbaria and botanical gardens in India	1
	22	Study the following families and their economic importance: Fabaceae (with sub-families), Rubiaceae, Euphorbiaceae and Poaceae	6
V	**Practical (Mandatory experiments)**		**30**
	1. Microscopic observation of vegetative and reproductive structures of *Nostoc* and *Spirogyra.* 2. Make suitable micro preparations of vegetative and reproductive structures of *Agaricus, Riccia, Pteris* and *Cycas.* 3. Study of vegetative and floral characters of the families in the syllabus. Students shall be able to describe the plants in technical terms and draw the L.S. of two plants of the families and record the same. 4. Mounting of properly dried and pressed specimen of any five wild plants of the families mentioned in the syllabus, with proper herbarium label.		
Practical (Open Ended-Suggestive list)			
	5. Field visit, identification and documentation of common Algae, Bryophytes and Pteridophytes. 6. Determine the systematic position of local plants comes under the syllabus based on their vegetative and floral characters. 7. Campus walk to identify and record campus plants.		

Suggested Readings

- Fritsch, F.E. 1935. The structure and reproduction of the algae. Vol. 1 and II, Uni. Press. Cambridge.
- Morris, I. 1967. An Introduction to the algae. Hutchinson and Co. London.
- Papenfuss, G.F. 1955. Classification of Algae.
- B.R. Vasishta. Introduction to Algae
- Mamatha Rao. 2009. Microbes and Non-flowering plants. Impact and applications. Ane Books, New Delhi.
- Sanders, W.B. 2001. Lichen interface between mycology and plant morphology, Bioscience, 51: 1025-1035.
- B.R. Vasishta. Introduction to Fungi.
- P.C. Vasishta. Introduction to Bryophytes.
- B.P. Pandey. Introduction to Pteridophytes
- Chamberlain C.J. 1935. Gymnosperms – Structure and Evolution, Chicago University Press.
- Sreevastava H.N. 1980. A Text Book of Gymnosperms. S. Chand and Co. Ltd., New Delhi.
- Vasishta P.C. 1980. Gymnosperms. S. Chand and Co., Ltd., New Delhi.
- Radford, A.E. 1986. Fundamentals of Plant Systematics. Harpor & Row Publishers, New York.
- Sivarajan, V.V. 1991. Introduction to Principles of Plant Taxonomy. Oxford & IBH,

New Delhi.

- Jeffrey, C. 1968. An introduction to Plant Taxonomy, Cambridge University Press, London.
- Gurucharan Singh. 2001. Plant Systematics. Theory and practice. Oxford & IBH Publications New Delhi.
- Sharma O.P. 1990. Plant Taxonomy – Tata McGraw Hills. Publishing company Ltd.
- Subramanyam N.S. 1999. Modern Plant Taxonomy. Vikas Publishing House Pvt Ltd.
- Pandey & Misra. 2008. Taxonomy of Angiosperms. Ane books Pvt Ltd.

Mapping of COs with POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	-	2	1	2	1	3
CO2	3	-	2	1	2	1	3
CO3	3	-	2	1	2	1	3
CO4	3	-	3	1	2	2	3
CO5	3	-	2	1	3	3	3

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Discussion
- Assignment/ Seminar
- Project/Practical
- Final Exam

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment/Seminar	Practical/Project Evaluation	End Semester Examinations
CO 1	✓	✓	✓	✓
CO 2	✓	✓	✓	✓
CO 3	✓	✓	✓	✓
CO 4	✓	✓	✓	✓
CO 5			✓	✓

CHRIST COLLEGE (AUTONOMOUS), IRINJALAKUDA

AESTHETIC BOTANY

Programme	B. Sc. BOTANY				
Course Title	**Plant Anatomy & Analytical Techniques**				
Type of Course	**Minor**				
Semester	**III**				
Academic Level	200-299				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	3	-	2	75
Pre-requisites	Higher Secondary level Biology course				
Course Summary	This course explores the intricate structures and functions of plant anatomy and the organization of tissues within plants and its diversity. The course also deals with a variety of analytical techniques crucial for studying various branches in biological sciences.				

Course Outcomes (CO): After completing the Course, the student should be able to:-

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools
CO1	Explain the basics, scope and applications of plant anatomy	U	F & P	Instructor-created exams / Observation of practical skills
CO2	Describe the special features of plant anatomy and compare the normal and abnormal behaviour of cambium	U	F & P	Viva voce/ Practical Assignment
CO3	Explain the analytical skills and apply it for various lab practices	U	F & P	Observation of practical skills
CO4	Discuss various separation techniques and apply it in lab practices	U	F & P	Instructor-created exams
CO5	Access the role of plant anatomy and analytical techniques in various fields of science.	E	C	Lab practicals

* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C)

- Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)

Detailed Syllabus:

Module	Unit	Content	Hrs (45 +30)
I	**Plant Anatomy -Basics, Scope and Applications**		**9**
	1	Introduction & Applications of plant anatomy in various fields	2
	2	Tissue systems - Simple & Complex, sclereids & fibres, Stomatal diversity	2
	3	Non-living inclusions of the cell & its applications	3
	4	Anatomical complexity in organization of shoot & root apex	2
II	**Special features in Plant Anatomy**		**12**
	5	Secondary thickening in dicot stem & root	2
	6	Anomalous secondary thickening - abnormal position and behaviour of cambium	2
	7	Anatomical diversity in major ecological groups of plants	3
	8	Wood anatomy - characteristics of wood & Types of wood	3
	9	Identification of various wood & defects in wood (shakes, knots, cross grain and stress defects)	2
III	**Analytical techniques**		**12**
	10	Solutions: representing concentrations: Molarity, Normality, Percentage and ppm	1
	11	Acids and bases, buffers and pH, measurement of pH	1
	12	Preparation and use of buffers in biological studies	1
	13	Microscopy – Introduction & Applications of Light microscopy	1
	14	Electron microscopy (SEM & TEM) - Principle, working & applications	2
	15	UV - Visible spectroscopy - Working and Applications	2
	16	IR spectroscopy - Applications	2
	17	Fluorescent spectroscopy - Principle & Applications	2
IV	**Separation techniques**		**12**
	18	Centrifugation - Basics, Principles behind various types & applications	2
	19	Differential, density gradient and Ultracentrifugation	2
	20	Chromatography - Introduction & Types	3
	21	Thin Layer Chromatography, Gas Chromatography & Liquid Chromatography - Principle and applications	3
	22	Mass spectroscopy - Basic principle and applications in plant science	2

V	Practical (Mandatory experiments)	30
	1. Normal secondary thickening in dicot stem and dicot root (any suitable material) 2. Anomalous secondary thickening of *Boerhaavia* and *Bignonia* 3. Special anatomical features of major ecological groups - any two plants depending on local availability (Hydrophytes, Xerophytes, Parasites) 4. Detection of different structures of plants - identification of starch grains, cystolith, raphides, any two types of sclereids and fibres 5. Stomatal types - identification	
	Practical (Open ended - Suggestive list)	
	6. Anatomical identification of commercial timber like (any two from the list - Teak, Rosewood, Artocarpus, Mahogany - Original specimen/ photographs and salient features) 7. Identification of types of wood and defects 8. Visit to a nearby analytical lab which facilitates the use of instruments mentioned in the syllabus and submission of report.	

Suggested Readings

- Esau, K. 1977. Anatomy of Seed Plants. John Wiley & Sons.
- Metcalfe, C. R., & Chalk, L. 1979. Anatomy of the Dicotyledons: Leaves, Stem, and Wood in Relation to Taxonomy with Notes on Economic Uses (Vol. 1). Oxford University Press.
- Raven, P. H., Evert, R. F., & Eichhorn, S. E. 2005. Biology of Plants (7th ed.). W.H. Freeman and Company.
- Mauseth, J. D. 2003. Botany: An Introduction to Plant Biology. Jones and Bartlett Publishers.
- Spectroscopic Techniques: Nakanishi, K., & Solomon, T. D. 1997. Infrared and Raman Spectra of Inorganic and Coordination Compounds. Wiley.
- Mass Spectrometry in Botany: Gross, J. H. 2011. Mass Spectrometry: A Textbook. Springer.
- Coutler E. G.1969. Plant Anatomy - Part I Cells and Tissues – Edward Arnold, London.
- Dickison, W.C. (2000). Integrative Plant Anatomy, Harcourt Academic Press, USA
- Eames A. J. Morphology of Angiosperms - Mc Graw Hill, New York.
- Evert, R.F. 2006. Esau‘s Plant Anatomy: Meristem, Cells, and Tissues of the Plant Body: Their Structure, Function and Development. John Wiley and Sons, Inc
- Fahn, A. 1992. Plant Anatomy, Pergamon Press, USA
- Ruzin S.E. 1999. Plant Microtechnique and Microscopy, Oxford University Press, New York. U.S.A.
- Webster J. G. 2004. Bioinstrumentation, John Wiley & Sons Inc.
- Narayanan P. 2000. Essentials of Biophysics, New Age Int. Pub. New Delhi.
- Hames G. G. 2005. Spectroscopy for the Biological Sciences, John Wiley & Sons Inc.

Mapping of COs with PSOs and POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	0	1	1	0	1	2
CO2	3	0	2	1	0	1	3
CO3	3	0	3	3	2	1	3
CO4	3	0	3	3	2	1	3
CO5	3	0	3	3	2	1	3

Correlation Levels:

Level	**Correlation**
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Discussion / Seminar
- Midterm Exam
- Project/Practical
- Final Exam

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	Practical/Project Evaluation	End Semester Examinations
CO 1	✓		✓	✓
CO 2	✓		✓	✓
CO 3	✓			✓
CO 4	✓			✓
CO 5			✓	✓

CHRIST COLLEGE (AUTONOMOUS), IRINJALAKUDA

BOTANICAL DIVERSITY

Programme	B. Sc. BOTANY				
Course Title	**Plant Diversity & Angiosperm Taxonomy**				
Type of Course	**Minor**				
Semester	**III**				
Academic Level	200-299				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	3	-	2	75
Pre-requisites	Higher secondary level Biology course				
Course Summary	This course covers a wide range of topics related to the classification and identification of plants. Students will learn about the diversity of plant species and the characteristics that define different plant groups. The course will also cover Taxonomy of Angiosperms and the methods and techniques used in it.				

Course Outcomes (CO): After completing the Course, the student should be able to:

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools
CO1	Explain the vegetative, reproductive and economic importance of Cyanobacteria, Algae and Fungi	U	F &P	Quiz/ Tests/ Lab Practical / Field Studies/ Assignments
CO2	Explain the vegetative, reproductive, ecological and economic importance of Bryophytes and Pteridophytes	U	F &P	Quiz/Test/ Assignments/ Lab Practical/ Field studies
CO3	Discus the vegetative, reproductive, ecological significance and economic importance of Gymnosperms	U	F & P	Lab Practical/ Field Work/ Assignments/ Quiz/Tests
CO4	Describe various classification systems and taxonomic principles to categorize and organize plant species.	U	F & P	Quiz/Test/ Assignments/ Lab Practical/ Field work
CO5	Appraise plant diversity and taxonomy in ecological and conservation contexts.	E	C	Lab practical/ Case Studies/ Field Studies/ Presentations

* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C)

- Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)

Detailed Syllabus

Module	Unit	Content	Hrs (45 + 30)
I	**Cyanobacteria, Algae and Fungi**		**15**
	1	Cyanobacteria - General Account, Ecological and Economic importance.	2
	2	*Nostoc* - Structure, life cycle and ecological significance.	2
	3	Algae - General characteristics, Thallus organization & reproduction , Ecological and economic importance.	2
	4	*Spirogya* - Structure and life cycle.	2
	5	Fungi - General characteristics, Nutrition and reproduction. Economic and ecological significance of fungi.	2
	6	Morphology, reproduction and life cycle of *Agaricus* (developmental details not required)	2
	7	Symbiotic Associations - Lichens: General features, reproduction, ecological and economic importance.	2
	8	Mycorrhiza - General account and its significance.	1
II	**Bryophytes & Pteridophytes**		**8**
	9	Bryophytes - General characteristics, Thallus diversity, Ecology and economic importance.	2
	10	Morphology, anatomy and reproduction of *Riccia.*	2
	11	Pteridophytes - General account, Ecological and economical importance of Pteridophytes.	2
	12	Morphology, Anatomy and life cycle of *Pteris.*	2
III	**Gymnosperms**		**5**
	13	Gymnosperm - General account. Ecological and economic importance.	2
	14	Morphology, anatomy and reproduction of *Cycas.*	3
IV	**Angiosperms**		**17**
	15	Angiosperms - General characters, reproduction, life cycle pattern	2
	16	Nomenclature - Binomial system of nomenclature	2
	17	Basic rules of nomenclature	1
	18	Systems of classification - Bentham & Hooker's system	2
	19	Herbarium techniques: collection, drying, poisoning, mounting & labelling	2
	20	Significance of herbaria and botanical gardens	1

	21	Important herbaria and botanical gardens in India	1
	22	Study the following families and their economic importance: Fabaceae (with sub-families), Rubiaceae, Euphorbiaceae and Poaceae	6
V	**Practical (Mandatory experiments)**		**30**
	1. Microscopic observation of vegetative and reproductive structures of *Nostoc* and *Spirogyra.* 2. Make suitable micro preparations of vegetative and reproductive structures of *Agaricus, Riccia, Pteris* and *Cycas.* 3. Study of vegetative and floral characters of the families in the syllabus. Students shall be able to describe the plants in technical terms and draw the L.S. of two plants of the families and record the same. 4. Mounting of properly dried and pressed specimen of any five wild plants of the families mentioned in the syllabus, with proper herbarium label.		
Practical (Open Ended-Suggestive list)			
	5. Field visit, identification and documentation of common Algae, Bryophytes and Pteridophytes. 6. Determine the systematic position of local plants comes under the syllabus based on their vegetative and floral characters. 7. Campus walk to identify and record campus plants.		

Suggested Readings

- Fritsch, F.E. 1935. The structure and reproduction of the algae. Vol. 1 and II, Uni. Press. Cambridge.
- Morris, I. 1967. An Introduction to the algae. Hutchinson and Co. London.
- Papenfuss, G.F. 1955. Classification of Algae.
- B.R. Vasishta. Introduction to Algae
- Mamatha Rao. 2009. Microbes and Non-flowering plants. Impact and applications. Ane Books, New Delhi.
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- B.R. Vasishta. Introduction to Fungi.
- P.C. Vasishta. Introduction to Bryophytes.
- B.P. Pandey. Introduction to Pteridophytes
- Chamberlain C.J. 1935. Gymnosperms – Structure and Evolution, Chicago University Press.
- Sreevastava H.N. 1980. A Text Book of Gymnosperms. S. Chand and Co. Ltd., New Delhi.
- Vasishta P.C. 1980. Gymnosperms. S. Chand and Co., Ltd., New Delhi.
- Radford, A.E. 1986. Fundamentals of Plant Systematics. Harpor & Row Publishers, New York.
- Sivarajan, V.V. 1991. Introduction to Principles of Plant Taxonomy. Oxford & IBH,

New Delhi.

- Jeffrey, C. 1968. An introduction to Plant Taxonomy, Cambridge University Press, London.
- Gurucharan Singh. 2001. Plant Systematics. Theory and practice. Oxford & IBH Publications New Delhi.
- Sharma O.P. 1990. Plant Taxonomy – Tata McGraw Hills. Publishing company Ltd.
- Subramanyam N.S. 1999. Modern Plant Taxonomy. Vikas Publishing House Pvt Ltd.
- Pandey & Misra. 2008. Taxonomy of Angiosperms. Ane books Pvt Ltd.

Mapping of COs with POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	-	2	1	2	1	3
CO2	3	-	2	1	2	1	3
CO3	3	-	2	1	2	1	3
CO4	3	-	3	1	2	2	3
CO5	3	-	2	1	3	3	3

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Discussion
- Assignment/ Seminar
- Project/Practical
- Final Exam

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment/Seminar	Practical/Project Evaluation	End Semester Examinations
CO 1	✓	✓	✓	✓
CO 2	✓	✓	✓	✓
CO 3	✓	✓	✓	✓
CO 4	✓	✓	✓	✓
CO 5			✓	✓

CHRIST COLLEGE (AUTONOMOUS), IRINJALAKUDA

AESTHETIC BOTANY

Programme	B. Sc. BOTANY				
Course Title	**Plant Anatomy & Analytical Techniques**				
Type of Course	**Minor**				
Semester	**III**				
Academic Level	200-299				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	3	-	2	75
Pre-requisites	Higher Secondary level Biology course				
Course Summary	This course explores the intricate structures and functions of plant anatomy and the organization of tissues within plants and its diversity. The course also deals with a variety of analytical techniques crucial for studying various branches in biological sciences.				

Course Outcomes (CO): After completing the Course, the student should be able to:-

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools
CO1	Explain the basics, scope and applications of plant anatomy	U	F & P	Instructor-created exams / Observation of practical skills
CO2	Describe the special features of plant anatomy and compare the normal and abnormal behaviour of cambium	U	F & P	Viva voce/ Practical Assignment
CO3	Explain the analytical skills and apply it for various lab practices	U	F & P	Observation of practical skills
CO4	Discuss various separation techniques and apply it in lab practices	U	F & P	Instructor-created exams
CO5	Access the role of plant anatomy and analytical techniques in various fields of science.	E	C	Lab practicals

* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C)

- Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)

Detailed Syllabus:

Module	Unit	Content	Hrs (45 +30)
I	**Plant Anatomy -Basics, Scope and Applications**		**9**
	1	Introduction & Applications of plant anatomy in various fields	2
	2	Tissue systems - Simple & Complex, sclereids & fibres, Stomatal diversity	2
	3	Non-living inclusions of the cell & its applications	3
	4	Anatomical complexity in organization of shoot & root apex	2
II	**Special features in Plant Anatomy**		**12**
	5	Secondary thickening in dicot stem & root	2
	6	Anomalous secondary thickening - abnormal position and behaviour of cambium	2
	7	Anatomical diversity in major ecological groups of plants	3
	8	Wood anatomy - characteristics of wood & Types of wood	3
	9	Identification of various wood & defects in wood (shakes, knots, cross grain and stress defects)	2
III	**Analytical techniques**		**12**
	10	Solutions: representing concentrations: Molarity, Normality, Percentage and ppm	1
	11	Acids and bases, buffers and pH, measurement of pH	1
	12	Preparation and use of buffers in biological studies	1
	13	Microscopy – Introduction & Applications of Light microscopy	1
	14	Electron microscopy (SEM & TEM) - Principle, working & applications	2
	15	UV - Visible spectroscopy - Working and Applications	2
	16	IR spectroscopy - Applications	2
	17	Fluorescent spectroscopy - Principle & Applications	2
IV	**Separation techniques**		**12**
	18	Centrifugation - Basics, Principles behind various types & applications	2
	19	Differential, density gradient and Ultracentrifugation	2
	20	Chromatography - Introduction & Types	3
	21	Thin Layer Chromatography, Gas Chromatography & Liquid Chromatography - Principle and applications	3
	22	Mass spectroscopy - Basic principle and applications in plant science	2

V	Practical (Mandatory experiments)	30
	1. Normal secondary thickening in dicot stem and dicot root (any suitable material) 2. Anomalous secondary thickening of *Boerhaavia* and *Bignonia* 3. Special anatomical features of major ecological groups - any two plants depending on local availability (Hydrophytes, Xerophytes, Parasites) 4. Detection of different structures of plants - identification of starch grains, cystolith, raphides, any two types of sclereids and fibres 5. Stomatal types - identification	
	Practical (Open ended - Suggestive list)	
	6. Anatomical identification of commercial timber like (any two from the list - Teak, Rosewood, Artocarpus, Mahogany - Original specimen/ photographs and salient features) 7. Identification of types of wood and defects 8. Visit to a nearby analytical lab which facilitates the use of instruments mentioned in the syllabus and submission of report.	

Suggested Readings

- Esau, K. 1977. Anatomy of Seed Plants. John Wiley & Sons.
- Metcalfe, C. R., & Chalk, L. 1979. Anatomy of the Dicotyledons: Leaves, Stem, and Wood in Relation to Taxonomy with Notes on Economic Uses (Vol. 1). Oxford University Press.
- Raven, P. H., Evert, R. F., & Eichhorn, S. E. 2005. Biology of Plants (7th ed.). W.H. Freeman and Company.
- Mauseth, J. D. 2003. Botany: An Introduction to Plant Biology. Jones and Bartlett Publishers.
- Spectroscopic Techniques: Nakanishi, K., & Solomon, T. D. 1997. Infrared and Raman Spectra of Inorganic and Coordination Compounds. Wiley.
- Mass Spectrometry in Botany: Gross, J. H. 2011. Mass Spectrometry: A Textbook. Springer.
- Coutler E. G.1969. Plant Anatomy - Part I Cells and Tissues – Edward Arnold, London.
- Dickison, W.C. (2000). Integrative Plant Anatomy, Harcourt Academic Press, USA
- Eames A. J. Morphology of Angiosperms - Mc Graw Hill, New York.
- Evert, R.F. 2006. Esau‘s Plant Anatomy: Meristem, Cells, and Tissues of the Plant Body: Their Structure, Function and Development. John Wiley and Sons, Inc
- Fahn, A. 1992. Plant Anatomy, Pergamon Press, USA
- Ruzin S.E. 1999. Plant Microtechnique and Microscopy, Oxford University Press, New York. U.S.A.
- Webster J. G. 2004. Bioinstrumentation, John Wiley & Sons Inc.
- Narayanan P. 2000. Essentials of Biophysics, New Age Int. Pub. New Delhi.
- Hames G. G. 2005. Spectroscopy for the Biological Sciences, John Wiley & Sons Inc.

Mapping of COs with PSOs and POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	0	1	1	0	1	2
CO2	3	0	2	1	0	1	3
CO3	3	0	3	3	2	1	3
CO4	3	0	3	3	2	1	3
CO5	3	0	3	3	2	1	3

Correlation Levels:

Level	**Correlation**
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Discussion / Seminar
- Midterm Exam
- Project/Practical
- Final Exam

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	Practical/Project Evaluation	End Semester Examinations
CO 1	✓		✓	✓
CO 2	✓		✓	✓
CO 3	✓			✓
CO 4	✓			✓
CO 5			✓	✓