HOLY CROSS COLLEGE (AUTONOMOUS) TIRUCHIRAPPALLI – 620002
SCHOOL OF LIFE SCIENCES
PG AND RESEARCH DEPARTMENT OF BOTANY
CHOICE BASED CREDIT SYSTEM

LEARNING OUTCOMES-BASED CURRICULUM FRAMEWORK (LOCF)

Program Outcomes(POs)

PO 1- Demonstrate ability and attitude to acquire knowledge and skills in the advancing global scenario to apply them effectively and ethically for professional and social development.

PO-2- Involve in research and innovative endeavors and share their findings for the wellbeing of the society.

PO-3 -Work effectively in teams and take up leadership in multi-cultural milieu.

PO-4- Act with moral, ethical and social values in any situation.

PO-5- Excel as empowered woman to empower women

PO-6- Participate in activities towards environmental sustainability goals as responsible citizens.

PO-7- Pursue higher studies in the related fields of science, humanities and management.

PO-8- Develop knowledge to utilize the microbes, plants and animals for human welfare, societal behavior, disease diagnosis, system regulations and ancestry study

PO-9- Originate into a taxonomist, horticulturist, quality analyst, drug designer and scientist.

Program Specific Outcomes (PSOs)

PSO-1 – Become competent enough in various analytical and technical skills related to plant science.

PSO-2 - Exhibit the skills on bio-prospecting of plants in herbal industries.

PSO-3 –Apply the practical skills on horticulture, plant tissue culture, organic farming,cultivation of mushroom, bio fertilizers and nutraceuticals to become professional and entrepreneurs.

I B.Sc., Botany (2022-2023 I & II SEMESTER)

(For Candidates admitted from the academic year 2022 onwards)

Sem.	Part	Course	Title of the paper	Course Code	Hrs/Week	Credits	Marks
I	I	Language	Tamil paper I/Hindi paper I/French paper1	U22TL1TAM01/ U22HN1HIN01/ U22FR1FRE01	3	3	100
	II	English	General English I	U22EL1GEN01	3	3	100
	III	MajorCore-1	Plant Diversity I	U22BO1MCT01	5	4	100
		MajorCore-2	Micro biology and Plant Pathology	U22BO1MCT02	4	4	100
		Major Core– 3	Main Practical I	U22BO1MCP03	4	4	100
		Allied-1	ChemistryPaper-1(for Botany students)	U22CH1ALT01	4	2	100
		Allied–2	ChemistryPaper-2(for Botany students)	U22CH1ALP02	4	2	100
	IV	Environmental studies	Environmental studies	U22RE1EST01	2	1	100
		Value Education	Bible/Catechism/Ethics	U22VE2LVE01/ U22VE2LVB01/ U22VE2LVC01	1		-
	VI	Extension Activities	Service Oriented Course				-
		Extra Credit	Internship / Field Work / Field Project 30Hours-ExtraCredit	U22SP1ECC01		2 (Extra Credit)	100
			Total		**30**	**23+2**	**800+100**
Sem.	**Part**	**Course**	**Title of the paper**	**Course Code**	**Hrs/Week**	**Credits**	**Marks**
II	I	Language	Tamil paper II/ Hindi paper II / French paper II	U22TL2TAM02/ U22HN2HIN02/ U22FR2FRE02	3	3	100
	II	English	General English II	U22EL2GEN02	3	3	100
	III	Major Core– 4	Plant Diversity – II	U22BO2MCT04	5	4	100
		Major Core– 5	Plant Anatomy	U22BO2MCT05	4	3	100
		Major Core -6	Main Practical II	U22BO2MCP06	4	4	100
		Major SBE –1	MSBE-1-Techniques in Botany/Urban Gardening and Cultivation of Micro greens	U22BO2SBP01/ U22BO2SBP02	2	1	100
	IV	Allied–3	Chemistry Allied–III	U22CH2ALT03	4	2	100
		SBC- 1	Soft Skills Development	U22SS2SBC01	2	1	100
		SBC– 2	Sustainable Rural Development and Student Social Responsibility	U22RE2SBC02	2	1	100
		Value Education	Bible/Catechism/Ethics	U22VE2LVB01/ U22VE2LVC01/ U22VE2LVE01	1	1	100
		Extra Credit	Online Course	U22OC2ECT01	-	1	100
	VI	Extension Activities	Service Oriented Course				
			RESCAPES			1	
		Extra Credit	Internship / Field Work / Field Project 30Hours-ExtraCredit	U22SP2ECC02		2 (Extra Credit)	100
			Total		**30**	**23+4**	**1000+100**

(For Candidates admitted from the academic year 2022-23 onwards)
HOLY CROSS COLLEGE (AUTONOMOUS), TIRUCHIRAPPALLI – 620 002
SCHOOL OF LIFE SCIENCES
PG & RESEARCH DEPARTMENT OF BOTANY
CHOICE BASED CREDIT SYSTEM
LEARNING OUTCOMES-BASED CURRICULUM FRAMEWORK (LOCF)
B.Sc. BOTANY
First Year - Semester – I

Course Title	**MAJOR CORE 1- PLANT DIVERSITY – I**
Code	**U22BO1MCT01**
Course type	**Theory**
Hours/Week	**5Hrs/wk**
Credits	**4**
Marks	**100**

CONSPECTUS

The students will be able to understand the classification, study of the genera belonging to various classes of algae, fungi & lichens, their habitat, thallus structure, reproduction and their economic importance.

COURSE OBJECTIVES

- To understand the classification and salient features of thallus organization, reproduction and life cycle patterns of various genera of algae
- To remember and understand the structure, reproduction and life cycles of various algae and evaluate the techniques related to the cultivation of freshwater algae.
- To classify and understand the morphology and reproduction of the various genera offungi.
- To describe the morphology, reproduction and life cycle of fungi and its economic importance.
- To remember and understand the classification and different types of lichens and analyze the economic importance of lichens.

UNIT – I Algae 15 Hrs

Outline classification of Algae (Fritsch, 1979). Salient features of various classes of algae. Distribution of algae. Thallus organization in algae- unicellular, colonial & multicellular. Structure, reproduction and life cycle patterns of the following genera:

Nostoc, Chlamydomonas, Chlorella, *Volvox, Ulva* and *Cladophora*.
Extra reading/Key words: *Nitrogen fixation, Pollution indicators*

UNIT – II Algae 15 Hrs

Structure, reproduction and life cycle patterns of the following genera: *Caulerpa, Diatom, Dictyota* and *Polysiphonia.* Techniques in algae: Cultivation of freshwater algae – Spirulina (SCP).Uses of algae as as food, fodder, medicine, pollution indicators and fertilizer.

Extra reading/Key words: *Life cycle patterns of parasitic algae, seaweeds and fossil algae*

UNIT – III Fungi **15 Hrs**

Outline classification of fungi (Ainsworth, 1971). Salient features of the main classes of fungi. Mode of nutrition and occurrence of Fungi. Morphology and reproduction of the following genera: *Albugo*, *Saccharomyces* and *Penicillium.*

Extra reading/Key words: *Pathogenic fungi, Fungal Sinusitis.*

UNIT – IV Fungi **15 Hrs**

Morphology and reproduction of the following genera: *Peziza*, *Puccinia, Polyporus*. Techniques in fungi: Cultivation and identification of fungi – soil, water and spoiled foods .Importance of fungi in human life-medicine, agriculture and food industry.

Extra reading/Key words: *Cultivation and identification of yeast.*

UNIT – V Lichens **15 Hrs**

Classification and structure of lichens. Nature of association of algal and fungal partners. Structure (External and Internal) & reproduction of *Usnea.* Economic importance of lichens.

Extra reading/Key words: *Dust lichens, sulphur dust lichens, wart lichens*

Note: Texts given in the Extra reading /Key words must be tested only through Assignment and Seminars.

Text Books:

1. Alexopoulos, C. J. 1971. Introductory Mycology – John Wiley and Sons Inc. New York,London.
2. Kumar, H. D. and Singh, H. N. 1982. A text Book on Algae, Affiliated East West Press Pvt.Ltd. New Delhi.
3. Smith, G. M. 1978. Cryptogamic Botany Vol – 1. Tata Mc Graw- Hill Pub. Company Ltd.New Delhi.
4. Webster, J. 1993. Introduction to Fungi – Cambridge University press, Cambridge.
5. Bilgrami, K.S. and Saha, L.C. 2018. A text book of algae. CBS Publications. Delhi.

Suggested Readings:

1. Vashishta, B. R. 2010. Botany for degree students Algae. S. Chand and Company Ltd, NewDelhi. Delhi.
2. Vashista, B. R. and Sinha, A. K. 2016. Botany for degree students Fungi. S. Chand and Company Ltd, New Delhi.

3.Robert , E. L. 2018. Phycology. Cambridge University Press, London.

4.Laxman, R.R and Ramesh, B. 2021. Text book of fungi. Mahipublication, Ahmedabad.

Web References:

1. https://www.biologydiscussion.com/algae/thallus-organisation-in-algae-botany/53555
2. https://www.plantscience4u.com/2018/11/what-is-mode-of-nutrition-in-fungi.html
3. https://www.biologydiscussion.com/lichens-2/lichens-symbiotic-association-and-reproduction/49914
4. https://www.biologydiscussion.com/lichens-2/economic-importance-of-lichens-botany/53600

COURSE OUTCOMES(CO)

CO No.	Course Outcomes	Cognitive Level
CO-1	Describe the classification, salient features and economic importance of algae, fungi and lichens.	K1
CO 2	Describe the mode of nutrition and summarize the life cycle of fungi and discuss the of methods of cultivation of algae and fungi.	K2
CO-3	Illustrate the thallus organization and life cycle patterns of algae and summarize the structure, nature of association and life cycle of lichens.	K3
CO-4	Analyse the types of fungi from different samples.	K4

PO – CO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO-1	H	M	M	H	M	M	M	M	H
CO-2	H	M	M	H	M	M	H	M	M
CO-3	H	H	M	M	H	L	H	M	H
CO-4	H	M	H	H	H	M	M	M	M

H-High M-Moderate L-Low

PSO – CO MAPPING

CO/PSO	PSO1	PSO2	PSO3
CO-1	H	H	H
CO-2	H	H	H
CO-3	M	H	H
CO-4	H	M	H

High M-Moderate L-Low

(For Candidates admitted from the academic year 2022-23 onwards)

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CHOICE BASED CREDIT SYSTEM
LEARNING OUTCOMES-BASED CURRICULUM FRAMEWORK (LOCF)
B.Sc. BOTANY
First Year - Semester – I

Course Title	**MAJOR CORE 2 – MICROBIOLOGY AND PLANT PATHOLOGY**
Total Hours	**60**
Hours/Week	**4 Hrs /Wk**
Code	**U22BO1MCT02**
Course Type	**Theory**
Credits	**4**
Marks	**100**

CONSPECTUS

The students will be able to understand the history of microbiology, structure, nutrition and reproduction of bacteria, types of virus and their structure and reproduction. It imparts knowledge on applied aspects of microbiology on milk, food, beverages, antibiotics and enzymes and also deals with the role of microbes in plant diseases.

COURSE OBJECTIVES

- To Classify microbe based on morphological characters
- To describe the structure, nutrition and reproduction of bacteria and viruses
- To analyze and apply the quality of milk, fermented foods, single cell protein & it'spreservation methods
- To understand the uses of microbes with reference to beverages, antibiotics, vaccines &tanning
- To comprehend the disease cycle of bacterial and fungal pathogens of plants.

UNIT – I History of Microbiology, Microorganisms and staining techniques: **12 hrs.**

Discovery of microbes (Anton Von Leeuwenhoek). Theory of spontaneous generation. Theory of Biogenesis vs. Abiogenesis (Louis Pastuer). Microbial diversity – general classification of microbes. Whittaker's Five kingdom concept. **Bacteria:** Morphology, Ultra structure and reproduction. **Viruses:** Types, structure, reproduction and life cycle of bacteriophages and plant viruses (TMV). Knowledge about phycoviruses and mycoviruses. **Staining:** Simple and differential staining: mechanism of gram staining.

Extra reading (Key Words): Two kingdom and three kingdom concepts, Arboviruses, FMDV

UNIT–II Food Microbiology: 12 hrs

Introduction, Microbiology of milk – sources and types. Pasteurization of milk (reductase and phosphatase test) Milk products – processing and production of yogurt. Fermented foods – Bread and Idly. Microbial protein: Fungal SCP – commercial production and use of yeast. Common food borne pathogens,
food spoilage, food intoxication. Food preservation methods: Physical and Chemical.

Extra reading (Key Words): Dualistic activity of Enterococcus in food, Listeriasis.

UNIT – III Industrial Microbiology: 12 hrs

Structure and use of fermentor. Large scale production and importance: ethanol (cane bagasse), Beverages – wine and beer, Antibiotics – narrow spectrum (Penicillin) and broad spectrum (streptomycin). Vaccine – polio. Enzyme: amylase – brewing (*Bacillus subtilis*) Protease – tanning (*Aspergillus oryzae*). Role of microorganisms in hydrocarbon degradation.

Extra reading/Key words: Biofilm, Industrial work horse

UNIT – IV Plant Pathology: 12 hrs

Plant diseases: Concept and pathogenesis. Koch's Postulates. Host parasite interaction – pathogenesis– entry of plant pathogen – development inside the host. Defense mechanism in plants – structural and biochemical.

Extra reading/Key words: *Phytoalexin, integrated disease management*

UNIT – V Plant Pathology: 12 hrs

Etiology, Causative organism, symptoms and control measures of the following diseases. Fungal disease – sheath blight of paddy, early leaf spot (*Cercospora personata*) and late leaf spot (*Phaeoisariopsis personata*) Bacterial disease – citrus canker and bacterial wilt of banana; Viral disease– tobacco mosaic and vein clearing of Papaya.

Extra reading/Key words: *Innate mechanism in plants, Crown Oomycetes.*

COURSE OUTCOMES

CO No.	Course Outcomes	Cognitive Level
CO-1	Describe the structure, reproduction and life cycle of bacteria and virus, write the defense mechanism in plants	K1
CO-2	Explain the theories related to discovery of microbes, phycovirus and mycovirus, food poisoning and food intoxication, microbiology of milk, commercial production of SCP and pathogenesis. Also Discuss the large scale production of ethanol, beverages, antibiotics, vaccine and enzymes	K2
CO-3	Compile the process and production of yoghurt, bread and idly, methods of food preservation and the role of microorganism in hydrocarbon degradation,	K3
CO-4	Outline the general classification of microbes, analyse the fungal, bacterial and viral diseases of plants.	K4

Text Book

1. Powar and Daginawala. 1993. General Microbiology Vol I and II. Himalaya Publishing house, New Delhi.
2. Tortora, G.J., Funke, B.R. and Case, C.L. 2004. Microbiology –An Introduction. 8th Edition. Pearsoneducation Pvt. Ltd. NewDelhi.
3. Geffery Manners J. 1993. Principles of Plant Pathology. Cambridge University Press.
4. Rangaswami G and Mahadevan A.2003. Diseases of crop plants in India. Prentice Hall of India Pvt.Ltd.
5. Gerard J. Tortora, Berdell R. Funke and Christine L. Case. 2019. Microbiology: An Introduction, 13th Edition Pearson publisher.
6. Anne Marte Tronsmo, D.Collinge, Djurle,Lisa Munk, Jonathan Yuen, 2020. Microbiology: An Introduction. Wallingford, Oxfordshire, UK ; Boston, MA : CAB International,

Suggested Reading:

1. Tauro, P., Kapoor, K. K. and Yadav, K. S. 1997. An introduction to Microbiology. Wiley eastern Company Ltd.,New Delhi.
2. Sharma, P. D. 1993. Microbiology and Plant Pathology. Rastogi Publications.
3. Balachandar. D. 2007. Introductory Microbiology, New India Publishing.
4. Prakash S. Bisen, MousumiDebnath, G. B. Prasad. 2012. Microbes: Concepts and Applications. JohnWiley & Sons Publishers.

5. Jacquelyn G. Black. 2008. Microbiology: Principles and Explorations. 7th Edition John Wiley & SonsPublishers.P.422.
6. Joanne Willey, Linda Sherwood and Christopher J. Woolverton . 2017. Prescotts Microbiology, 10th Edition Mcgraw-Hill Education.
7. Krishna Singh, Shamarao Jahagirdar, Birinchi Kumar Sarma, 2021. Emerging Trends in Plant Pathology Springer Singapore.

Web References:

1.https://www.idfa.org/pasteurization
2.https://www.fightbac.org/food-poisoning/foodborne-pathogens/
3.http://webstor.srmist.edu.in/web_assets/srm_mainsite/files/files/PENCILLIN.pdf
4.https://www.biologydiscussion.com/plants/defense-mechanism/defense-mechanism-in-plants-with-diagram-botany/64023

Note: Learners are advised to use latest edition of books.

Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO 1	H	M	M	H	M	M	M	M	H
CO2	H	M	H	H	H	M	H	M	H
CO3	H	H	M	M	H	H	H	M	H
CO4	H	H	H	H	H	M	M	M	M

H-High M-Moderate L-Low

CO/PSO	PSO 1	PSO2	PSO3
CO 1	H	H	H
CO2	M	H	M
CO3	M	H	H
CO4	H	M	H

H-High M-Moderate L-Low

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CHOICE BASED CREDIT SYSTEM
LEARNING OUTCOMES-BASED CURRICULUM FRAMEWORK (LOCF)
B.Sc. BOTANY
First Year - Semester – I

Course Title	**MAJOR CORE – 3 - PRACTICAL PAPER-1**
Code	**U22BO1MCP03**
Course type	**Practical**
Hours/Week	**4Hrs/wk**
Credits	**4**
Marks	**100**

CONSPECTUS

To enable the students to understand thallus organization, internal and the reproductive structures ofalgae, fungi, lichen, test the quality of milk, identify and study the different types of plant diseases.

COURSE OBJECTIVES

- To remember and understand the thallus organization, internalstructure and reproduction of algae.
- To remember and understand the internal structure and reproduction of fungi.
- To understand the morphology of thallus & apothecium of *Usnea*.
- To understand the growth pattern and cultivation techniques of bacteria & fungi and totest the quality of milk
- To remember, understand, identify and study the different types of plant diseases.

UNIT – I **12 Hrs**

Algae: Observation and identification of the algal forms: *Nostoc* colony and filament, *Chlamydomonas, Chlorella* and *Volvox* coenobium with daughter colony, *Ulva* thallus, *Cladophora* filaments, *Caulerpa* thallus and rhizome,

Diatom, *Dictyota* thallus with oogonial sorus and *Polysiphonia* with carposporophyte. Sectioning: *Ulva* thallus and *Caulerpa* rhizome.

UNIT – II **12 Hrs**

Fungi: Observation and identification of the fungal forms: *Albugo*- infected crucifer leaf, *Sacchromyces*, *Penicillium* conidia, *Peziza* apothecium, *Polyporus* basidiocarp, *Puccinia* infected leaves showing uredia, telia, pycnidia and aecidia.

Sectioning: *Albugo* infected leaves.

UNIT –III **12 Hrs**

Fungi: *Puccinia* infected leaves showing uredia, telia, pycnidia and aecidia stages.

Lichens: Observation & identification of lichen form **:** *Usnea***–** Morphology of thallus & V.S. of apothecium.

UNIT – IV **12 Hrs**

Microbiology: Cultivation of Microorganisms: Bacterial culture on agar-slant/agar-plate streak. Cultivation and Identification of Fungi. Staining Techniques: Simple Staining, Gram staining- Gram positive/ Gram negative. Microbiological examination of milk: By Methylene-blue dye reduction test.

UNIT – V **12 Hrs**

Plant Pathology: Etiology, Causative organism, symptoms and control measures of the following diseases: Fungal disease – sheath blight of paddy, early leaf spot (*Cercospora personata*) and late leaf spot (*Phaeoisariopsis personata*) bacterial disease – citrus canker and viral disease – tobacco mosaic.

COURSE OUTCOMES (CO)

CO No.	Course Outcomes	Cognitive Level
CO-1	Identify and illustrate the morphological and anatomical features of algae, fungi and lichens	K1
CO-2	Relate the morphology and reproduction of the various genera of algae, fungi and lichens	K2
CO-3	Demonstrate and identify the different bacteria and fungi from soil and test the quality of milk	K3
CO-4	Analyze the pest of bacterial, fungal and viral diseases of plants	K4

PO – CO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO-1	H	M	M	H	H	M	M	M	H
CO-2	H	M	H	H	H	M	H	M	H
CO-3	H	H	M	M	H	M	H	M	H
CO-4	H	H	H	H	H	M	M	M	M

PSO – CO MAPPING

CO/PSO	PSO1	PSO2	PSO3
CO-1	H	H	H
CO-2	M	H	H
CO-3	H	H	H
CO-4	H	H	H

(For Candidates admitted from the academic year 2022-23 onwards)

HOLY CROSS COLLEGE (AUTONOMOUS) TIRUCHIRAPPALLI –2

SCHOOL OF LIFE SCIENCES

PG AND RESEARCH DEPARTMENT OF BOTANY

CHOICE BASED CREDIT SYSTEM

LEARNING OUTCOMES-BASED CURRICULUM FRAMEWORK (LOCF)

B.Sc. BOTANY

First Year - Semester – II

Course Title	**MAJOR CORE 4 - PLANT DIVERSITY – II**
Total Hours	**75**
Hours/Week	**5 Hrs /Wk**
Code	**U22BO2MCT04**
Course Type	**Theory**
Credits	**4**
Marks	**100**

CONSPECTUS

The students will be able to understand the classification, morphology, structure, reproduction and life cycle of bryophytes, pteridophytes and gymnosperms.

COURSE OBJECTIVES

- To remember and understand the classification, structure and reproduction, ecology and economic importance of the main classes of bryophytes.
- To classify the pteridophytes by their characteristic features.
- To remember and understand the stelar evolution, types of fossils, geological time scale and apply the economic importance of pteridophytes.
- To describe the salient features of gymnosperm, morphology and reproductive characters of important genera of gymnosperm.
- To understand the significance and important genus of fossil gymnosperm.

UNIT-I Bryophytes 15 Hrs

Outline classification of Bryophytes (Rothmaler, 1951). Salient features of the main classes of Bryophytes. Structure and reproduction of Hepaticopsida – *Marchantia*, Anthocerotopsida –*Anthoceros*, and Bryopsida – *Funaria* (development excluded). Ecology and economic importance of Bryophytes. Evolution of Sporophytes in Bryophytes.

Extra reading/Key words: *Alternation of generation, Spore dispersal*

UNIT–II Pteridophytes **15 Hrs**

Classification of Pteridophytes(Reimers,1975). Salient features of main classes of Pteridophytes. Morphology, structure, reproduction, life cycle of *Selaginella, Equisetum, Adiantum* and *Marsilea.* Economic importance of Pteridophytes.

Extra reading/Key words: *Phytoliths, evolutionary trends of pteridophytes.*

UNIT–III Pteridophytes **1 5Hrs**

Evolution of heterospory and seed habit. Stelar evolution. Fossils- Types of fossils and fossilization. Significance of fossils. Geological time scale- eras, periods & epoch. Carbon dating. oil deposits. Geological distribution and reconstructed structure – form genera *Rhynia* and *Calamites.*

Extra reading/Key words: *Phytoremediation, pollution indicators*

UNIT–IV -Gymnosperms **15Hrs**

Classification of gymnosperms (K.R. Sporne, 1965). Salient features of main classes of gymnosperms. Morphology, structure, reproduction and medicinal & industrial importance of *Cycas* and *Pinus.*

Extra reading/Key words: *Cypress, Taxus.*

UNIT–V Gymnosperms **15 Hrs**

Morphology, structure and reproduction of *Gnetum*. Angiospermic characters of *Gnetum,* Economic importance of Gymnosperms. Geological distribution and reconstructed structure – form genus *Williamsonia*.

Extra reading/Key words: *Fossil- Metasequoia, Zoodiogamy in fossil Gymnosperm*

Note: Texts given in the Extra reading /Key words must be tested only through Assignment and Seminars.

COURSE OUTCOMES (CO)

The learner will be able to

CO No.	Course Outcomes	Cognitive Level
CO-1	Describe the classification, structure and reproduction of the main classes of bryophytes, pteridophytes and gymnosperms.	K1
CO-2	Discuss the evolution of sporophytes in bryophytes, heterosporyand seed habit, stelar evolution of pteridophytes and summarize the economic importance of bryophytes, pteridophytes and gymnosperms.	K2
CO-3	Classify types of fossils and illustrate the geological time scale-eras, periods and epoch	K3
CO-4	Analyse distribution and reconstructed structure of form genera *Rhynia* and *Calamites* and *Williamsonia* and apply the significance of important genus of fossils and oil deposits.	K4

Text Books:

1. Vashista, B. R. Bryophyta. 2010. S. Chand and Company Ltd, New Delhi.
2. Vashista, B. R. Pteridophyta. 2010. S. Chand and Company Ltd, New Delhi.
3. Vashista, B. R. Gymnosperms. 2010. S. Chand and Company Ltd, New Delhi.
4. Vashista, P.C., Sinha, A.K. and Anilkumar. 2007. Botany for degree student- Gymnosperms. Chand & company Ltd Publishers. New Delhi.

Suggested Reading:

1. Rashid, A. 1976. An introduction to Pteridophytes. Vikas Publishing House Pvt. Ltd, New Delhi.
2. Sporne, K. R. 1965. Morphology of Gymnosperms. Hutchinson and Company Ltd. London.
3. Sporne, K. R. 1970. Morphology of Pteridophytes. Hutchinson and Company Ltd. London.
4. Satish Kumar. 2014. Diversity of Pteridophytes, Gymnosperms and Elementary Palaeobotany. Pragati Prakashan, Meerut, Uttar Pradesh.
5. Sambamurthy, A.V.S.S. 2020. A text book of Bryophytes, Pteridophytes, Gymnosperms and Paleo botany. Kindle Edition. I.K. International. Publishing House Pvt. Ltd, New Delhi.

Web Reference:

1. https://www.toppr.com/guides/biology/plant-kingdom/pteridophytes/
2.https://www.peoi.org/Courses/Coursesen/bot/bot16.html
3.https://bio.libretexts.org/Bookshelves/Introductory_and_General_Biology/Book%3A_General_Biology_(Boundless)/32%3A_Plant_Reproductive_Development_and_Structure/32.1%3A_Plant_Reproductive_Development_and_Structure/32.1B%3A_Sexual_Reproduction_in_Gymnosperms
4. https://www.sciencedirect.com/topics/earth-and-planetary-sciences/fossilization

PO – CO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO 1	H	M	M	H	H	M	M	M	H
CO2	H	M	H	H	H	M	H	M	H
CO3	H	H	M	M	H	H	H	M	H
CO4	H	H	H	H	H	M	M	M	M

H-High M-Moderate L-Low

PSO – CO MAPPING

CO/PSO	PSO 1	PSO2	PSO3
CO 1	H	H	H
CO2	H	M	M
CO3	M	H	H
CO4	H	M	H

H-High M-Moderate L-Low

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CHOICE BASED CREDIT SYSTEM
LEARNING OUTCOMES-BASED CURRICULUM FRAMEWORK (LOCF)
B.Sc. BOTANY

First Year - Semester – II

Course Title	**MAJOR CORE – 5 PLANT ANATOMY**
Total Hours	**60**
Hours/Week	**4 Hrs/Wk**
Code	**U22BO2MCT05**
Course Type	**Theory**
Credits	**3**
Marks	**100**

CONSPECTUS

To enable the students to understand the anatomical features of the root, stem and the leaves, flowers, adaptive anatomical features of xerophyte, halophyte, hydrophyte and epiphyte and the concepts of anatomy in relation to taxonomy and wood anatomy in relation to taxonomy.

Course Objectives

- To understand the tissue systems and describe the anatomical structure of dicots and monocots.
- To classify the types of meristem, wood , stomata and node.
- To describe the adaptive anatomical features of xerophyte, halophyte, hydrophyte and epiphyte.
- To explain the concepts of anatomy in relation to taxonomy and wood anatomy inrelation to taxonomy.
- Analyze the anatomy of floral parts, sclereid, raphide and laticifers.

UNIT – I 12 Hrs

Introduction and scope of Plant Anatomy. Tissues: Classification, structural characteristics and functions of the following tissues - meristematic, simple and complex . Developmental anatomy - organization and importance of shoot apex (Tunica Carpus theory) and root apex (Korper – Kappe theory). Floral meristem and ontogeny of floral parts.

Extra reading /Key Words: *Plastochron, idioblast*

UNIT-II: **12 Hrs**

Primary structure of dicot stem (*Vernonia*), root (*Cicer*), monocot stem (*Bambusa*) and root (*Canna*). Structure of dicot leaf (Sun flower). Normal secondary growth in dicot stem and root (*Vernonia*). Secondary growth in monocotyledons – *Dracaena*. Dendrochronology, Annual rings, Sapwood and heartwood; Ring and diffuse porous wood; Early and late wood and tyloses.

Extra reading /Key Words: *Leaf gaps, Cambium grafting*

UNIT – III **12 Hrs**

Development and composition of periderm, rhytidome and lenticels. Wood anatomy in relation to taxonomy-vessels, parenchyma, rays, fibers and intercellular canals. Anamalous secondary growth of Dicotyledons stem of *Aristolochia*, *Boerhaavia*, *Bignonia* and *Nyctanthus.* Nodal types of dicot plants - uni, tri and multi lacunar.

Extra reading /Key Words: *Solitary vessels, Xylem efficiency*

UNIT – IV: **12 Hrs**

Properties of wood – physical, chemical & mechanical. Processing & seasoning of wood. Commercial uses of wood. Microscopic studies on the distribution, structure and functions of stomata (Dicot & monocots), epidermal hair, sclereids, raphides (*Colocasia*), cystolith (*Ficus* leaf) and starch grains (rice). Laticifers – distribution, structure and types. Anatomy in relation to taxonomy-hairs, stomata, epidermal cells and hypoderm, sclerenchyma of pericycle, medullary rays, bicollateral bundles and secondary thickening.

Extra reading /Key Words: *Transparent wood, quiescent centre*

UNIT – V: **12 Hrs**

Study of adaptive anatomical features of parasite -Cuscuta haustoria, halophyte - Rhizophora - anatomy of stem, leaf and breathing root. Hydrophyte-Nymphaea petiole, epiphyte-Vanda root and Xerophyte -Nerium leaf. Applications of anatomical studies in climatology, pharmacognosy, forensic science and archaeology.

Extra reading /Key Words: *protophloem and metaphloem*

COURSE OUTCOMES (CO)

CO No.	Course Outcomes	Cognitive Level
CO-1	Explain the tissue systems, anatomical structure of monocot and dicot plants. stomata, sclereid,raphide and laticifers.	K1
CO-2	Classify the types of meristem, wood , stomata and node	K2
CO-3	Illustrate the anamolous structure of *Aristolochia*, *Boerhaavia*, *Bignonia* and *Nyctanthus*. Secondary growth in monocotyledons – *Dracaena*.	K3
CO-4	Analyze the properties and processing of wood.adaptive anatomical features of parasite -*Cuscuta* haustoria, Rhizophora, breathing root, *Nymphaea* petiole, Vanda root and Xerophyte -Nerium leaf. Apply the knowledge of anatomical studies in climatology, pharmacognosy, forensic science and archaeology.	K4

Text Books:

1. Pandey, B.P.2002.Plant anatomy. Chand and company, New Delhi.
2. Pandey, B.P.2012.Botany for degree students. Chand and company, New Delhi.
3. Crang R, Sobakshi SL, Wise R. (2018). Plant Anatomy: A concept – Based Approach to the structure of Seed plants. (1st ed). Switzerland: Springer Nature Switzerland AG.

Suggested Reading:

1. Roy P. (2010). Plant Anatomy (2nd ed). Kolkata: New central book agency (P) Ltd.
2. Desai R. (2008). Plant Anatomy: Principles and practices (1st ed). New Delhi: Adhyayan publishers & distributors.
3. Evert RF. (2020). Plant Anatomy (3rd ed). New Delhi: CBS Publishers & distributors.
4. Cutter, E. G. 1978. Anatomy part I – The English Language Book Society and EdwardArnolds Ltd. London.
6. Eames, A. J. and Mac Daniels, l. H. 1947. An introduction to plant Anatomy. MC Grawand Hill Book Company, INC., New York, London.
6. Varghese, T. M. An Introduction to the Anatomy of Angiosperms. Allied Publishers,
7. Richard Crang, Lyons, Shiels and Robert 2018. Plant Anatomy - A Concept-based Approach to the Structure of Seed Plants, Springer.

Web references:

1. https://www.biologydiscussion.com/stems-2/dicot-stem/secondary-growth-in-dicot-stem-with-diagram/70397
2. https://www.embibe.com/exams/secondary-growth-in-plants/
3. https://organismalbio.biosci.gatech.edu/growth-and-reproduction/plant-development-i-tissue-differentiation-and-function/
4. https://www.vedantu.com/biology/apical-meristem

Mapping

PO – CO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO 1	H	H	M	H	H	M	H	H	H
CO2	H	H	M	H	H	M	H	H	H
CO3	H	H	M	M	H	M	H	H	H
CO4	H	H	H	H	H	M	H	H	H

H-High M-Moderate L-Low

PSO – CO MAPPING

CO/PSO	PSO 1	PSO2	PSO3
CO 1	H	M	H
CO2	H	H	H
CO3	H	H	H
CO4	H	M	H

H-High M-Moderate L-Low

(For Candidates admitted from the academic year 2022-23 onwards)

HOLY CROSS COLLEGE (AUTONOMOUS) TIRUCHIRAPPALLI –2

SCHOOL OF LIFE SCIENCES

PG AND RESEARCH DEPARTMENT OF BOTANY

CHOICE BASED CREDIT SYSTEM

LEARNING OUTCOMES-BASED CURRICULUM FRAMEWORK (LOCF)

B.Sc. BOTANY

First Year - Semester – II

Course Title	**MAJOR CORE 6- MAIN PRACTICAL-II**
Total Hours	**60**
Hours/Week	**4 Hrs /Wk**
Code	**U22BO3MCP06**
Course Type	**Practical**
Credits	**4**
Marks	**100**

CONSPECTUS

The students will be able to understand internal, reproductive structures of bryophytes, pteridophytes and gymnosperms and primary, normal and anomalous secondary structure of dicot stem, root and adaptive features of hydrophyte.

COURSE OBJECTIVES

- To Understand the morphology of thallus and structure of bryophytes.
- To Remember and understand the morphology, anatomy and reproductive structures of pteridophytes and fossil forms.
- To Understand the morphology and anatomical features in Gymnosperms.
- To understand and analyze .the structure of stomata types and the root and shootof dicot plants.
- To Understand the adaptive anatomical features and analyze the anomalous structure of dicot plants.

UNIT – I **12 Hrs**

Bryophytes: Observation and identification of morphological structure of *Marchantia, Anthoceros, Funaria*. Identification of permanent slides (*Marchantia*- thallus T.S, *Anthoceros* – sporophyte V.S and *Funaria*- antheridial cluster, archegonial cluster, capsule L.S)

UNIT – II **12 Hrs**

Pteridophytes: Study of morphology, anatomy and reproductive structures of the following: *Selaginella, Equisetum, Adiantum* and *Marsilea*. Observation and study of permanent slides of fossil plants – *Rhynia*- stem-T.S and *Calamites* -stem-T.S.

UNIT – III **12 Hrs**

Gymnosperms: Morphological and anatomical study of the vegetative and reproductive parts of *Pinus* and *Gnetum.*

UNIT – IV **12 Hrs**

Anatomy: Identification of stomatal types (Dicot-anomocytic, anisocytic, paracytic and Monocot – Graminaceous type) primary and normal secondary structure of Dicot stem (*Vernonia*) and root (*Cicer*)**,** Monocotstem (*Bamboo*) and root (*Canna*).

UNIT – V **12** Hrs

Anatomy: Study of adaptive anatomical features of Hydrophyte (*Nymphaea* petiole). Anomalous secondary structure of *Bignonia, Boerhaavia* and *Nyctanthes,* Nodal types of dicot plants -Uni, tri and multi lacunar. Microscopical study of epidermal hairs, sclereids and starch grains.

COURSE OUTCOMES (CO)

The learner will be able to

CO No.	Course Outcomes	Cognitive Level
CO-1	Identify and illustrate the morphological and anatomical structures of bryophytes, pteridophytes , gymnosperms and stomatal types, primary and normal secondary structure of Dicot stem	K1
CO-2	Relate the morphology and reproductive structures of bryophytes, pteridophytes and gymnosperms	K2
CO-3	Examine the structure of stem of fossil genera *Rhynia, Calamites.*	K3
CO-4	Analyse the structure of stomata, epidermal hairs,sclereids and starch grains	K4

PO – CO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO-1	H	M	M	H	H	M	M	M	H
CO-2	H	M	H	H	H	M	H	M	H
CO-3	H	H	M	M	H	M	H	M	H
CO-4	H	H	H	H	H	M	M	M	M

High M-Moderate L-Low

PSO – CO MAPPING

CO/PSO	PSO 1	PSO2	PSO3
CO 1	H	H	H
CO2	M	H	H
CO3	H	H	H
CO4	H	H	H

H-High M-Moderate L-Low

(For Candidates admitted from the academic year 2022-23 onwards)
HOLY CROSS COLLEGE (AUTONOMOUS) TIRUCHIRAPPALLI-620 002
SCHOOL OF LIFE SCIENCES
PG & RESEARCH DEPARTMENT OF BOTANY
LEARNING OUTCOMES-BASED CURRICULUM FRAMEWORK (LOCF)
B.Sc. BOTANY
First Year - Semester – II

Course Title	**MSBE - 1 - TECHNIQUES IN BOTANY**
Total Hours	**30**
Hours/Week	**2 Hrs /Wk**
Code	**U22BO2SBP01**
Course Type	**Practical**
Credits	**1**
Marks	**100**

CONSPECTUS

To enable the students to acquire skills in the preparation of solutions, measurement of stomata and epidermal hairs using micrometer, histochemical localization, microtome sectioning, mitosis, horticulture and hybridization techniques and application of statistics in botany.

COURSE OBJECTIVES

- To understand the preparation of chemical solutions
- To recognize the phytochemicals in plant tissues
- To apply the knowledge and skills in microtome sectioning
- To comprehend and study the different stages of mitosis
- To implement different propagation and hybridization techniques

Unit-I Preparations of chemical solutions: 6 hrs

Stock solutions: molar, normal, percentage, ppm. Preparation of buffer solutions (Phosphate andacetate).

Unit – II Micrometry and Histochemistry: 6 hrs

Measurements and drawing of stomata, epidermal hairs and pollen of different species using Camera Lucida and digital camera. Histochemical localization of starch (KI method)/toluidine blue method , Protein (Bromo Phenol method) &lipid (Sudan B method).

Unit – III Sectioning and staining: 6 hrs

Hand section- Double staining with safranin and fast green. Sectioning using rotary microtome –Fixing specimens and preparation of paraffin blocks and affixing ribbons.

Unit- IV Cell Biology and Biostatistics: 6 hrs

Cell division –Preparation of squash (Mitosis -Onion root tip) Statistical calculation through SPSS.

Unit- V Horticulture and Plant breeding 6 hrs

Vegetative propagation -cutting and grafting. Hybridization techniques-emasculation and bagging

COURSE OUTCOMES (CO)

CO No.	Course Outcomes	Cognitive level
CO-1	Demonstrate the preparation of chemical solution, Plant breeding and horticulture techniques, microtome sectioning	K1
CO-2	Examine the methods of measuring plant parts and histochemical localization of phytochemicals	K2
CO-3	Identify the plant tissues by double staining method	K3
CO-4	Evaluate the different stages of mitosis, statistical data through SPSS	K4

T e x t Books:

1. Gahan P.B.1984. Plant histochemistry & cytochemistry – An introduction. Academic Press,London.
2. Wilson K. & Walker J. 1994. Practical biochemistry. 4th edition, Cambridge University,London.
3. Krishnamurthy, K.V. 1988. Methods in Plant Histochemistry.Viswanathan Publishers,Madras.
4. Ramakrishnan, P. 2003. Biostatistics. Saras Publications, Nagercoil.

Suggested reading:

1. Van Norman R.W. 1971. Experimental biology. IInd Edition, Prentice Hall, Inc., New Jersey.
2. Berlyn & Mische, 1976. Botanical microtechnique & cytochemistry. Iowa State UniversityPress.
3. Plummer, D. T. 1982. An introduction to Practical biochemistry. Tata Mc Graw – Hill publishing company, Ltd, New Delhi.
4. Mani. K. and Vijayraj. D., 2002. Bioinformatics to beginners, Kalaikathir pathippagam,Coimbatore.

PO – CO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO-1	H	M	M	H	H	M	M	M	H
CO-2	H	M	H	H	H	M	H	M	H
CO-3	H	H	M	M	H	M	H	M	H
CO-4	H	H	H	H	H	M	M	M	M

High M-Moderate L-Low

PSO – CO MAPPING

CO/PSO	PSO 1	PSO2	PSO3
CO 1	H	H	H
CO2	M	H	H
CO3	H	H	H
CO4	H	H	H

HOLY CROSS COLLEGE (AUTONOMOUS) TIRUCHIRAPPALLI-620 002
SCHOOL OF LIFE SCIENCES
PG & RESEARCH DEPARTMENT OF BOTANY
LEARNING OUTCOMES-BASED CURRICULUM FRAMEWORK (LOCF)
B.Sc. BOTANY
First Year - Semester – II

Course Title	MSBE - 1 - URBAN GARDENING AND CULTIVATION OF MICROGREENS
Total Hours	30Hrs
Hours/Week	2 Hrs /Wk
Code	U22BO2SBT02
Course Type	Theory
Credits	1
Marks	100

COURSE OBJECTIVE

It deals with the importance of microgreens which are tiny greens rich in nutrients. It also gives knowledge on different steps involved in the cultivation of microgreens, harvest andmarketing. It also encourages students to learn a skill to cultivate microgreens at their home level (micro entrepreneurship).

COURSE OBJECTIVES

- Remember, Understand and apply the scope and importance organic urban gardens and enables cities to produce their own food
- Remember the preparation of growth medium and container designing for micro greens
- Understand and apply the collection of organic waste and production of compost.
- Understand and apply the selection of plants for cultivation
- Remember and Understand the life cycle of plants, pest and disease management of cultivated plants

UNIT – I **6 hrs.**

Organic urban gardens – scope and importance - cities to produce their own food- increasing awareness on urban gardening- Food security and Government programmes related to urban gardening.

Extra reading/Key words: *Roof top planters, Balcony planters*

UNIT –II **6 hrs.**

Selection of Growing medium and container design, Biodegradable waste trays- Soil – Coir pith – Fortification – Growth promoters and irrigation

Extra reading/Key words: *Hydroponic growing media***,** *Vermiculite* Justification *:*

UNIT – III **6 hrs.**

Collection of Organic waste and composting - Vermicompost and organic manures. Production of organic manure from kitchen waste.

Extra reading/Key words: *Compost pails***,** *Rockwool*

UNIT – IV **6 hrs.**

Selection of Plants– Green leafy vegetables – Fruits and vegetables – Medicinal plants - seeds of leafy vegetables, fruits and medicinal plants

Extra reading/Key words: *Mulching, Prunning*

UNIT – V **6 hrs.**

pH of the soil, water and manures - pest and disease management- Harvest – Marketing and tie -up, Nutritional benefit of Microgreens.

Extra reading/Key words: *Horticultural Society, AIPH*

Note: Texts given in the Extra reading /Key words must be tested only through Assignment and Seminars.

COURSE OUTCOMES (CO)

CO No.	Course Outcomes	Cognitive Level
CO-1	Describe the urban garden techniques, explain selection of growing medium and plants	K1
CO-2	Discuss the method of collection of organic waste, composting, explain the preparation of growth medium and container designing for microgreens	K2
CO-3	apply the scope and importance in organic urban gardens, organic manure production	K3
CO- 4	Analyse the pH of the soil and life cycle of plants, pest and disease management, harvest of microgreens.	K4

Text Books:

1. Espiritu, K. 2019. Field Guide to Urban Gardening. Cool Springs Press. USA.
2. Mani Bhusahan Rao, K.1991. Text book of Horticulture-MacMillan India Ltd., Madras.
3. Arumugam, N. and Kumaresan, V.2010. Fundamentals of horticulture and Plantbreeding. Saras Publications.

Suggested reading:

1. Edmond J.B., Senn, T.L. and Andrews, F.S. 1964. Fundamentals of Horticulture- TataMc Graw –Hill Publishing Compani Ltd., New Delhi.
2. Peter M. and Tessa Eve. 2007. Garden planning and Garden design. SouthwaterPublishing. London.
3. McSheehy, J.2020.Vegetable Gardening for Beginners, Rockridge Press, Emeryville, California.
4. Stross, A. 2018. The Suburban Micro-Farm: Modern Solutions for Busy People KindleEdition. Twisted Creek Press; Cincinnati, Ohio.

Web References

1. ***https://www.bayer.com/en/news-stories/urban-farming-growing-vegetables-in-cities***
2. ***https://dengarden.com/gardening/Growing-and-selling-Microgreens-An-example-of-a-commercial-urban-agriculture-operation***
3. ***https://instagreen.eu/***

PO – CO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO-1	H	M	M	H	H	M	M	M	H
CO-2	H	M	H	H	H	M	H	M	H
CO-3	H	H	M	M	H	M	H	M	H
CO-4	H	H	H	H	H	M	M	M	M

High M-Moderate L-Low

PSO – CO MAPPING

CO/PSO	PSO 1	PSO2	PSO3
CO 1	H	H	H
CO2	M	H	H
CO3	H	H	H
CO4	H	H	H

II B.Sc.,BOTANY (2022-2023) III & IV SEMESTER

For Candidates admitted from the academic year 2021-22 onwards)

COURSE STRUCTURE (III SEMESTER) – CBCS

Sem.	Part	Course	Title of the paper	Course Code	Hrs/ Week	Credits	Marks
III	I	Language	Tamil paper I/ Hindi paper I / French paper 1	U21TL3TAM03/ U21HN3HIN03/ U21FR3FRE03	3	3	100
	II	English	General English I	U21EL1GEN03	3	3	100
	III	Major Core -6	MC-6 Plant Diversity II	U21BO3MCT06	5	4	100
		Major Core -7	MC-7 Plant Anatomy	U21BO3MCT07	4	3	100
		Major Core – 8	Main Practical II	U21BO3MCP08	4	3	100
		MSBE –II (Star College paper)	MSBE - 2 - Botanical Techniques for Chemistry/ Botanical Techniques for Physics	U21BO3SBP03/ U21BO3SBP04	2	1	100
		Allied-4	Paper I -Plant Diversity, Taxonomy, Anatomy, Embryology, Ecology and Physiology	U21BO3ALT04	4	2	100
	IV	NME	NME – 1 Food Science and Technology	U21BO3NMT01	3	3	100
		Gender	Gender Studies	U21WS3GST01	1	1	100
		Value Education	Bible/Catechism/Ethics	U21VE3LVE02/ U21VE3LVB02/ U21VE3LVC02	1		-
	VI	Extension Activities	Service Oriented Course (Any one activity based on the student's choice – 15 activities)				-
		Extra Credit	Internship / Field Work / Field Project 30 Hours - Extra Credit	U21SP3ECC03		2 (Extra Credit)	100
			Total		**30**	**23+2**	**900+100**
Sem.	**Part**	**Course**	**Title of the paper**	**Course Code**	**Hrs/ Week**	**Credits**	**Marks**
III		Major Elective-1	Course outside the school- Home Gardening and Nursery Maintenance/ Organic Farming	U21BO3MET01/ U21BO3MET02	4	3	100

Sem.	Part	Course	Title of the paper	Course Code	Hrs/ Week	Credits	Marks
IV	I	Language	Tamil paper II/ Hindi paper II / French paperII	U21TL4TAM04/ U21HN4HIN04/ U21FR4FRE04	3	3	100
	II	English	General English II	U21EL4GEN04	3	3	100
	III	Major Core – 9	Embryology and Seed Technology	U21BO4MCT09	4	4	100
		Major Core – 10	Phytogeography and Forestry	U21BO4MCT10	4	4	100
		Major Elective – 2	Course within School – Phytomedicine	U21BO4METO3	4	3	100
		Allied – 5	Paper-II Bioprospecting and Plant Biotechnology	U21BO4ALT05	4	2	100
		Allied – 6	Paper-III.Practical-1	U21BO4ALP06	4	2	100
	IV	NME-2	Herbal Remedies	U21BO4NMT02	3	3	100
		Value Education	Bible/Catechism/Ethics	U21VE4LVB02/ U21VE4LVC02/ U21VE4LVE02	1	1	100
	VI	Extension Activities	Service Oriented Course (Any one activity based on the student's choice – 15 activities**)**	-	-	2	100
		Extra Credit	Internship / Field Work / Field Project 30 Hours - Extra Credit	U21SP4ECC04		2 (Extra Credit)	100

			Total		**30**	**24+4**	**900+200**

(For Candidates admitted from the academic year 2021-22 onwards)
HOLY CROSS COLLEGE (AUTONOMOUS) TIRUCHIRAPPALLI –2
SCHOOL OF LIFE SCIENCES

PG AND RESEARCH DEPARTMENT OF BOTANY

CHOICE BASED CREDIT SYSTEM
LEARNING OUTCOMES-BASED CURRICULUM FRAMEWORK (LOCF)
B.Sc. BOTANY
Second Year - Semester – III

Course Title	**MAJOR CORE 6- PLANT DIVERSITY – II**
Total Hours	**75**
Hours/Week	**5 Hrs /Wk**
Code	**U21BO3MCT06**
Course Type	**Theory**
Credits	**4**
Marks	**100**

CONSPECTUS

The students will be able to understand the classification, morphology, structure, reproduction and life cycle of bryophytes, pteridophytes and gymnosperms.

COURSE OBJECTIVES

- To remember and understand the classification, structure and reproduction, ecology and economic importance of the main classes of bryophytes.
- To classify the pteridophytes by their characteristic features.
- To remember and understand the stelar evolution, types of fossils, geological time scale and apply the economic importance of pteridophytes.
- To describe the salient features of gymnosperm, morphology and reproductive characters of important genera of gymnosperm.
- To understand the significance and important genus of fossil gymnosperm.

UNIT-I Bryophytes 15 Hrs

Outline classification of Bryophytes (Rothmaler, 1951). Salient features of the main classes of Bryophytes. Structure and reproduction of Hepaticopsida – *Marchantia*, Anthocerotopsida –*Anthoceros*, and Bryopsida – *Funaria* (development excluded). Ecology and economic importance of Bryophytes. Evolution of Sporophytes in Bryophytes.

Extra reading/Key words: *Alternation of generation, Spore dispersal*

UNIT–II Pteridophytes 15 Hrs

Classification of Pteridophytes(Reimers,1975). Salient features of main classes of Pteridophytes. Morphology, structure, reproduction, life cycle of *Selaginella, Equisetum, Adiantum* and *Marsilea.* Economic importance of Pteridophytes.

Extra reading/Key words: *Phytoliths, evolutionary trends of pteridophytes.*

UNIT–III Pteridophytes **15Hrs**

Evolution of heterospory and seed habit. Stelar evolution. Fossils- Types of fossils and fossilization. Significance of fossils. Geological time scale- eras, periods & epoch. Carbon dating. oil deposits. Geological distribution and reconstructed structure – form genera *Rhynia* and *Calamites.*

Extra reading/Key words: *Phytoremediation, pollution indicators*

UNIT–IV **15 Hrs**

Classification of gymnosperms (K.R. Sporne, 1965). Salient features of main classes of gymnosperms. Morphology, structure, reproduction and medicinal & industrial importance of *Cycas* and *Pinus.*

Extra reading/Key words: *Cypress, Taxus.*

UNIT–V Gymnosperms **15 Hrs**

Morphology, structure and reproduction of *Gnetum*.Angiospermic characters of *Gnetum*, Economic importance of Gymnosperms. Geological distribution and reconstructed structure – form genus *Williamsonia*.

Extra reading/Key words: *Fossil- Metasequoia, Zoodiogamy in fossil Gymnosperm*

Note: Texts given in the Extra reading /Key words must be tested only through Assignment and Seminars.

COURSE OUTCOMES (CO)
The learner will be able to

CO No.	Course Outcomes	Cognitive Level
CO-1	Describe the classification, structure and reproduction of the main classes of bryophytes, pteridophytes and gymnosperms.	K1
CO-2	Discuss the evolution of sporophytes in bryophytes,heterospory and seed habit and stelar evolution of pteridophytes and summarize the economic importance of bryophytes, pteridophytes and gymnosperms.	K2
CO-3	Classify types of fossils and illustrate the geological time scale-eras, periods, epoch and carbon dating.	K3
CO-4	Analyse distribution and reconstructed structure of form genera *Rhynia* and *Calamites* and *Williamsonia* and apply the significance of important genus of fossils and oil deposits.	K4

Text Books:

5. Vashista, B. R. Bryophyta. 2010. S. Chand and Company Ltd, New Delhi.
6. Vashista, B. R. Pteridophyta. 2010. S. Chand and Company Ltd, New Delhi.
7. Vashista, B. R. Gymnosperms. 2010. S. Chand and Company Ltd, New Delhi.
8. Vashista, P.C., Sinha, A.K. and Anilkumar. 2007. Botany for degree student- Gymnosperms. Chand & company Ltd Publishers. New Delhi.

Suggested Reading:

6. Rashid, A. 1976. An introduction to Pteridophytes. Vikas Publishing House Pvt. Ltd, New Delhi.
7. Sporne, K. R. 1965. Morphology of Gymnosperms. Hutchinson and Company Ltd. London.
8. Sporne, K. R. 1970. Morphology of Pteridophytes. Hutchinson and Company Ltd. London.
9. Satish Kumar. 2014. Diversity of Pteridophytes, Gymnosperms and Elementary Palaeobotany. Pragati Prakashan, Meerut, Uttar Pradesh.
10. Sambamurthy, A.V.S.S. 2020. A text book of Bryophytes, Pteridophytes, Gymnosperms and Paleo botany. Kindle Edition. I.K. International. Publishing House Pvt. Ltd, New Delhi.

Web Reference:

1. https://www.toppr.com/guides/biology/plant-kingdom/pteridophytes/
2.https://www.peoi.org/Courses/Coursesen/bot/bot16.html
3.https://bio.libretexts.org/Bookshelves/Introductory_and_General_Biology/Book%3A_General_Biology_(Boundless)/32%3A_Plant_Reproductive_Development_and_Structure/32.1%3A_Plant_Reproductive_Development_and_Structure/32.1B%3A_Sexual_Reproduction_in_Gymnosperms
4. https://www.sciencedirect.com/topics/earth-and-planetary-sciences/fossilization

PO – CO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO 1	H	M	M	H	H	M	M	M	H
CO2	H	M	H	H	H	M	H	M	H
CO3	H	H	M	M	H	H	H	M	H
CO4	H	H	H	H	H	M	M	M	M

H-High M-Moderate L-Low

PSO – CO MAPPING

CO/PSO	PSO 1	PSO2	PSO3
CO 1	H	H	H
CO2	H	M	M
CO3	M	H	H
CO4	H	M	H

H-High M-Moderate L-Low

(For Candidates admitted from the academic year 2021-22 onwards)

HOLY CROSS COLLEGE (AUTONOMOUS) TIRUCHIRAPPALLI –2
SCHOOL OF LIFE SCIENCES
PG AND RESEARCH DEPARTMENT OF BOTANY
CHOICE BASED CREDIT SYSTEM
LEARNING OUTCOMES-BASED CURRICULUM FRAMEWORK (LOCF)
B.Sc. BOTANY
First Year - Semester – III

Course Title	**MAJOR CORE – 7 PLANT ANATOMY**
Total Hours	**60**
Hours/Week	**4 Hrs/Wk**
Code	**U21BO3MCT07**
Course Type	**Theory**
Credits	**3**
Marks	**100**

CONSPECTUS

To enable the students to understand the anatomical features of the root, stem and the leaves, flowers, adaptive anatomical features of xerophyte, halophyte, hydrophyte and epiphyte and the concepts of anatomy in relation to taxonomy and wood anatomy in relation to taxonomy.

Course Objectives

- To understand the tissue systems and describe the anatomical structure of dicots and monocots.
- To classify the types of meristem, wood , stomata and node.
- To describe the adaptive anatomical features of xerophyte, halophyte, hydrophyte and epiphyte.
- To explain the concepts of anatomy in relation to taxonomy and wood anatomy in relation to taxonomy.
- Analyze the anatomy of floral parts, sclereid, raphide and laticifers.

UNIT – I **12 Hrs**

Introduction and scope of Plant Anatomy. Tissues: Classification, structural characteristics and functions of the following tissues - meristematic, simple and complex . Developmental anatomy - organization and importance of shoot apex (Tunica Carpus theory) and root apex (Korper – Kappe theory). Floral meristem and ontogeny of floral parts.

Extra reading /Key Words: *Plastochron, idioblast*

UNIT-II: **12 Hrs**

Primary structure of dicot stem (*Vernonia*), root (*Cicer*), monocot stem (*Bambusa*) and root (*Canna*). Structure of dicot leaf (Sun flower). Normal secondary growth in dicot stem and root (*Vernonia*). Secondary growth in monocotyledons – *Dracaena*. Dendrochronology, Annual rings, Sapwood and heartwood; Ring and diffuse porous wood; Early and late wood and tyloses.

Extra reading /Key Words: *Leaf gaps, Cambium grafting*

UNIT – III **12 Hrs**

Development and composition of periderm, rhytidome and lenticels. Wood anatomy in relation to taxonomy-vessels, parenchyma, rays, fibers and intercellular canals. Anamalous secondary growth of Dicotyledons stem of *Aristolochia*, *Boerhaavia*, *Bignonia* and *Nyctanthus.* Nodal types of dicot plants - uni, tri and multi lacunar.

Extra reading /Key Words: *Solitary vessels, Xylem efficiency*

UNIT – IV: **12 Hrs**

Properties of wood – physical, chemical & mechanical. Processing & seasoning of wood. Commercial uses of wood. Microscopic studies on the distribution, structure and functions of stomata (Dicot & monocots), epidermal hair, sclereids, raphides (*Colocasia*), cystolith (*Ficus* leaf) and starch grains (rice). Laticifers – distribution, structure and types. Anatomy in relation to taxonomy-hairs, stomata, epidermal cells and hypoderm, sclerenchyma of pericycle, medullary rays, bicollateral bundles and secondary thickening.

Extra reading /Key Words: *Transparent wood, quiescent centre*

UNIT – V: **12 Hrs**

Study of adaptive anatomical features of parasite -Cuscuta haustoria, halophyte - Rhizophora - anatomy of stem, leaf and breathing root. Hydrophyte-Nymphaea petiole, epiphyte-Vanda root and Xerophyte -Nerium leaf. Applications of anatomical studies in climatology, pharmacognosy, forensic science and archaeology.

Extra reading /Key Words: *protophloem and metaphloem*

COURSE OUTCOMES (CO)

CO No.	Course Outcomes	Cognitive Level
CO-1	Explain the tissue systems, anatomical structure of monocot and dicot plants. stomata, sclereid,raphide and laticifers.	K1
CO-2	Classify the types of meristem, wood , stomata and node	K2
CO-3	Illustrate the anamolous structure of *Aristolochia*, *Boerhaavia*, *Bignonia* and *Nyctanthus*. Secondary growth in monocotyledons – *Dracaena*.	K3
CO-4	Analyze the properties and processing of wood.adaptive anatomical features of parasite -Cuscuta haustoria, Rhizophora, breathing root, Nymphaea petiole, Vanda root and Xerophyte -Nerium leaf. Apply the knowledge of anatomical studies in climatology, pharmacognosy, forensic science and archaeology.	K4

Prescribed Text Books:

3. Pandey, B.P.2002.Plant anatomy. Chand and company, New Delhi.
4. Pandey, B.P.2012.Botany for degree students. Chand and company, New Delhi.
2. Crang R, Sobakshi SL, Wise R. (2018). Plant Anatomy: A concept – Based

Approach to the structure of Seed plants. (1st ed). Switzerland: Springer Nature Switzerland AG.

Books for Reference:

5. Roy P. (2010). Plant Anatomy (2nd ed). Kolkata: New central book agency (P) Ltd.
6. Desai R. (2008). Plant Anatomy: Principles and practices (1st ed). New Delhi: Adhyayan publishers & distributors.
7. Evert RF. (2020). Plant Anatomy (3rd ed). New Delhi: CBS Publishers & distributors.
8. Cutter, E. G. 1978. Anatomy part I – The English Language Book Society and EdwardArnolds Ltd. London.
6. Eames, A. J. and Mac Daniels, l. H. 1947. An introduction to plant Anatomy. MC Grawand Hill Book Company, INC., New York, London.
8. Varghese, T. M. An Introduction to the Anatomy of Angiosperms. Allied Publishers,
9. Richard Crang**,** Lyons, Shiels and Robert 2018. Plant Anatomy - A Concept-based Approach to the Structure of Seed Plants, Springer.

Mapping

PO – CO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO 1	H	H	M	H	H	M	H	H	H
CO2	H	H	M	H	H	M	H	H	H
CO3	H	H	M	M	H	M	H	H	H
CO4	H	H	H	H	H	M	H	H	H

H-High M-Moderate L-Low

PSO – CO MAPPING

CO/PSO	PSO 1	PSO2	PSO3
CO 1	H	M	H
CO2	H	H	H
CO3	H	H	H
CO4	H	M	H

H-High M-Moderate L-Low

(For Candidates admitted from the academic year 2021-22 onwards)

HOLY CROSS COLLEGE (AUTONOMOUS) TIRUCHIRAPPALLI –2
SCHOOL OF LIFE SCIENCES

PG AND RESEARCH DEPARTMENT OF BOTANY
CHOICE BASED CREDIT SYSTEM
LEARNING OUTCOMES-BASED CURRICULUM FRAMEWORK (LOCF)
B.Sc. BOTANY
Second Year - Semester – III

Course Title	**MAJOR CORE 8- MAIN PRACTICAL-II**
Total Hours	**60**
Hours/Week	**4 Hrs /Wk**
Code	**U21BO3MCP08**
Course Type	**Practical**
Credits	**3**
Marks	**100**

CONSPECTUS

The students will be able to understand internal, reproductive structures of bryophytes, pteridophytes and gymnosperms and primary, normal and anomalous secondary structure of dicot stem, root and adaptive features of hydrophyte.

COURSE OBJECTIVES

- To Understand the morphology of thallus and structure of bryophytes.
- To Remember and understand the morphology, anatomy and reproductive structures of pteridophytes and fossil forms.
- To Understand the morphology and anatomical features in Gymnosperms.
- To understand and analyze .the structure of stomata types and the root and shoot of dicot plants.
- To Understand the adaptive anatomical features and analyze the anomalous structure of dicot plants.

UNIT – I **12 Hrs**

Bryophytes: Observation and identification of morphological structure of *Marchantia, Anthoceros, Funaria*. Identification of permanent slides (*Marchantia*- thallus T.S, *Anthoceros* – sporophyte V.S and *Funaria*- antheridial cluster, archegonial cluster, capsule L.S)

UNIT – II **12 Hrs**

Pteridophytes: Study of morphology, anatomy and reproductive structures of the following: *Selaginella, Equisetum, Adiantum* and *Marsilea*. Observation and study of permanent slides of fossil plants – *Rhynia*- stem-T.S and *Calamites* -stem-T.S.

UNIT – III **12 Hrs**

Gymnosperms: Morphological and anatomical study of the vegetative and reproductive parts of *Pinus* and *Gnetum.*

UNIT – IV **12 Hrs**

Anatomy: Identification of stomatal types (Dicot-anomocytic, anisocytic, paracytic and Monocot –Graminaceous type) primary and normal secondary structure of Dicot stem (*Vernonia*) and root (*Cicer*)**,** Monocotstem (*Bamboo*) and root (*Canna*).

UNIT – V **12 Hrs**

Anatomy: Study of adaptive anatomical features of Hydrophyte (*Nymphaea* petiole). Anomalous secondary structure of *Bignonia, Boerhaavia* and *Nyctanthes,* Nodal types of dicot plants -Uni, tri and multi lacunar. Microscopical study of epidermal hairs, sclereids and starch grains.

COURSE OUTCOMES (CO)

The learner will be able to

CO No.	Course Outcomes	Cognitive Level
CO-1	Identify and illustrate the morphological and anatomical structures of bryophytes, pteridophytes , gymnosperms and stomatal types, primary and normal secondary structure of Dicot stem	K1
CO-2	Relate the morphology and reproductive structures of bryophytes, pteridophytes and gymnosperms and adaptive anatomical features of hydrophyte.	K2
CO-3	Examine the structure of stem of fossil genera *Rhynia, Calamites.*	K3
CO-4	Analyse the structure of stomata, epidermal hairs,sclereids and starch grains	K4

PO – CO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO-1	H	M	M	H	H	M	M	M	H
CO-2	H	M	H	H	H	M	H	M	H
CO-3	H	H	M	M	H	M	H	M	H
CO-4	H	H	H	H	H	M	M	M	M

H-High M-Moderate L-Low

PSO – CO MAPPING

CO/PSO	PSO1	PSO2	PSO3
CO-1	H	H	H
CO-2	M	H	H
CO-3	H	H	H
CO-4	H	H	H

H-High M-Moderate L-Low

(For Candidates admitted from the academic year 2021-22 onwards)

HOLY CROSS COLLEGE (AUTONOMOUS) TIRUCHIRAPPALLI –2

SCHOOL OF LIFE SCIENCES

PG AND RESEARCH DEPARTMENT OF BOTANY
CHOICE BASED CREDIT SYSTEM

LEARNING OUTCOMES-BASED CURRICULUMFRAMEWORK (LOCF)
B.Sc. BOTANY
Second Year - Semester – III

Course Title	MSBE- 2 BIOLOGIAL TECHNIQUES FOR CHEMISTRY
Total Hours	30
Hours/Week	2 Hrs /Wk
Code	U21BO3SBP03
Course Type	Theory cum Lab
Credit	1
Marks	100

CONSPECTUS

The students will be able to learn the basic and recent skills on the fundamental organization of plants and their function, and also mass propagation of protein rich products and to become an entrepreneur.

COURSE OBJECTIVES

- Understand the basic building blocks of plant system.
- Understand and apply the structure and function of plant anatomy with practical skills.
- Understand the basic Physiological function of plants.
- Apply the knowledge and skills in production of protein rich products.
- Understand, apply the tissue culture techniques in micro propagation.

UNIT I- Biological System: **6hrs**

Organization of Plant system - Cells– cell organelles – tissues–internal structure of dicot stem and root.

Lab exercise: Observation of internal features of dicot stem & root.

Extra reading/Key words: *Bulliform cells, anamolous growth*

UNIT II– Cytology **6hrs**

Cell cycle, Cell division- mitosis- Prophase, Metaphase, Anaphase &Telophase. Role of cell division in plant growth.

Lab exercise: Observation of different stages of mitosis in onion root tip by squash technique.

Extra reading/Key words: *Meiosis, Karyogamy*

UNITIII–Physiology: **6hrs**

Absorption and translocation of water and minerals, Osmosis and its significance.

Lab exercise: Ascent of sap, Thistle Funnel Experiment.

Extra reading/Key words: *Guttation, foliar nutrition*

UNIT IV –Mass production of Protein-rich products: **6hrs**

SCP algal protein – *Spirulina* cultivation- Fungal protein- Mushroom cultivation and Nutritional value of Mushroom.

Lab exercise: Spirulina & mushroom cultivation

Extra reading/Key words: *Chlorella, Mycoprotein*

UNIT V- Plant Tissue Culture: **6hrs**

Methods and applications of Micropropagation, Callus culture and Synthetic seed. Role of plant tissue Culture in conservation of biodiversity.

Lab exercise: Callus induction, Synthetic seed preparation.

Extra reading/Key words: *Hybrids, Cybrids*

COURSE OUTCOMES (CO)

CO No.	Course Outcomes	Cognitive Level
CO-1	Describe the basic organization in plants, cell division and absorption and translocation of water and minerals in plants.	K1
CO-2	Discuss micropropagation and relate the structure of dicot root and stem.	K2
CO-3	Illustrate the different stages of mitosis and demonstrate ascent of sap and thistle funnel experiments.	K3
CO-4	Analyze callus culture and Synthetic seed preparation the steps involved in production of protein rich organism	K4

Text Books:

1. Jain, V. K. 1990. Fundamentals of Plant Physiology. S. Chand and Company Ltd., New Delhi.
2. Dubey. R. C. 2006. Text book of biotechnology. S. Chand and Company Ltd. NewDelhi.
3. V. Kumaresan, 2005. Text book of Biotechnology, Saras Publication, Nagercoil, Tamilnadu.
4. Rastogi, S.C. 2020.Cell and Molecular Biology. Rastogi Publications.*N*EW AGE International Pvt Ltd. New Delhi.

Suggested Reading:

1. DeRobertis,E.D.P.and DeRobertis,E.M.F.1995.Cell and Molecular Biology, Saunders College, PA.
2. Powar, C.B. 2002. Cell Biology, Himalaya Publishing House, Mumbai,India.
3. Sharma, B.B. 1993. A Guide to home Gardening.Ministry of information and broadcasting, Govt.ofIndia.
4. Jain.V.K.2017.Fundamentals of plant physiology. S Chand Publishing House. New Delhi.
5. Devlin, R. M. 2017. Outline of Plant Physiology.CBS publishers and Distributors, New Delhi.

Web references:

1. **https://academic.oup.com/plphys**
2. https://en.wikipedia.org *› wiki › Plant_physiology*
3. **https://www.britannica.com/science/cell-biology**
4. **https://www.mushroomoffice.com/mushroom-cultivation/**

PO – CO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO-1	H	M	M	H	H	M	M	M	H
CO-2	H	M	H	H	H	M	H	M	H
CO-3	H	H	M	M	H	M	H	M	H
CO-4	H	H	H	H	H	M	M	M	M

PSO – CO MAPPING

CO/PSO	PSO1	PSO2	PSO3
CO-1	H	H	H
CO-2	M	H	H
CO-3	H	H	H
CO-4	H	H	H

(For Candidates admitted from the academic year 2021-22 onwards)

HOLY CROSS COLLEGE (AUTONOMOUS) TIRUCHIRAPPALLI-620002
SCHOOL OF LIFE SCIENCES
PG & RESEARCH DEPARTMENT OF BOTANY

CHOICE BASED CREDIT SYSTEM

LEARNING OUTCOMES-BASED CURRICULUM FRAMEWORK (LOCF)
B.Sc. BOTANY
Second Year - Semester – III

CourseTitle	**MSBE- 2 BIOLOGICAL TECHNIQUES FOR PHYSICS**
Code	**U21BO3SBP04**
Course type	**Theory cum Lab**
Hours/Week	**2 Hrs /Wk**
Credit	**1**
Marks	**100**

CONSPECTUS

The students will be able to understand the basic and recent skills on the fundamental organization of plants and their function, and also mass propagation of protein rich products and to become entrepreneur.

COURSE OBJECTIVES

- To understand the basic building blocks of plant system.
- To understand and apply the structure and function of plant anatomy and celldivision with practical skills.
- To describe the basic Physiological function of plants and biochemical nature &phytoconstituents.
- To apply the knowledge and skills in production of protein rich products.
- To understand, apply the plant tissue culture techniques for the conservation ofplant species.

UNIT- I-Biological System: **6hrs**

Organization of Plant system- structure of a plant cell and cell organelles–tissues -types and functions –Interna lstructureofdicotstemand root.

Lab exercise: Observation of internal features of dicot stem & root.

Extra reading/Key words: *Bulliform cells, anamolous growth*

UNIT II– Cytology **6hrs**

Cell division- mitosis- Prophase, Metaphase, Anaphase, Telophase. Role of cell division in plant growth.

Lab exercise: Observation of different stages of mitosis in onion root tip by squash technique.

Extra reading/Key words: *Meiosis, Karyogamy*

UNIT III –Physiology&Phytochemistry: **6hrs**

Absorption of water and minerals. phytochemical compounds - Alkaloids & Polyphenols and their antioxidant property.

Lab exercise: Ascent of sap, Tests for the presence of phytochemical compounds.

Extra reading/Key words: *Guttation, foliar nutrition*

UNIT IV –Mass production ofProtein-rich products: **6hrs**

SCP algal protein – Spirulina cultivation- Fungal protein- Mushroom cultivation and their application.

Lab exercise: Spirulina & mushroom cultivation

Extra reading/Key words: *Chlorella, Mycoprotein*

UNIT V- Plant Tissue Culture: **6hrs**

Methods- Micropropagation- Synthetic seed preparation. Role of plant tissue culture in biodiversity conservation.

Lab exercise: Meristem culture, Synthetic seed preparation.

Extra reading/Key words: *Somatic hybridization, Cybrids.*

COURSE OUTCOMES (CO)

CO No.	Course Outcomes	Cognitive Level
CO-1	Explain the basic organization plants, Illustrate the structure of dicot root and stem	K1
CO-2	Describe the stages of mitosis and its role in plant growth	K2
CO-3	Demonstrate the basic physiological function of plants, biochemical nature & phytoconstituents and steps involved in production of protein rich organisms	K3
CO-4	Develop the practical skills by learning the fundamental organization of plants and cultivation of plant based product to become an entrepreneur, Analyze the tissue culture techniquesin plant conservation.	K4

Text Books:

1. Jain, V. K. 1990. Fundamentals of Plant Physiology. S. Chand and Company Ltd., New Delhi.
2. Dubey. R. C. 2006. Text book of biotechnology. S. Chand and Company Ltd., New Delhi.
3. Kumaresan, V. 2005. Text book of Biotechnology,
4. Annie Ragland, V. Kumaresan, N. Arumugam, 2019. Cell Biology, Saras Publication,Nagercoil, Tamilnadu.

5. Pandey B. P. 2012. Plant Anatomy (Revised Edition). S. Chand and Company Ltd. New Delhi.
6. Satyanarayana U. 2015. Biotechnology. Books and Allied (P) Ltd. Kolkata.

Suggested Reading:

1. De Robertis,E.D.P. and De Robertis,E.M.F.(1995). Cell and Molecular Biology, Saunders College, PA.

2. Powar, C.B. 2002. Cell Biology, Himalaya Publishing House, Mumbai,India.

3. Bishun Deo Prasad, Sangita Sahni, Prasant Kumar, Mohammed Wasim Siddiqui. 2021. Plant Biotechnology, Principles, Techniques and Applications. Apple AcademicPress.

Web References:

1. https://organismalbio.biosci.gatech.edu/growth-and-reproduction/plant-development-i-tissue-differentiation-and-function/
2. https://www.britannica.com/science/cell-biology/Cell-division-and-growth
3. https://www.siyavula.com/read/science/grade-10-lifesciences/support-and-transport-systems-in-plants/05-support-and-transport-systems-in-plants-05
4. https://www.sciencedirect.com/topics/agricultural-and-biological-sciences/phytochemical
5. http://www.brahmanandcollege.org.in/pg_biochemistry/Single-cell-protein.pdf
6.https://www.apsnet.org/edcenter/disimpactmngmnt/labexercises/PlantBiotechnology/Documents/PlantTissueCulture.pdf

PO – CO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO 1	M	M	M	M	M	M	H	H	H
CO2	H	M	H	M	H	M	H	H	H
CO3	H	H	H	H	H	H	H	M	H
CO4	H	H	H	H	H	H	H	M	H

H-High M-Moderate L-Low

PSO – CO MAPPING

CO/PSO	PSO 1	PSO2	PSO3
CO 1	H	H	M
CO2	H	M	M
CO3	H	H	H
CO4	H	H	H

H-High M-Moderate L-Low

(For Candidates admitted from the academic year 2021-22 onwards)
HOLY CROSS COLLEGE (AUTONOMOUS) TIRUCHIRAPPALLI-620 002
SCHOOL OF LIFE SCIENCES
PG & RESEARCH DEPARTMENT OF BOTANY

CHOICE BASED CREDIT SYSTEM

LEARNING OUTCOMES-BASED CURRICULUM FRAMEWORK (LOCF)
B.Sc. BOTANY
Second Year - Semester – III

Course Title	**Allied-4 - PAPER I- PLANT DIVERSITY, TAXONOMY, ANATOMY, EMBRYOLOGY, ECOLOGY AND PHYSIOLOGY**
Total Hours	**60**
Hours/Week	**4 Hrs /Wk**
Code	**U21BO3ALT04**
Course Type	**Theory**
Credits	**2**
Marks	**100**

CONSPECTUS

To enable the students to understand the basic concepts and fundamentals of various branches of botany like algae, fungi, bryophytes, pteridophytes and gymnosperm, taxonomy, anatomy, embryology, ecology and physiology.

COURSE OBJECTIVES:

- To remember and understand the general characteristics of algae and fungi
- To remember and understand the life cycle pattern of bryophytes, pteridophytesand gymnosperms
- To understand, apply and analyse the internal structure of dicot plants anddevelopment of embryo
- To understand and analyse the floral taxonomy of angiosperms
- To understand and apply the different physiological and biochemical reactions inthe higher plants

UNIT – I Algae and Fungi: **12 Hrs**

General characteristics of Algae and Fungi. Structure, reproduction, uses and life cycle of algae – Nostoc, Ulva andVolvox. Structure, reproduction and life cycle of fungi – Penicillium and Agaricus and Puccinia. Economic importance of algae and fungi.

Extra reading (Key Words): SCP production, Mushroom cultivation

UNIT –II Bryophyte, Pteridophyte and Gymnosperm: 12 Hrs

General characteristics of Bryophyte, Pteridophyte and Gymnosperm. Structure, reproduction,economic importance and life cycle of Bryophyte - Funaria. Pteridophyte - Nephrolepis. Gymnosperm - Cycas.

Extra reading (Key Words): Stelar evolution, Molecular phylogeny

UNIT – IIIAnatomy and Embryology: 12 Hrs

Anatomy- Primary and secondary structure of dicot root and stem(Commercial wood), Nodal types of dicot plants - Uni, tri and multi lacunar. Embryology – structure of anther, microsporogenesis and male gametophyte. Structure of dicot embryo, Structure of ovule, megasporogenesis and female gametophyte. Double fertilization.

Extra reading (Key Words): Wood anatomy, Poly embryony

UNIT – IVTaxonomy of Angiosperms: 12 Hrs

General outline classification of Bentham and Hooker. Detailed study of the following families and their economic importance: Annonaceae, Rutaceae, Rubiaceae, Amaranthaceaeand Poaceae.

Extra reading (Key Words): Euphorbiaceae, Meliaceae

UNIT - V Physiology and Ecology: 12 Hrs

Absorption of water – mechanism. Transpiration – mechanism of stomatal transpiration. Photosynthesis – light reaction (cyclic and non-cyclic).Dark reaction (Calvin cycle). Respiration- Aerobic (Glycolysis, Kreb's cycle and Electron transportchain). Photoperiodism. Morphological and anatomical adaptations of hydrophytes, halophytes and xerophytes.

Extra reading (Key Words): Photorespiration, CAM pathway, Stress physiology

Note: Texts given in the Extra reading /Key wordsmust be tested only through Assignment and Seminars.

COURSE OUTCOMES (CO)

The learner will be able to

CO No.	Course Outcomes	Cognitive Level
CO-1	Recall and relate the general characters of algae and fungi. Explain the photosynthetic system of plants	K1
CO-2	Explain the life cycle patterns of bryophyte and Pteridophytes	K2
CO-3	Compare the reproductive patterns of cryptogamic plants	K3
CO-4	Analyze and contrast the floral characters of different families. Outline the internal structure of dicot plants,	K4

Prescribed Text Books:

1. Ganguli, H. G. ,Kumud Shankar Das and Chittatosh Dutta, 2011. College Botany.Vol – I and II. New Central Book Agency, Calcutta.
2. Verma, V. 1985. A text book of Plant Physiology. Emkay Publications, New Delhi.

Books for Reference:

1. Sharma, P.D. 1992. Ecology and environment. Rastogi Publication, Meerut.
2. Agarwal, S.K. 1992. Fundamentals of ecology. Ashish Publishing House, New Delhi.
3. Pandey, B. P. 1984. Plant Anatomy. S. Chand and Company Ltd, New Delhi.
4. Bhojwani, S. S. and Bhatnagar, S. P. 1978. The Embryology of Angiosperms. Vikas Publishing House Pvt. Ltd,
5. Shukla and Chandel, 1994. Plant ecology and soil Science . S. Chand and CompanyLtd., New Delhi.
6. Pandey, B. P, 2010. College Botany. Vol. III. S. Chand and Company Ltd, NewDelhi.
7. Jain.V.K.2017.Fundamentals of plant physiology. S Chand Publishing House.New Delhi.
8. Bishun Deo Prasad, Sangita Sahni, Prasant Kumar, Mohammed Wasim Siddiqui.2021. Plant Biotechnology, Principles, Techniques and Applications. Apple Academic Press.

Web Reference

- https://www.keaipublishing.com/en/journals/plant-diversity/
- https://towson.libguides.com/biol208/websites
- https://www.sciencedirect.com/science/article/pii/S2468265916300300
- http://www.bsienvis.nic.in/Database/Status_of_Plant_Diversity_in_India_17566. aspx

PO – CO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO-1	H	M	M	H	H	M	M	M	H
CO-2	H	M	H	H	H	M	H	M	H
CO-3	H	H	M	M	H	M	H	M	H
CO-4	H	H	H	H	H	M	M	M	M

H- High M-Moderate L-Low

PSO –CO MAPPING

CO/PSO	PSO1	PSO2	PSO3
CO-1	H	H	H
CO-2	M	H	H
CO-3	H	H	H
CO-4	H	H	H

(For Candidates admitted from the academic year 2021- 2022 onwards)
HOLY CROSS COLLEGE (AUTONOMOUS) TIRUCHIRAPPALLI-620 002
SCHOOL OF LIFE SCIENCES
PG & RESEARCH DEPARTMENT OF BOTANY

CHOICE BASED CREDIT SYSTEM
LEARNING OUTCOMES-BASED CURRICULUM FRAMEWORK (LOCF)
B.SC. BOTANY

Second Year - Semester – III

Course Title	NON MAJOR ELECTIVE 1 – FOOD SCIENCE AND TECHNOLOGY
Total Hours	45
Hours/Week	3 Hrs /Wk
Code	U21BO3NMT01
Course Type	Theory
Credits	3
Marks	100

CONSPECTUS

To enable the students to learn the basic principles of the major classes of nutrients and nutritive values of food. Preservation of food and food additives, safetymeasures and food laws.

COURSE OBJECTIVES

- To understand, apply and evaluate the major classes of food, and their nutrients of selected examples
- To remember and understand the different types of cooking, and apply the knowledge ofloss of nutrients
- To apply, analyse and evaluate the types of food additives, food safety, hazards and risks and role of international agencies.
- To understand various methods of food preservation and principles of food packing.
- To apply food preservation techniques in various food preparation

UNIT – I Major classes of food, and their nutrients: 9 hrs

Cereals and products (Rice- carbohydrates), Pulse (red gram - protein), fatsandoils (vanaspathi and sunflower oil), fruits and vegetables (vitamins A, C and minerals), Milk and milk products (pasteurized milk, butter and paneer). Economicimportance of cereals and pulses.

Extra reading/Key words: Macro nutrients, Micro nutrients.

UNIT – II Types of cooking: 9hrs

Traditional method of cooking- Clay pot cooking; Wet methods of cooking - boiling, simmering, poaching, stewing, blanching, steaming and pressure cooking. Dry methods – roasting, grilling, toasting, baking, salting and frying. Loss of nutrients.

Extra reading/Key words: Seasoning, Shrivelling

UNIT – III Food processing technology: 9 hrs

Introduction, Scope of food processing and technology. Preparation of jam - mixed fruit jam and pineapple jam. Preparation of squashes - orange squash and grape crush.

Extra reading/Key words: Fermentation, Radiation

UNIT – IV Food preservation technology: 9 hrs

Definition, importance, principles of preservation. Oil, spices, salt and sugars as preservatives. Methods of preservation – low, high temperature and drying.Principles of food packing- functions of food packing and requirements for effective food packing. Food laws and standards.

Extra reading/Key words: Ultrasonics, Cold plasma

UNIT - V Food additives and Food standards: 9hrs

Definition, types of additives. Food adulteration: definition, types of adulterants–intentional, incidental and metallic contaminants. Role of international agencies like FAO and WHO – major objectives in eradicating poverty. Food safety,hazards and risks.

Extra reading/Key words: Role of IFAD, WF

COURSE OUTCOMES (CO)

The learner will be able to

CO No.	Course Outcomes	Cognitive Level
CO-1	List the major classes of food, and their nutrients. Describe the different role of international agencies.	K1
CO-2	Differentiate types of cooking. Summarize various methods of food preservation.	K2
CO-3	Demonstrate the loss of nutrients during cooking.Classify the kinds of wet and dry cooking methods	K3
CO-4	Analyze the toxicity status in the given food material and the requirements for effective food packing.	K4

Prescribed Text Books:

1. Sumathi, R., Madambi and Rajagopal, M. V. 1997. Fundamentals of foods andnutrition. New Age International Pvt. Ltd., New Delhi.
2. Sree Lakshmi, B. 1997. Food Science. New Age International Pvt. Ltd., New Delhi.

Books for Reference:

1. Swaminathan, M. 1985. Advanced text book in food and nutrition Vol. I and II. The Bangalore Printing and Publishing Co. Ltd., Bangalore.
2. Visakh P. M., Laura B. Iturriaga., Pablo Ribotta and Sabu Thomas. 2013.Advances inFoodScience & Nutrition. Vol. II. Scrivener Publishers.
3. Roday, S. 2007. Food Science and Nutrition. Oxford University Press.
4. Jose M. Saavedra and Anne M. Dattilo, 2016.Early Nutrition and Longterm health.Woodhead publishers.
4. Wolfert, Paula. 2009. Mediterranean clay pot cooking. Traditional and modern recipestosavor and share. Hoboken, N.J: John Wiley & Sons Publishers.
5. Norman N. Potter and Joseph H. Hotchkiss.2021. Food science. Fifth edition. S. K.Jainfor CBS publishers and distributors. New Delhi

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https://ifst.onlinelibrary.wiley.com/journal/26891816
https://www.frontiersin.org/journals/food-science-and-technology
https://www.sciencedirect.com/journal/trends-in-food-science-and-technology https://www.karger.com/fst
https://www.academia.edu/40614191/Handbook_of_Food_Science_and_Technology_2_ Food_Process_Engineering_and_Packaging

PO-CO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO-1	H	M	M	H	H	M	M	M	H
CO-2	H	M	H	H	H	M	H	M	H
CO-3	H	H	M	M	H	M	H	M	H
CO-4	H	H	H	H	H	M	M	M	M

H-High M-Moderate L-Low

CO/PSO	PSO1	PSO2	PSO3
CO-1	H	H	H
CO-2	M	H	H
CO-3	H	H	H
CO-4	H	H	H

(For Candidates admitted from the academic year 2021-22 onwards)
HOLY CROSS COLLEGE (AUTONOMOUS) TIRUCHIRAPPALLI –2
SCHOOL OF LIFE SCIENCES
PG AND RESEARCH DEPARTMENT OF BOTANY
CHOICE BASED CREDIT SYSTEM
B.Sc. BOTANY
Second Year - Semester – IV

Course Title	MAJOR CORE-9 - EMBRYOLOGY AND SEED TECHNOLOGY
Total Hours	60
Hours/Week	4 Hrs /Wk
Code	U21BO4MCT09
Course Type	Theory
Credits	4
Marks	100

CONSPECTUS

The students will be able to understand the anatomical features of the root, stem and the leaves, developmental stages of the plant and development of the anther, ovule, male and female gametophytes and embryo.

COURSE OBJECTIVES

- To understand the knowledge of embryology through microsporogenesis and megasporogenesis.
- To classify the pollination, fertilization and types of endosperm.
- Understand and analyse the structure and development of embryo.
- To describe the structure of seed, reserve food, longevity through selected seed technologies.
- To understand the structure of seed, reserve food, longevity through selected seed technologies.
- To describe the concept of seed certification, inspection and legislation

UNIT – I Embryology: **12hrs**

Introduction, history and scope of embryology. Anther structure and development. Microsporogenesis. Male gametophyte and its development. Pollen grains – morphology, aperture types, Number, Position and Characters (NPC) classification (Erdtman, 1969). **S**tructure of pollen wall: wall features, sporopollenin, stratification and ornamentation/sculpturing. Pollenkitt. Applications of palynology: Basic concepts of palaeopalynology, aeropalynology and forensic palynology.

Extra reading /Key Words: Obturator, endothelium

UNIT – II Embryology: **12hrs**

Types and structure of ovule. Megasporogenesis, Structure and development of female gametophyte. Types of embryosac with special reference to Polygonum type. Pollination-dehiscence of anther, types- autogamy and allogamy, pollinating agencies. Fertilization: Pollen germination, pollen tube- growth, entry into ovule and discharge and Double fertilization.

Extra reading /Key Words: Triploid production, sexual incompatibility

UNIT – III Embryology: **12hrs**

Types, structure and function of endosperm (Nuclear, Helobial, Cellular and Ruminate). Structure and development of dicot embryo (Capsella) and monocot embryo (Zea mays). Seed-structure and development. Fruits-structure and development, dehiscence of fruits. Parthenocarpy and its applications. Apomixis and its significance.

Extra reading/Key words: *Deceptive pollinator, Rudimentation*

UNIT – IV Seed technology: **12hrs**

Types of seed – monocot, dicot, endospermic and perispermic. Storage reserves in seeds – carbohydrates, proteins and lipids. Seed dormancy-Factors causing seed dormancy and artificial methods of breaking seed dormancy and its advantages. Germination- Phases, factors accompanying seed germination. Seed viability- Types and its advantages and disadvantages, Tetrazolium test.

Extra reading/Key words: Synthetic Seed, *Seed fortificaion*

UNIT – V Seed technology: **12hrs**

Seed drying-sun drying and force air drying. Seed storage: principles, factors affecting seed longevity during storage, storage behaviour of seeds based on maturation drying – orthodox and recalcitrant seed. Seed Act and Rules- Seed certification- Concept and procedure for seed certification, specific crop standard for seed certification. Seed inspection, seed legislation and seed law enforcement (quarantine).

Extra reading /Key Words: Seed sanitization, Seed trade

Note: Texts given in the Extra reading /Key words must be tested only through Assignment and Seminars.

COURSE OUTCOMES (CO)

The learner will be able to

CO No.	Course Outcomes	Cognitive Level
CO-1	Describe the scope of embryology, structure of anther, ovule, endosperm and seed dormancy	K1

CO-2	Discuss the Male gametophyte and its development, dehiscence of anther, structure and development, phases, factors accompanying seed germination and factors affecting seed longevity during storage, storage behaviour of seeds based on maturation drying	K2
CO-3	Classify types of pollen grains, ovule, embryo sac and endosperm, seed	K3
CO-4	Analyse the stratification, ornamentation ,sculpturing of pollen wall, pollen germination, parthenocarpy and seed certification	K4
CO-5	Evaluate the concepts of palaeopalynology, aeropalynology and forensic palynology, double fertilization, apomixes, seed viability and seed inspection	K5

Text Books:

1. Maheswari, P. 1950. An introduction to the Embryology of Angiosperms. Vikas Publishing House Pvt. Ltd.
2. Basra, A.S. 2007. Handbook of Seed science and Technology. Scientific Publishers, India.

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Suggested Reading:

1. Agarwal, S. B. 1972. Embryology of angiosperms. Sahitya Bhavan, Agra.
2. Bhojwani, S. S. and Bhatnagar, S. P. 1978. The Embryology of Angiosperms. Vikas Publishing House Pvt. Ltd,
3. Maheswari,P. 1963. Recent Advances in the Embryology of Angiosperms. International Society of Plant Morphologists, University of Delhi.
4. Agrawal, R.L. 1982. Seed technology. Oxford and IBH Publishing CO.Remington John Stewart. 1993. Seed testing. Printwell, Jaipu

Web references:

1. https://www.biologydiscussion.com/plant-anatomy/pollen-and-spore-walls/npc-classification-of-pollen-and-spore-wall-plants/68892
2. https://www.yourarticlelibrary.com/biology/pollination-in-plants-types-advantages-and-disadvantages/11790
3. https://www.toppr.com/ask/question/give-one-example-of-endospermic-dicot-seed-and-nonendospermic-seed/
4. https://www.cicr.org.in/pdf/legislation_seed_quality.pdf

PO – CO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO 1	H	M	M	H	H	M	M	M	H
CO2	H	M	H	H	H	M	H	M	H
CO3	H	H	M	M	H	H	H	M	H
CO4	H	H	H	H	H	M	M	M	M
CO5	H	H	H	H	H	M	H	M	H

H-High M-Moderate L-Low

PSO – CO MAPPING

CO/PSO	PSO 1	PSO2	PSO3
CO 1	H	H	H
CO2	H	M	M
CO3	M	H	H
CO4	H	M	H
CO5	H	H	H

(For Candidates admitted from the academic year 2021-22 onwards)

HOLY CROSS COLLEGE (AUTONOMOUS) TIRUCHIRAPPALLI –2

SCHOOL OF LIFE SCIENCES

PG AND RESEARCH DEPARTMENT OF BOTANY

CHOICE BASED CREDIT SYSTEM

B.Sc. BOTANY

Second Year - Semester – IV

Course Title	**MAJOR CORE 10- PHYTOGEOGRAPHY AND FORESTRY**
Total Hours	**60**
Hours/Week	**4 Hrs /Wk**
Code	**U21BO4MCT10**
Course Type	**Theory**
Credits	**3**
Marks	**100**

CONSPECTUS:

The students will be able to understand the principle and types of plant distribution, diversity of plants, different types of vegetations in India, forest protection and forest policies and forest acts.

COURSE OBJECTIVES:

- To understand the principle and types of phyto geographical distribution and Factors influencing plant distribution
- To Remember and understand the vegetation types, migration and evolution of floras, floristic regions of the world and vegetation zones related to latitudes and altitudes
- To classify the Biodiversity hotspots, conservation and seed banks.
- To describe the concept of forest ecosystem, forest types in India and restoration ecology
- Tp Understand the various policies and organization related to forestry, necessity, principle of forest laws and acts.

UNIT– I Phytogeography **12hrs**

Definition, concepts --Descriptive and dynamic -Continental drift, age and area theory, Endemism and Barriers to plant distribution, centre of origin, Methods of dispersal, migrations and isolation; Theory of tolerance. Factors influencing plant distribution; Migration of floras, and Evolution of floras. Topographic factors- Altitude and latitude. GPS. Remote sensing.

Extra Reading/Key words: *Theory of polar oscillations, Shifting of poles, glaciations*

UNIT- II Vegetation types in India: 12hrs

Tropical rain forest, Sholas and Deciduous Forest – Sand dunes and Mangrove vegetation and Scrubjungle, phytogeographical regions of India. Sunderbans and its characteristics, Eastern and Western Himalayan regions. GIS and its application. Floristic regions of the world: Vegetation Zones in relation to latitudes and altitudes.

Extra Reading/ Key words: *Biogeographical regions of India and vegetational types of Tamil Nadu.*

UNIT- III Plant Biodiversity and its Conservation 12hrs

Definition, levels of biodiversity-genetic, species and ecosystem. Biodiversity hotspots- Criteria, hotspots of India. Loss of biodiversity – causes and conservation (In-situ and ex-situ methods). Seed banks - conservation of genetic resources and their importance.

Extra Reading/ Key words: *Neo endemics, paleo endemics, pseudo endemics, National parks*

UNIT – IV Forest ecology 12hrs

Definition - biotic and abiotic components - forest ecosystem - forest community - concepts - succession - primary productivity - nutrient cycling. Composition of forest types in India - classification of India's forests - species composition - association and diversity. Restoration ecology - global warming - green house effects - ozone layer depletion - acid rain.

Extra Reading/ Key words: *Social Forestry, Silvi culture, Hydrology*

UNIT- V Forest Policies and Legislations: 12hrs

Forest policies - Necessity - Formulation of National Forest Policy. History of forest development in India - Indian Forest Policy of 1894, 1952 and 1988. Forest Organizations and Institutes - National - FRI, IGNFA, - International - ICRAF, ITTO. Forest laws - necessity - general principles - Indian Forest Act 1927, Forest Conservation Act 1980. National Biodiversity Authority 2003 – Salient features.

Extra Reading/Key words: *Wildlife Protection Act, 1972, Tamil Nadu Forest Act, 1882, Tamil Nadu Timber Transit Rules, 1968,*

Course Outcomes (CO):

The learner will be able to

CO No.	Course Outcomes	Cognitive Level
CO-1	List the Methods of dispersal, factors influencing plant distribution, and explain the different types of phyto geographical distribution and theories of phytogeography.	K1

CO-2	Discuss the policies and laws related to forestry, Describe the Role of forest protection in Indian Forestry and agencies that cause damage to forest and protective measures.	K2
CO-3	Classify types of soils, biodiversity hotspots in India, conservation of biodiversity and seed banks.	K3
CO-4	Analyze the floristic regions of the world: Vegetation Zones in relation to latitudes and altitudes.	K4
CO-5	Evaluate the protective measures and benefits due to chemical and biological control. ozone layer depletion - acid rain.	K5

Prescribed Text Books:

1. McManus B. Collins and Fred M White, 1981. Elementary Forestry. Reston Publishing Company, Inc., Reston, Virginia.
2. MacDonald, G.2003. Biogeography: Introduction to Space, Time and Life. John Wiley & Sons, Inc. 3. Sagreiya, K.P., 1967. Forests and Forestry. National Book Trust, India.

Books for Reference

1. Dwivedi, A.P., 1993. A Text Book of Silviculture. International Book Distributors, Dehra Dun.
2. Longman, K.A. and Jenik, J., 1987. Tropical forest and its Environment: ELBS, 2nd edn. London.
3. Shanmughavel, P., 2003: Techniques in Forestry,Pointer, Jaipur.
4. Simmons, I. G. 1979. Biogeography: Natural and Cultural. Edward Arnold Ltd.
5. Tiwari, K.M. and Singh, R.V., 1984. Social Forestry Plantations. Oxford & IBH Publishing Co., New Delhi.

Web References

1. ***https://www.bayer.com/forestry-geography-growing-vegetables-in-cities***
2. ***https://forest policies.com/gardening/soils-forest ecology.***
3. ***https://www.bayer.com/floristic region-India***
4. ***https://www.biologydiscussion.com/plant-floral region/vegetative zone-and-spore-walls/npc-classification-of-soil-/68892***
5. ***https://www.yourarticlelibrary.com/biology/apiculture-sericulture-types-advantages-and-disadvantages/190***

(For Candidates admitted from the academic year 2021-22 onwards)
HOLY CROSS COLLEGE (AUTONOMOUS) TIRUCHIRAPPALLI –2
SCHOOL OF LIFE SCIENCES
PG AND RESEARCH DEPARTMENT OF BOTANY
CHOICE BASED CREDIT SYSTEM
B.Sc. BOTANY
Second Year - Semester – IV

Course Title	**MAJOR ELECTIVE-3 PHYTOMEDICINE**
Total Hours	**60**
Hours/Week	**4 Hrs /Wk**
Code	**U21BO4MET03**
Course Type	**Theory**
Credits	**3**
Marks	**100**

GENERAL OBJECTIVE
To enable the students to learn the classification, constituents, collection, processing and uses of crude drugs obtained from various plant parts.

COURSE OBJECTIVES
The learner will be able to

CO No.	Course Objectives
CO-1	Understand, apply and analyze the importance of Indian system of medicine.
CO-2	Analyse the phytoconstituents of therapeutic values & evaluate the drug adulteration
CO-3	Understand the authentication of plant drugs, it's collection and processing
CO- 4	Remember the indigenous traditional drugs
CO- 5	Understand and apply the pharmaceutical preparation for commerce

UNIT- I Introduction **12 hrs**

History, Definition and scope of plant medicine; Indian system of Medicines –Ayurveda, Siddha and Unani. Sources of plant drugs. Classification of Crude drugs – Taxonomical, Morphological, Pharmacological and chemical classifications. Importance of plant medicines, Plant Vs. conventional drugs.

Extra reading/Key words: *Aroma therapy, Forensic and eco pharmacognosy*

UNIT – II Drug constituents & adulteration **12 hrs**

Carbohydrates, glycosides, lipids – fixed oils, volatile oils, resins, gums, alkaloids, tannins and polyphenols. Definition and types of drug adulteration and its detection. Methods of drug evaluation– physical, morphological and microscopical.

Extra reading/Key words: *Plant metabolomics, drug Quality control*

UNIT-III Processing & Extraction of Drugs **12 hrs**

Identification and authentication of plants, Different methods of processing of herbs like collection, harvesting, garbling, packing and storage. Methods of drying – Natural and artificial drying methods with their merits and demerits. General methods of plant extraction-Cold and Hot method, isolation and purification of phytoconstituents.

Extra reading/Key words: *DNA based authentication of plants, standardization of plant drugs*

UNIT – IV Indigenous traditional drugs of India **12 hrs**

Distribution, biological source, characters, chemical constituents and medicinal uses of the following: Amla (*Emblica officinalis*), Brahmi (*Hydrocotyl asiatica*), Tulasi *(Ocimum sanctum*), Garlic (*Allium sativum*), Vasaka (*Adhatoda vasica*), Ginger (*Zingiber officinale*), Clove (*Syzygium aromaticum*), Pepper (*Piper nigrum*), Cinchona (*Cinchona officinalis*) and Lemon grass oil (*Cymbopogon citratus*).

Extra reading/Key words: *Psychoactive drugs, plants as neutraceuticals.*

UNIT- V Preparation of crude drugs for commerce. **12 hrs**

Preparation of herbal infusions- Hot and cold infusion, decoctions for cold and fever, lotions- sunscreen lotion, tinctures for burns and wounds, syrups for dry cough and digestion, poultices for inflammation and insect bites, ointments for wounds and swelling, oils- hair growth and insect repellet. Surgical fibre-cotton, sutures and dressings materials from plants.

Extra reading/Key words*: Jute and Silk fibres, synthetic polypropylene sutures*

COURSE OUTCOMES (CO)

The learner will be able to

CO No.	Course Outcomes	PSOs Addressed	Cognitive Level
CO-1	Define the types of Indian system of medicine	PSO 1 PSO 5	R, U
CO-2	Classify the crude drugs	PSO 1 PSO 5	An
CO-3	Summarize and analyse the phytoconstituents of therapeutic values of plant drugs	PSO 1 PSO 8	U, An
CO-4	Analyse the drug adulteration	PSO 1 PSO 8	An
CO-5	Lists the indegenous traditional drugs	PSO 1 PSO 5	R
CO-6	Explain the collection and processing of plant drugs	PSO 1 PSO 5	R, U

CO-7	Discuss the various plants as technical products	PSO 1 PSO 5	R, U
CO-8	Describe the preparation of crude drugs for commerce	PSO 1 PSO 5	R, U

PO – Programme Outcomes; CO – Course Outcome; R- Remember; U- Understand; Ap Apply; An – Analyse; E- Evaluate; C – Create

Prescribed Text Books:

1. Roseline, A. 2011. Phamacognosy. MJP Publishers, Chennai.
2. Kokate, C. K., Purohit, A. P. & Gokhale, S. B. 1998. Pharmacognosy. Nirali Prakashan, Pune.

Books for Reference:

1. Wallis, T. E. Text book of Pharmacognosy. CBS Publishers & Distributers. Jain Bhawan, New Delhi.
2.Hill.A.F, 1996. Economic Botany –Tata Mc Grew –Hill publishing company Limited,New Delhi.
3.Mohammed Ali. Text book of Pharmacognosy. CBS Publishers & Distributers, New Delhi.
4.Edwin Jerald, E and Sheeja Edwin Jerald, 2007. Text book of Pharmacognosy and Phytochemistry. CBS Publishers and Distributors Pvt. Ltd.

5.Biren N. Shah and Seth, A. K. 2010.Text book of Pharmacognosy and Phytochemistry. Elsevier Publishers.
6.Michael Heinrich, Joanne Barnes, Jose M. Prieto Garcia, Simon Gibbons and Elizabeth M. Williamson. 2018. Fundamentals of Pharmacognosy and Phytotherapy. Elsevier Publishers.
7.Chengki Z, Junfu Z, 1984. Chinese sea weeds in herbal medicine. Junk Publishers, Dordrecht.

(For Candidates admitted from the academic year 2021-22 onwards)
HOLY CROSS COLLEGE (AUTONOMOUS) TIRUCHIRAPPALLI –2
SCHOOL OF LIFE SCIENCES
PG AND RESEARCH DEPARTMENT OF BOTANY
CHOICE BASED CREDIT SYSTEM
B.Sc. BOTANY
Second Year - Semester – IV

Course Title	**ALLIED CORE 5 – PAPER II – BIOPROSPECTING AND PLANT BIOTECHNOLOGY**
Total Hours	**60**
Hours/Week	**4 Hrs /Wk**
Code	**U21BO4ALT05**
Course Type	**Theory**
Credits	**2**
Marks	**100**

CONSPECTUS:
The students will be able to understand the utilization of plants as food, medicine and cosmetics. It also emphasizes the various biotechnological tools involved in plant biotechnology.

COURSE OBJECTIVES:

- Understand and apply their knowledge on cultivation practices, economic products and uses of various plants.
- Understand, apply and analyze the sources and uses of vegetables, fruits, fibre, wood and rubber
- Remember, understand and analyze the sources, extraction and uses of certain exudates of plants
- Understand and analyze the sources, extraction and uses of different plant products
- Understand, apply and analyze the plants through biofertilizer, SCP and various biotechnological methods.

UNIT – I Bioprospecting: 12 Hrs
Cultivation practices, economic products and uses of the following plants. Main economic products and their uses: cereals (*Oryza,Maize*), Pulses (*Cajanus,Black gram*), Sunflower oil, Sesame oil (*Helianthus,Sesamum*), Sugarcane, (*Saccharum*), Beverage (*Coffea*).
Extra reading (Key Words): Sugarcane industries in Tamil nadu

UNIT – II Bioprospecting: 12 Hrs
Sources and uses of the following: Vegetable (*Moringa* – leaf & unripe fruit), Fruit – Banana (*Musa*), Fibre (*Gossypium*). Wood – structure, seasoning and use of Teak (*Tectona grandis*) and Sandal wood (*Santalum album*).Rubber – Morphology of the plant, tapping, processing, grading, packing and use of *Hevea brasiliensis*.
Extra reading (Key Words): Jute and silk

UNIT – III Bioprospecting: 12 Hrs
Source and extraction and use of the following: Medicine – Alkaloid (*Cinchona*) and antioxidants (Green tea). Essential oil – extraction and uses of Eucalyptus and Lemon grass oil. Paper and pulp – Source, manufacture and use of papers (Bamboo and bagasse). Coir – Source, process and use of coconut.
Extra reading (Key Words): Lycopene, quinolizidine alkaloid

UNIT – IV Bioprospecting: **12 Hrs**

Sources ,extraction and uses of the following: Sago – *Manihot utilissima*, Tannins – fruit of *Terminalia chebula*. Dyes – Henna (*Lawsonia inermis*), rhizome of turmeric (*Curcuma domestica*) and ginger (*Zingiber officinalis*) Gums – neem (*Azadirachta indica*).

Extra reading (Key Words): Phenolic compounds, volatile oils

UNIT – V Plant Biotechnology: **12 Hrs**

Regeneration of plants through micropropagation .Production of transgenic plant- insect pest resistance (*Bt* cotton and *Bt* Brinjal). Benefits and risks of GMOs. Large scale production of biofertilizer – (*Rhizobium*). Commercial production of SCP (*Spirulina*) and (*chlorella*) and its nutritive value, advantages and uses. Patent – IPR and its importance.

Extra reading (Key Words): Synthetic seed production, Azolla cultivation

Note: Texts given in the Extra reading /Key wordsmust be tested only through Assignment and Seminars.

COURSE OUTCOMES (CO)

The learner will be able to

COURSE OUTCOMES (CO)

CO No.	Course Outcomes	Cognitive Level
CO-1	Recall, relate and explain the general characters of algae and fungi, the life cycle patterns of bryophyte and pteridophytes	K1
CO-2	Explain and Utilize the, economic products and uses of various plants, biotechnological methods to develop plants using *in vitro* propagation	K2
CO-3	Outline and explain the internal structure of dicot plants, the developmental process of dicot embryo, Compare and contrast the floral characters of different families,	K3
CO-4	Evaluate the concepts of palaeopalynology, aeropalynology and forensic palynology, double fertilization, apomixes, seed viability and seed inspection	K4
CO-5	Develop the practical skills by observing the basic structure and life cycle patterns of plant diversity and morphological and anatomical features of higher plants	K5

Prescribed Text Books:

1. Pandey, B.P. 2007. Economoic Botany. S.Chand & Company LTD. New Delhi.
2. Dubey. R. C. 2006. Text book of biotechnology. S. Chand and Company Ltd. New Delhi.
3. Rajni Gupta and Tarun Rajpal, 2012. Concise notes on Biotechnology, Mc Grew –Hill publishing company Limited,New Delhi.
4. Ganguli, H. G. , Kumud Shankar Das and Chittatosh Dutta, 2011. College Botany. Vol –I and II. New Central

Book Agency, Calcutta.
5. Verma, V. 1985. A text book of Plant Physiology. Emkay Publications, New Delhi.

Books for Reference:

1. Hill.A.F, 1996. Economic Botany –Tata Mc Grew –Hill publishing company Limited,New Delhi.
2. Kumaresan, V. 2004. Biotechnology. SARAS Publication.
3. Kochhar, S. L, 2016. Economic Botany. 5th Edition- A Comprehensive study.
4. Firdose Alam Khan, 2016. Biotechnology Fundamentals. CRC Press.
5. Sharma, P.D. 1992. Ecology and environment. Rastogi Publication, Meerut.
6. Agarwal, S.K. 1992. Fundamentals of ecology. Ashish Publishing House, New Delhi.
7. Pandey, B. P. 1984. Plant Anatomy. S. Chand and Company Ltd, New Delhi.
8. Bhojwani, S. S. and Bhatnagar, S. P. 1978. The Embryology of Angiosperms. Vikas Publishing House Pvt. Ltd,
9. Shukla and Chandel, 1994. Plant ecology and soil Science . S. Chand and Company Ltd., New Delhi.

Web References

1. ***https://www.bayer.com/en/economic botany-in-cities***
2. ***https://bioprospecting and biotechnology-operation***
3. ***https://instagreen.eu/***

(For Candidates admitted from the academic year 2020-21 onwards)
HOLY CROSS COLLEGE (AUTONOMOUS) TIRUCHIRAPPALLI –2
SCHOOL OF LIFE SCIENCES
PG AND RESEARCH DEPARTMENT OF BOTANY
CHOICE BASED CREDIT SYSTEM
B.Sc. BOTANY
Second Year - Semester – IV

Course Title	**ALLIED 6 -PAPER III– PRACTICAL – I**
Total Hours	**60**
Hours/Week	**4 Hrs /Wk**
Code	**U21BO4ALP06**
Course Type	**Practical**
Credits	**2**
Marks	**100**

CONSPECTUS:

To enable the students to give the practical exposure on the basic structure and life cycle pattern of primitive forms such as Algae, Fungi, Bryophytes, Pteridophytes and Gymnosperms. It also provides knowledge on anatomy, embryology, floral taxonomy of angiosperms and different physiological reactions in the higher plants. Morphological and anatomical structures of hydrophytes, xerophytes and halophytes.

COURSE OBJECTIVES:

The learner will be able to

- Remember and understand the general characteristics of algae and fungi, life cycle pattern of bryophytes, Pteridophytes and gymnosperms
- Understand, apply and analyze the internal structure of dicot plants and development of embryo
- Understand and analyze the floral taxonomy of angiosperms
- Understand and apply the different physiological and ecological adaptations in the higher plants
- Understand and analyze the economic products and uses of various plants, SCP and plant tissue culture techniques.

UNIT – I Algae and Fungi: **12 hrs**

Structure of Nostoc, Ulva and *Volvox*, vegetative and reproductive structure of *Penicillium* and *Agaricus and Puccinia*. Bryophyte, Pteridophyte and Gymnosperm: Structure of gametophytes, and sporophytes of *Funaria, Nephrolepis* and *Cycas*.

UNIT- II Anatomy and Embryology: **12 hrs**

Primary and secondary structure of dicot stem (*Vernonia*) and root (Primary-*Cicer*, Secondary-*Vernonia*). Nodal types of dicot plants - Uni, tri and multi lacunar.Structure of mature anther and anatropous ovule.

UNIT – III Taxonomy of Angiosperms : **12 hrs**

Dissecting and drawing the floral parts and flower M.L.S and floral diagram of the following families: Annonaceae, Rutaceae, Rubiaceae, Amaranthaceae and Poaceae.

UNIT – IV Physiology and Ecology : **12 hrs**

Experiments on absorption (osmosis) photosynthesis (test tube funnel), transpiration (Ganong's potometer) respiration (Ganong's respiroscope). Morphological and Anatomical structures of hydrophytes (*Hydrilla*-Stem), xerophytes (*Nerium*-Leaf). Morphology of halophytes (*Avicennia*- pneumatophore and Viviparous germination of seedling).

UNIT – V Bioprospecting and Plant Biotechnology: 12 hrs

Oryza, Maize, Cajanus, Black gram, Helianthus, sesamum,Saccharum, Musa, Coffea and *Gossypium*. Tissue culture techniques –Sterilization, medium preparation, inoculation and micropropagation. SCP – Spirulina and Chlorella.

Course Outcomes (CO):

CO No.	Course Outcomes	Cognitive Level
CO-1	Recall, relate and explain the general characters of algae and fungi, the life cycle patterns of bryophyte and pteridophytes	K1
CO-2	Explain the photosynthetic system of plants and the respiration process of plants.	K2
CO-3	Outline and explain the internal structure of dicot plants, the developmental process of dicot embryo	K3
CO-4	Compare and contrast the floral characters of different families	K4
CO-5	Develop the practical skills by observing the basic structure and life cycle patterns of plant diversity and morphological and anatomical features of higher plants	K5

PO – CO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO-1	H	M	M	H	H	M	M	M	H
CO-2	H	M	H	H	H	M	H	M	H
CO-3	H	H	M	M	H	M	H	M	H
CO-4	H	H	H	H	H	M	M	M	M

High M-Moderate L-Low

PSO – CO MAPPING

CO/PSO	PSO 1	PSO2	PSO3
CO 1	H	H	H
CO2	M	H	H
CO3	H	H	H
CO4	H	H	H

H-High M-Moderate L-Low

(For Candidates admitted from the academic year 2021-22 onwards)

HOLY CROSS COLLEGE (AUTONOMOUS) TIRUCHIRAPPALLI –2
SCHOOL OF LIFE SCIENCES
PG AND RESEARCH DEPARTMENT OF BOTANY
CHOICE BASED CREDIT SYSTEM
B.Sc. BOTANY
Second Year - Semester – IV

Course Title	**NON MAJOR ELECTIVE 2 - HERBAL REMEDIES**
Total Hours	**45**
Hours/Week	**3 Hrs /Wk**
Code	**U21BO4NMT02**
Course Type	**Theory**
Credits	**3**
Marks	**100**

CONSPECTUS

To enable the students to learn the basic principles of Indian system of medicine, home remedies for common ailments and body care by natural means, preparation of herbal medicines.

COURSE OBJECTIVES

- Understand, apply and analyze the importance of Indian system of medicine
- Understand and apply the alternate herbal remedies for common ailments.
- Understand and apply the skin, hair care, kidney, uterus problems by natural ways & Herbal remedies for glycemia.
- Apply and evaluate the knowledge on cultivation and processing of herbs
- Understand, apply and evaluate the herbal preparations.

UNIT I Indian system of medicine: 9 hrs

Introduction and scope. Basic principles of Indian system of medicine - Ayurveda, Siddha and Unani. Aroma therapy and its significance.

Extra reading/Key words: *Naturopathy, Acupuncture, homeopathy*

UNIT – II Herbal home remedies for the common ailments: 9 hrs

Herbal home remedies for the common ailments of mouth infections; respiratory and intestinal problems.

Extra reading/Key words : *FenguFu Therapy, Addison's disease*

UNIT – III Herbal home remedies: 9 hrs

Skin and hair care by natural means. Herbal remedies for kidney and uterine problems. Herbal remedies for glycemia- Hyper and Hypoglycemia.

Extra reading/Key words: *Immunotherapy, Basaglar*

UNIT – IV Cultivation & Processing of herbs: **9 hrs**

Cultivation of herbs - Tulasi, Katralai, Brahmi, karpooravalli and thuthuvalai. Harvesting drying and storage of herbs.

Extra reading/Key words: *Azolla cultivation, Spirulina cultivation*

UNIT – V Herbal preparations: **9 hrs**

Herbal preparations – decoctions, tea, infusions, oils, sanitizer, cosmetics and powders.

Extra reading/Key words: *Bioprospecting, National Medicinal Plants Board*

Note: Texts given in the Extra reading /Key words must be tested only through Assignment and Seminars.

Prescribed Text Books:

1. Girija Khanna.1986. Herbal Remedies –Vikas Publishing house Ltd, New Delhi.
2. Roseline, A. 2011. Phamacognosy. MJP Publishers, Chennai.
3. Joseph E. Pizzarno and Michael T Murray, 2013. Text book of Natural Medicine. Churchill Livingstone Publisher.
4. Anne Kennedy, 2017. Herbal Medicine Natural Remedies.
5. Rahana Hammed and Lateef Ahmed Rather, 2019.Herbal Medicine- A Text Book for Under graduate Students. Akinik Publications.

Books for Reference:

1. Karen Phillip, 1994, Everyday Aromatherapy – Brock Hampton press, Italy. Kurian- Medicinal plants, 2007.
2. Kokate, C. K., Purohit, A. P. & Gokhale, S. B. 1998. Pharmacognosy. Nirali Prakashan, Pune.
3. Nigel C. Veitch, Michael Smith, 2013. Herbal Medicines Fourth edition. Pharmaceutical Press.
4. Mary Jones, 2017.Herbal antibiotics. Createspace Independent Publishing Platform.

Web Reference

https://www.sciencedirect.com/book/9780323523424/textbook-of-natural-medicine
https://www.thegoodtrade.com/features/natural-remedies-books
https://www.ncbi.nlm.nih.gov/books/NBK92773/
https://www.akinik.com/products/273/herbal-medicine-a-text-book-for-undergraduate-students
https://www.booktopia.com.au/books-online/non-fiction/mind-body-spirit/complementary-therapies/traditional-medicine-herbal-remedies/cVXHT-p1.html

III B.Sc.,BOTANY 2022-2023 (V & VI SEMESTER)

Sem.	Part	Course	Title of the paper	Course Code	Hrs/ Week	Credits	Marks
V	III	MajorCore-11	MC-11 Genetics and Molecular Biology	U20BO5MCT11	5	4	100
		MajorCore-12	MC-12 Morphology, Taxonomy of Angiosperms and Ethno botany	U20BO5MCT12	6	5	100
		Major Core– 13	MC- 13 Bio prospecting and utilization of plant resources	U20BO5MCT13	5	4	100
		Major Core– 14	MC-14 Practical – III	U20BO5MCP14	5	4	100
		Major Elective- 3	Course within/outside School – Industrial and Economic Botany /Automated Mushroom cultivation.	U20BO5MET05/ U20BO5MET06	4	3	100
	IV	NME-3	NME – 3 Floriculture	U20BO5NMT03	3	3	100
		Industrial Relation	Herbal Entrepreneurship	U20BO5BIR01	1	1	100
		Extra Credit	Online Course	U20OC5ECT01	-	2	100
		Value Education	Bible/Catechism/Ethics	U20VE5LVE03/ U20VE5LVB03/ U20VE5LVC03	1		-
		Extra Credit	Internship / Field Work / Field Project 30Hours-ExtraCredit	U20SP5ECC05		2 (Extra Credit)	100
			Total		**30**	**24+4**	**700+200**

Sem.	Part	Course	Title of the paper	Course Code	Hrs/ Week	Credits	Marks
VI	III	Major Core– 15	Plant Physiology and Biochemistry	U20BO6MCT15	6	5	100
		Major Core– 16	Plant tissue culture, Genetic engineering and Nanotechnology	U20BO6MCT16	5	4	100
		Major Core– 17	Instrumentation and botanical techniques	U20BO6MCT17	4	4	100
		Major Core– 18	Practical IV	U20BO6MCP18	5	4	100
		Major Elective -4	Course within School – Immunology	U20BC6MET07	4	3	100
	IV	NME-4			3	3	100
		SBC-3	Research Methodology (Theory Cum Project)	U20DS6SBC03	2	1	100
		Value Education	Bible/Catechism/Ethics	U20VE6LVB03/ U20VE6LVC03/ U20VE6LVE03	1		100
	V	Extension Activities	RESCAPES - Impact Study Projects	U20RE6ETF01		4	100
		Extra Credit	Internship / Field Work / Field Project 30Hours-ExtraCredit	U20SP6ECC06		2 (Extra Credit)	100
			Total		**30**	**24+6**	**700+200**
			Grand Total		**180**	**140 + 20 Extra Credits = 160**	**5000 + 900 (EC)**

(For Candidates admitted from the academic year 2020-21 onwards)

HOLY CROSS COLLEGE (AUTONOMOUS) TIRUCHIRAPPALLI –2
SCHOOL OF LIFE SCIENCES

PG AND RESEARCH DEPARTMENT OF BOTANY
CHOICE BASED CREDIT SYSTEM
B.Sc. BOTANY
Third Year - Semester – V

Course Title	**MAJOR CORE -11 GENETICS AND MOLECULAR BIOLOGY**
Total Hours	**75**
Hours/Week	**5 Hrs/Wk**
Code	**U20BO5MCT11**
Course Type	**Theory**
Credits	**4**
Marks	**100**

General Objectives:

To enable the students to understand Mendel's ratios and deviation, blood groups, linkage and crossing over, central dogma of molecular biology, DNA replication, mutation and translation.

Course Objectives:

The learner will be able to

CO No.	Course Objectives
CO-1	understand, apply and evaluate the laws of Mendel in classical genetics and deviations from Mendelian ratios.
CO-2	remember and understand the different types of Gene interaction.
CO-3	understand and analyse the concept of linkage and crossing over.
CO-4	remember and understand sex determinationand apply the concepts of cytoplasmic inheritance,the mechanism of replication.
CO-5	remember and understand the mechanism of translation and mutation.

UNIT – I Classical genetics: 15 hrs

Mendel's experiments. Law of segregation and Monohybrid cross, Back cross-dominant and recessive. Test cross. Law of Independent assortment and Dihybridcross,Trihybrid crosses.Biological significance of Mendel's laws. Deviations from Mendelian ratios: Incomplete dominance - flower colour in *Mirabilis jalapa*. Codominance - coat colour in cattle.

Extra reading/Key words:*Aneuploidy, chromosomal rearrangement*

UNIT – II Gene interaction: 15hrs

Complementary factor - flower colour in sweet pea, Supplementary factor- Coat colour in mice, Duplicate factor - seed shape in shepherd's purse. Epistasis: dominant epistasis - fruit colour in *Cucurbita*, recessive epistasis – petiole length in Tobacco, Lethality: dominant lethal – coat colour in mice, recessive lethal – leaf colour in maize.

Extra reading/Key words:*Karyotype, Duplicate gene*

UNIT – III Gene interaction:
15hrs

Multiple alleles -coat colour in rabbit and blood grouping. Polygenic or quantitative inheritance - kernel colour in wheat.

Linkage and Crossing over : Linkage -complete and incomplete linkage, Crossing over and recombination, Sex determination in plants (*Melandrium* and *Zea mays*), Sex linkage: Inheritance of X – linked genes - *Drosophila* (eye colour) & human being (colour blindness and Haemophilia).

Extra reading/Key words:*Male sterility,recombination frequency*

UNIT – IV Cytoplasmic inheritance 15hrs

Cytoplasmic inheritance in diploid organisms (plastid transmission in plants, kappa particles transmission in *Paramecium*), Cytoplasmic inheritance in haploid organisms (yeast), Significance.

Molecular Biology: History of Molecular Biology. Organization and Structure of DNA, Alternative forms of chromosomal DNA–A,B, C and Z forms .DNA polymerases.DNA replication: semi-conservative mode of replication - Initiation, Elongation & Termination.

UNIT – IV Molecular Biology:
15hrs

Mutation- Intergeneric and Intrageneric. Base pair substitution, Fram shift mutation, Silent Mutation. Chromosomal proteins – histones and protamines. Structure and functions of RNA, Types- tRNA, mRNA and rRNA. RNA promoters (TATA box, CAAT box), RNA polymerases, Mechanism of translation in plants- Initiation, Elongation & Termination.

Extra reading/Key words:*Polymorphic gene,Pleiotropy*

Note: Texts given in the Extra reading/ Key words must be tested only through Assignments and Seminars.

COURSE OUTCOMES (CO)

The learner will be able to

CONo.	Course Outcomes	PSOs Addressed	Cognitive Level
CO-1	Explain the laws of Mendel in classical genetics and deviations from Mendelian ratios.	PSO1	U
CO-2	Describe the complementary factor, epistasis and duplicate factor.	PSO1	R
CO-3	Discuss linkage, crossing over and sex determination.	PSO1 PSO3	U
CO-4	Explain the concepts of cytoplasmic inheritance	PSO1 PSO3	U
CO-5	Describe the mechanism of replication mutation.	PSO1	R
CO-6	Describe the mechanism of mutation.	PSO1	R
CO-7	Explain the protein synthesis in plants.	PSO1 PSO3	U

Prescribed Text Books:

1. Verma,P.S. and Agarwal,V.K.2007. CellBiology, Genetics, Molecular Biology,Evolution and Ecology
.S.Chand&Company Ltd. New Delhi.
2. De Roberties. 2019. Cell and Molecular Biology. CCH, a Wolters Kluwer Business. New Delhi.

Books for References:

1. Gardner,F. J.1972.PrinciplesofGenetics. WileyEastern Pvt.CompanyLtd.,New Delhi.
2. Singh, B. D. 2018. Fundamentals of Genetics. Kalyani Publications. New Delhi.
3. Shane Simpson. 2019. Plant Genetics and Genomics. Larsen and Keller Education. New Delhi.
4. Miguel A. Andrade. 2020. Bioinformatics and Genomes- Current Perspectives. HorizonScientific Press Ltd. India.
5. Nancy Craig, Rachel Green, Carol Greide, Gisela Storz. 2021. Molecular Biology: Principles ofGenomeFunction. OUP Oxford Publishers.

(For Candidates admitted from the academic year 2020-21 onwards)

HOLY CROSS COLLEGE (AUTONOMOUS) TIRUCHIRAPPALLI –2
SCHOOL OF LIFE SCIENCES

PG AND RESEARCH DEPARTMENT OF BOTANY
CHOICE BASED CREDIT SYSTEM
B.Sc. BOTANY
Third Year - Semester – V

CourseTitle	**MAJOR CORE – 12 MORPHOLOGY,TAXONOMY OF ANGIOSPERMS AND ETHNOBOTANY**
TotalHours	**75**
Hours/Week	**6Hrs /Wk**
Code	**U20BO5MCT12**
CourseType	**Theory**
Credits	**5**
Marks	**100**

GENERALOBJECTIVE

To enable the students to understand the morphological variation of the plant, the significance of angiosperm taxonomy, botanical nomenclature, vegetative and floral characters of Angiosperms and their economic value, ethnobotanical applications and traditional medicine

COURSE OBJECTIVES

The learner will be able to

CONo.	Course Objectives
CO-1	Understand, apply the morphological variation and modifications of the plant parts
CO-2	Understand and apply the importance of botanical nomenclature and herbarium andits importance
CO-3	Apply the knowledge gained instudying the classification of Bentham and Hookerand others and plants belonging to the families Annonaceae to Apiaceae

CO-4	Apply the knowledge gained in studying the plants belonging to the families Rubiaceae to Poaceae
CO-5	Understand and apply the relationship and human and plants, and evaluate the origin and application of traditional medicine system

UNIT–I Morphology: **18hrs**

Root types and modifications: Adventitious – *Ruellia*, Tap root– *Daucus*. Stem modifications: Aerial-phylloclade-*Opuntia*, cladode-*Asparagus*, underground–ginger. Leaf:Types :Simple– *Hibiscus*, Compound : Pinnate – *Cassia*, Palmate – *Manihot*. Venation & Phyllotaxy, Modifications :Phyllode-*Acacia*. Leaftendril–*Gloriosa*. Leaf pitcher- *Nepenthes*. Inflorescence types with examples. Flower – Technical description of flower. Fruit -types with examples.

Extrareading/Keywords: *Stolon, Cladode*

UNIT-II Taxonomy of Angiosperms: **18hrs**

Systems of classification: Broad outline of Bentham and Hooker. Binomial Nomenclature. Elementary knowledge of ICBN and its significance. Citation of authors. Floras: definition, identification, collection and uses. Herbarium techniques: Methodology of preparation, management and role of herbarium. Important herbaria and Botanical gardens of India.

Extrareading/Keywords:*Digitalherbaria,Kewbotanicalgarden,PLANTSDatabases*

UNIT-III Taxonomy: **18hrs**

Systematic position (Bentham and Hooker), diagnostic features (vegetative and floral) and economic importance of the following families: Annonaceae, Capparidaceae, Brassicaceae, Rutaceae, Anacardiaceae, Leguminosae- (Fabaceae and Caesalpiniaceae), Cucurbitaceae and Apiaceae.

Extrareading/Key words: *Mimosaceae, Keypreparation, field note book*

UNIT–IV Taxonomy: **18hrs**

Systematic position (Bentham and Hooker), diagnostic features (vegetative and floral) and economic importance of the following families:Rubiaceae,Asteraceae,Asclepiadaceae,Acanthaceae,Lamiaceae,Amaranthaceae,Euphorbiaceae, Orchidaceae, Liliaceae and Poaceae.

Extrareading/Key words: *Musaceae, National tropical botanical garden,*

UNIT–V Ethno botany **18hrs**

Definition and Scope of Ethno botany. Interdisciplinary approaches in Ethno botany. Ethnic groups of India. Study of plants used by tribals (Foods, Medicine and Fodder). Role of medicinal plants in Indian system of medicine- Siddha, Ayurvedic and Unani. Basic principles in relation to ethnobotany. Role of ethnobotany in the conservation - Sacred groves. (religious belief, social custom and Taboos) and domestication of native plant genetic resources. Role of Herbaria in ethnobotany.

Extrareading/Keywords: *Ecotourism, validation of ethno medicine*

Note: Texts given in the Extra reading /Key words must be tested only through Assignment and Seminars.

COURSE OUTCOMES(CO)

The learners will be able to

CONo.	**CourseOutcomes**	**PSOs Addressed**	**Cognitive Level**
CO-1	Differentiate the morphological variation of the plant parts	PSO1 PSO6	R,U
CO-2	List the importance of botanical nomenclature	PSO1 PSO6	R
CO-3	Indicate the importance of herbariums	PSO1 PSO6	U
CO-4	Outline the classification of Bentham and Hooker and others	PSO1 PSO6	R
CO-5	Illustrate the salient features of plants belonging to the families Annonaceae to Apiaceae	PSO1 PSO6	An
CO-6	Distinguish the plants belonging to the families rubiaceae to poaceae	PSO1 PSO6	U
CO-7	Correlate relationship and human and plants	PSO1 PSO5	R,An
CO-8	Evaluate the origin and application of traditionalmedicine system	PSO1 PSO5	U

PO–ProgrammeOutcomes;CO–CourseOutcome;R-Remember;U-Understand;Ap–Apply;An – Analyse;E-Evaluate;C–Create

PrescribedTextBooks:

1. SinghandJain. 1987.Taxonomy of Angiosperms.Rastogi Publications, Meerut, India.
2. Jain,S.K.1987.AManual of Ethnobotany-Scientificpublishers,Jodhpur.
3. Pandey,S.N.and Misra,S.P.2008.Taxonomy of Angiosperms.AneBooks, India, NewDelhi.
4. Sharma,O.P.2017. PlantTaxonomy. 2nd Edition. McGraw Hill Education.
5. Annie Ragland, V. Kumaresan.2019.Taxonomy of Angiosperms – Taxonomy, Systematic Botany, Economic Botany, Ethnobotany. Saras Publication. India.

BooksforReferences:

1. Lawrence.1955.AnintroductiontoPlantTaxonomy.CentralBookDepot. Allahabad.
2. PaulandJain1998.TribalMedicine–OxfordandIBH PublishingCo.,NewDelhi.
3. Sambamoorthy, A.V.S.S.2019. Taxonomy of Angiosperms. Dreamtech Press. NewDelhi, India.
4. Micahel G. Simpson. 2019. Plant Systematics, 3rd Edition. Academic Press. India.

(For Candidates admitted from the academic year 2020-21 onwards)

HOLY CROSS COLLEGE (AUTONOMOUS) TIRUCHIRAPPALLI –2
SCHOOL OF LIFE SCIENCES

PG AND RESEARCH DEPARTMENT OF BOTANY
CHOICE BASED CREDIT SYSTEM
B.Sc. BOTANY
Third Year - Semester – V

Course Title	**MAJOR CORE 13 –BIOPROSPECTING AND UTILIZATION OF PLANT RESOURCES**
Total Hours	**75**
Hours/Week	**5 Hrs /Wk**
Code	**U20BO5MCT13**
Course Type	**Theory**
Credits	**4**
Marks	**100**

GENERAL OBJECTIVE:

To enable the students to understand the utilization of plants as food, medicine and economically important products. It also emphasizes the marine and microbial bioprospecting and their applications in industries.

COURSE OBJECTIVES:

The learner will be able to

CO No.	Course Objectives
CO-1	Understand, apply and analyze the cultivation practices, economic products and uses of cereals, pulses, vegetables, fruits, oils and beverages.
CO-2	Remember, understand and analyze the sources, extraction and uses of certain medicinal plants
CO-3	Understand and analyze the sources, production of economically important bioproducts.
CO- 4	Understand, apply and analyze the marine and microbial bioresources
CO- 5	Remember and Understand the bioprospecting concepts and methods, biopiracy and Traditional Knowledge Digital Library (TKDL)

Unit I **15 hrs**

Bioprospecting: Introduction and scope of bioprospecting; Role of traditional knowledge in bioprospecting. **Bioprospecting of food, oil and beverage plants:** Cultivation practices, economic products and uses of the following plants: Cereals (rice, wheat), Pulses (redgram, black gram), Vegetable (Moringa), Fruit (Banana) Oil (Sunflower, Sesame), Beverage (Coffee, tea).

Extra reading (Key Words): dry drupes

Unit II **15 hrs**

Bioprospecting of medicinal plants: Source, extraction and uses of the following: Alkaloid (*Cinchona, Catharanthus*), Morphine (*Papaver*), Glycosides (*Senna, Digitalis*) Antioxidant (*Camellia, Brassica*), Tannins (*Terminalia, Acacia*), Essential oils (*Eucalyptus, Lemon grass*)

Extra reading (Key Words): Phenolic compounds, volatile oils

Unit III **15 hrs**

Bioprospecting of economically important plants: Wood - Structure , seasoning and uses of *Tectona grandis* and *Santalum album.* Paper and pulp – source, manufacture and uses of paper (bamboo, baggase). Rubber – Morphology of the plant, tapping, processing, grading, packing and uses of *Hevea brasiliensis*. Coir – Source, Process and uses of *Cocos nucifera*. .

Extra reading (Key Words): Sago, natural dyes

Unit IV **15 hrs**

Marine and microbial Bioprospecting: Sources, isolation, cultivation and industrial application of marine yeast. Bioactive chemicals from seaweed and their application. Pharmacologically active agents of microbial origin: Source, industrial production and uses – Antibiotics (streptomycin) , Vaccines (Bacterial – BCG, Viral - Rabies).

Extra reading (Key Words): Kelp forest

Unit V **15 hrs**

Bioprospecting Process: Methods of extraction of plant sample - Cold percolation, hot continuous extraction (soxlet). Assays in bioprospecting - antibacterial and antifungal. Biopiracy -Case studies (Basmati, Neem, Turmeric); Traditional Knowledge Digital Library (TKDL)— concept and importance. Bioprospecting policies. Approval and IPR, protection policies of Bioprospecting.

Extra reading (Key Words): Drug designing

Note: Texts given in the Extra reading /Key words must be tested only through Assignment andSeminars.

COURSE OUTCOMES (CO)
The learner will be able to

CO No.	Course Outcomes	PSOs Addressed	Cognitive Level
CO-1	Outline and explain the bioprospecting concepts and methods	PSO 1, PSO 3	R, U, Ap
CO-2	Recall, relate and explain the cultivation practices, economic products and uses of cereals, pulses, vegetables, fruits, oils and beverages	PSO 1, PSO3	R, U, Ap
CO-3	Recall, relate and explain the sources, extraction and uses of certain medicinal plants.	PSO 1 PSO 6	U, An
CO-4	Explain and compare the sources, production of economically important bioproducts.	PSO 1	U, An
CO-5	Apprehend the bioprospecting aspects related to marine and microbial bioresources	PSO 1 PSO 2	U, An, Ap
CO-6	Outline and explain biopiracy and bioprospecting polices	PSO1	U, An, Ap

Prescribed Text Books:

1. Pandey, B.P. 2007. Economoic Botany. S.Chand & Company LTD. New Delhi.
2. Roseline, A. 2011. Phamacognosy. MJP Publishers, Chennai.
3. Sashi, V and Poornima, S. 2014. Bioreources conservation strategies.Narosa Publishers.

Books for Reference:

1. Hill.A.F, 1996. Economic Botany –Tata Mc Grew –Hill publishing company Limited, NewDelhi.
2. Kochhar, S. L, 2016. Economic Botany. 5th Edition- Cambridge University Press.
3. Tanveer Bilal Pirzadah, Bisma Malik, Rouf Ahmad Bhat, Khalid Rehman Hakeem. 2022.Bioresource Technology: Concept, Tools and Experiences. John Wiley & Sons Ltd.
4. Joanna Mossop**.** 2015**.** Marine Bioprospecting**,** The Oxford Handbook of the Law of the Sea.Oxford University Press.
5. Web address for TKDL: http://www.tkdl.res.in

(For Candidates admitted from the academic year 2020-21 onwards)

HOLY CROSS COLLEGE (AUTONOMOUS) TIRUCHIRAPPALLI –2

SCHOOL OF LIFE SCIENCES

PG AND RESEARCH DEPARTMENT OF BOTANY

CHOICE BASED CREDIT SYSTEM

B.Sc. BOTANY

Third Year - Semester – V

Course Title	MAJORCORE14–PRACTICAL III
TotalHours	75
Hours/Week	5Hrs/Wk
Code	U20BO5MCP14
Course Type	Practical
Credits	4
Marks	100

GENERAL OBJECTIVE

To enable the students learn problems in genetics with examples, practical knowledge on technical description of vegetative and floral parts of the families, Basic aspects of bioprospecting and utilization of plant resources.

COURSE OBJECTIVES

The learner will be able to

CONo.	Course Objectives
CO-1	Understand, apply and evaluate the laws of Mendel in classical genetics and deviations from Mendelian ratios.
CO-2	Understand, apply the morphological variation and modifications of the plant parts.
CO-3	Apply the knowledge gained by studying the plants belonging to Polypetalae
CO-4	Apply the knowledge gained by studying the plants belonging to Gamopetalae and Mocotyledons
CO-5	Understand and apply the bioprospecting and utilization of plant resourses.

UNIT–I Genetics and Molecular Biology **15hrs**

Simple problems in monohybrid and dihybrid ratios, backcross dominant and recessive, incomplete dominance, lethalgene, gene interaction, multiple allele, codominant allele. Alternative forms of chromosomal DNA. Mutation- Intergeneric and Intrageneric. Structure and functions of RNA.

UNIT–II Plant Morphology **15hrs**

Root modification –Tap root – carrot, adventitious root – *Ruellia*. Stem – cladode (*Asparagus*),phylloclade (*Muehlenbeckia*, *Opuntia*). Leaf modification – phyllode – *Acacia*, leaf pitcher –*Nepenthes*.Leaftendril– *Gloriosa*.

UNIT–III Taxonomy **15hrs**

Study of the following families (locally available) Description of plants in technical terms. Identification of economic products from the families.Field study of flora. Polypetalae:Annonaceae, Capparidaceae, Rutaceae, Anacardiaceae, Leguminosae (Fabaceae, Caesalpiniaceae), Cucurbitaceae.

UNIT– IV Taxonomy **15hrs**

Gamopetalae :Rubiaceae, Asteraceae, Asclepiadaceae, Acanthaceae, Lamiaceae. Monochalmydeae an d Monocots:Amaranthaceae, Euphorbiaceae, Liliaceae, Poaceae.

UNIT–V Ethnobotany and Bioprospecting and utilization of plant resources **15hrs**

The traditional usage of medicinal plants by tribal people. Preliminary phytochemical detection of some secondary metabolites. Drug adulteration. Traditional medicines. Economic products of some important families.

COURSE OUTCOMES (CO)
The learner will be able to

CONo.	Course Outcomes	PSOs Addressed	Cognitive Level
CO-1	Explain the laws of Mendel in classical genetics and deviations from Mendelian ratios.	PSO1 PSO2	R, U

CO-2	Describe the morphological variation of the plant parts	PSO1 PSO2	U
CO-3	Illustrate the salient features of plants belonging to Polypetalae.	PSO1 PSO2	U
CO-4	Illustrate the salient features of plants belonging to Gamopetalae.	PSO1 PSO2	U
CO-5	Illustrate the salient features of plants belonging to Monocotyledons.	PSO1 PSO3	U
CO-6	Analyse the drug adulteration	PSO1 PSO3	An
CO-7	Evaluate the origin and application oftraditional medicine system	PSO5 PSO6	R
CO-8	Describe the medicinal properties of traditional drug	PSO5 PSO6	R, U

(For Candidates admitted from the academic year 2020-21 onwards)

HOLY CROSS COLLEGE (AUTONOMOUS) TIRUCHIRAPPALLI –2
SCHOOL OF LIFE SCIENCES

PG AND RESEARCH DEPARTMENT OFBOTANY
CHOICE BASED CREDIT SYSTEM
B.Sc. BOTANY
Third Year - Semester – V

Course Title	**MAJOR ELECTIVE -3 – INDUSTRIAL AND ECONOMIC BOTANY WITH MACHINE LEARNING TECHNOLOGY**
Total Hours	**60**
Hours/Week	**4 Hrs /Wk**
Code	**U20BO5MET05**
Course Type	**Theory cum lab**
Credits	**3**
Marks	**100**

GENERAL OBJECTIVE:

To enable the students to understand the utilization of plants as food & medicine, economic products of plants with industrial value and the commercial production of plant products.

COURSE OBJECTIVES:
The learner will be able to

CO No.	Course Objectives
CO-1	Understand and apply their knowledge on sources, economic products and uses of cereals, millets, legumes and nuts.
CO-2	Understand, apply and analyze the sources and uses of root & stem vegetables, fruits, and fibre.
CO-3	Remember, understand and analyze the sources, extraction and uses of certain exudates of plants.
CO- 4	Understand and analyze the sources, extraction and uses of different plant products.
CO- 5	Understand, apply and analyze the cultivation practices and industrial uses of various plants.To predict and anlyze the plant culturing and processing with the help of machine learning techniques

UNIT –I Economic Botany **12Hrs**

Sources, cultivation practices, economic products and uses of the following plants. Cereals (wheat), millets (Pearl millet), Legumes (green gram) and nuts (Cashew).
Practical: Recipes with pearl millet and cashew nut.

Extra reading (Key Words): Semolina, corn grits.

UNIT–II Economic Botany: **12Hrs**

Sources and uses of the following: Root Vegetable (Tapioca), Stem vegetable (Potato), Fruit – Banana (*Musa*) and Fibre (*Gossypium*).
Practical: Preparation of fruit jam, production of sago.
Extra reading (Key Words): Artichoke, Jute.

UNIT–III Industrial Botany: **12Hrs**

Wood – structure, seasoning and use of Teak (*Tectona grandis*) and Sandal wood (*Santalum album*). Rubber – Morphology of the plant, tapping, processing, grading, packing and use of *Hevea brasiliensis*.
Practical: Herbal face powder, Herbal face pack
Extra reading (Key Words): Lacquers, resins.

UNIT –IV Industrial Botany: **12Hrs**

Sources, extraction and uses of the following: Medicine– Alkaloid (*Catharanthus*) and antioxidants (Green tea). Essential oil–extraction and uses of Lemongrass oil, Dye – Henna (*Lawsonia inermis*).
Practical: Preparation of herbal oil and dye.
Extra reading (Key Words): Phenolics, quinolizidine alkaloid

UNIT- V : Machine Learning Techniques for Plant Processing **12Hrs**

Fundamentals of Machine Learning –Types of Machine Learning –Applications of Machine Learning- Data Objects and Attribute Types – Basic Statistical Description of Data – Data Visualization – Data Pre-processing Steps - Imputing Missing Data – Technical Requirements – Removing observations with Missing Data –Performing mean or median imputation – Implementing mode or frequent category imputation

Extra Reading (Key Words): Support Vector Machine, Bagging, Boosting and Stacking

Note: Texts given in the Extra reading /Key words must be tested only through Assignment and Seminars.

COURSE OUTCOMES (CO)

The learner will be able to

CO No.	Course Outcomes	PSOs Addressed	Cognitive Level
CO-1	Recall, relate and explain the sources, economic products and uses of wheat, pearl millet, green gram and cashew nut	PSO 1, PSO 3	R, U
CO-2	Outline and explain the sources and economic uses of vegetables, fruits, fibres	PSO 1, PSO3	R, U
CO-3	Compare and contrast the nature of wood, seasoning and uses of teak and sandal wood	PSO 1, PSO 6	U, An
CO-4	List the uses of rubber tree and explain the processes involved in rubber production	PSO 1	U
CO-5	Explain and relate the extraction of alkaloids, antioxidants, essential oils and dyes	PSO 1, PSO 2	U, Ap
CO-6	Develop the practical skills by learning and apply ing Machine Learning techniques in various fields	PSO-1	C

Prescribed Text Books:

1. Sunidhi Miglani, 2016. Economic Botany, ABS Books, India.
2. Pandey, B.P. 2007. Economic Botany. S.Chand& Company LTD. New Delhi.
3. Ganguli, H. G, Kumud Shankar Das and Chittatosh Dutta, 2011. CollegeBotany. Vol –I and II. New Central Book Agency, Calcutta.
4. Jiawei Han & Micheline Kamber, “Data Mining Concepts and Techniques”, Elsevier Inc.
2012.

Books for Reference:

1. Kochhar, S. L, 2016. Economic Botany. 5th Edition- A Comprehensive study.
2. Hill.A.F, 1996. Economic Botany –Tata Mc Grew –Hill publishing companyLimited,New Delhi.
3. Soledad Galli, “Python Feature Engineering Cookbook”, Packt Publishing, 2020.

(For Candidates admitted from the academic year 2020-21 onwards)
HOLY CROSS COLLEGE (AUTONOMOUS) TIRUCHIRAPPALLI-620 002
SCHOOL OF LIFE SCIENCES
PG & RESEARCH DEPARTMENT OF BOTANY
B.Sc. BOTANY
Third Year - Semester – v

Course Title	**MAJOR ELECTIVE 3-AUTOMATED MUSHROOM CULTIVATION**
Code	**U20BO5MET06**
Course type	**Theory cum lab**
Hours/Week	**3 Hrs /Wk**
Credits	3
Marks	**100**

General Objectives

To enable the students to understand the importance of mushroom in the nutritious diet, provide knowledge on different steps involved in the cultivation of edible mushroom and recipie formation. To encourage students to produce mushroom at their home level as microentrepreuner ship with post harvest technology.

COURSE OBJECTIVES

CO No.	Course Objectives
CO-1	Remember and understand the life cycle of common edible mushrooms and the anatomy of gills.
CO-2	Understand the structure, and construction of mushroom sheds and techniques of spawn production..
CO-3	Apply the knowledge of substrate and compost production - bed preparation, spawning, spawn running and harvesting of mushrooms.
CO-4	Understand the problems about diseases and pest related to mushrooms and its management
CO-5	Apply the skill of post harvest technology and management of waste produced out of mushrooms.

UNIT – I **9 Hrs**

History . present scenario and Scope of mushroom cultivation. Life cycle of common edible mushrooms - Agaricus and Pleurotus

Practicals : Sectioning of gills of *Agaricus*

Extra reading/Key words: *Epigenous and hypogenous mushrooms*

UNIT –II **9 Hrs**

Construction of mushroom cultivation sheds. Cultivation - isolation, spawn production and growth media for oyster and milky mushroom.

Practicals: preparation of spawn substrate, selection and culture of correct spawn, mother spawn production and storage of spawn.

Extra reading/Key words: *Life cycle patterns oyster and milky mushroom*

UNIT – III **9 Hrs**

Substrate and compost production – bed preparation, spawning, spawn running and harvesting of mushrooms and nutritive value of mushrooms

Practicals: straw preparation, bed preparation, spawn running, cultivation of oyster mushroom and harvesting.

Extra reading/Key words: *Edible and poisonous mushrooms.*

UNIT – IV **9 Hrs**

Problems in mushroom cultivation - diseases, pests and nematodes, weed moulds and their management strategies.

Practicals: Harvesting, Storage of fresh and dry mushrooms.

Extra reading/Key words: *Mushrooms and entrepreneurial skills*

UNIT – V **9 Hrs**

Introduction to IoT: Introduction to Internet of Things - Definition and Characteristics of IoT - IoT enabling Technologies: Wireless Sensor Networks, Cloud Computing, Big data analytics, Communication protocols, Embedded Systems. **Automated Mushroom growth monitoring and control:** Introduction – Smart mushroom farming requirements – Features – Advantages – Hardware Implementation – Software Implementation - Case Study: IoT for Smart Mushroom Farm at Maejo University.

Note: Texts given in the Extra reading /Key words must be tested only through Assignmentand Seminars.

COURSE OUTCOMES (CO)

The learner will be able to

CO No.	Course Outcomes	PSOs Addressed	Cognitive Level
CO-1	Distinguish the different types of edible mushrooms.	PSO 1PSO 6	R, U
CO-2	Summarize the nutritional value and importance of mushrooms	PSO 1 PSO 7	U,An
CO-3	Describe the construction of mushroom shed .	PSO 1 PSO 5	U
CO-4	Discuss the various techniques involved in spawn production	PSO 1 PSO 5	R, U
CO-5	Summarize the production of mushroom and its steps	PSO 1 PSO 7	An
CO-6	Describe the different pests of mushrooms and its management	PSO 1 PSO 5	R, U
CO-7	Discuss the skill of post harvest technology and management of waste produced.	PSO 1 PSO 5	R, U

Text Book:

1.Paul Stamets, J.S. and Chilton, J.S. 2004. Mushroom cultivation A practical guide to growing mushrooms at home, Agarikon Press.

2.Tewan and Pankaj Kapoor S.C. 1993. Mushroom cultivation. Mittal Publication. Delhi.

3.Marimuth et al., 1991. Oyster Mushrooms. Dept. of Plant pathology, TNAU, Coimbatore.

4.Nita Bahl. 1988. Hand book of Mushrooms, 2nd Edition, Vol I & II.

5.Shu Fing Chang, Philip G. Miles and Chang, S.T. 2004. Mushrooms Cultivation, nutritional value, medicinal effect and environmental impact.2nd ed., CRC press.

6.Tripathi, D.P. (2005) Mushroom Cultivation, Oxford & IBH Publishing Co. PVT.LTD,New Delhi.

7.V.N. Pathak, Nagendra Yadav and Maneesha Gaur, Mushroom Production and Processing Technology/ Vedams Ebooks Pvt Ltd., New Delhi (2000).

8.Arshdeep Bahga, Vijay Madisetti, "Internet of Things: A Hands- on Approach", Universities Press, 2015.

Suggested Reading:

1. National Horticulture Board : Cultivation Technology and Tecchnical Standards of Components of Integrated Button Mushroom Unit; Protected production under NHB Scheme (Technical Standard o.NHB-BM- Type 01-2011

2. Anupam Mishra, SRK Singh and MP Thakur: Training Manual on Cultivation of TropicalMushroom and its Value addition. Agricultural Technology Application Research Institute – ICAR - Zone VII, JNKVV, Jabalpur

3.Nailoke Pauline Kadhila, Favian SInvula Mubiana, and Keumbo Lorna Halueendo, 2012:Mushroom Cultivation – A Beginners Guide; Published byUniversity of Namibia

4.Practical Botany (Part I) ISBN #:81-301-0008-8 Sunil D Purohit, Gotam K Kukda & Anamika Singhvi Edition:2013 Apex Publishing House Durga Nursery Road,Udaipur, Rajasthan (bilingual)

Web References:

a. https://agrimoon.com/wp-content/uploads/Mashroom-culture.pdf 2
b. http://nhb.gov.in/pdf/Cultivation.pdf 3.
c. https://www.classcentral.com/course/swayam-vocational-mushroom- production- 23137

(For Candidates admitted from the academic year 2020-21 onwards)
HOLY CROSS COLLEGE (AUTONOMOUS) TIRUCHIRAPPALLI –2
SCHOOL OF LIFE SCIENCES

PG AND RESEARCH DEPARTMENT OF BOTANY
CHOICE BASED CREDIT SYSTEM
B.Sc. BOTANY
Third Year - Semester – V

Course Title	**NON MAJOR ELECTIVE 3 – FLORICULTURE**
Total Hours	**30**
Hours/Week	**3Hrs /Wk**
Code	**U20BO5NMT03**
Course Type	**Theory**
Credits	**3**
Marks	**100**

General Objectives:
To enable the students to learn the techniques of Landscapping, plantation, cultivation, post harvesting techniques, indoor and outdoor gardening, Water and nutrient management, IPM,Trade of Floriculture- Domestic and Global scenario

Course Objectives:

The learner will be able to

CO No.	Course Objectives
CO-1	Understand, apply and analyze the Commercial Floriculture.
CO-2	Understand and apply the different kinds of gardens
CO-3	Relate the mind relaxation by through Aromatherapy
CO- 4	Apply and evaluate the knowledge on Ornamental floriculture.
CO- 5	Understand, apply and analyze the fresh and dry flower arrangements.

Unit – I. Floriculture **9 hrs**
Introduction, Definition, Scope and Importance of floriculture. Nursery management andspecial practices on floriculture. Present status of floriculture in India, Prospects of floriculture in India.
Extra reading/Key words: Olericulture,Pomology.

Unit- II Cultivation and Management **9 hrs**
Soil requirements and artificial growing media for floriculture plants, planting methods, influence of environmental parameters.Water and nutrient management, fertigation, weed management,use of growth regulators, IPM.
Extra reading/Key words: ABA, Florigen

Unit – III Commercial Floriculture **9 hrs**

Types of Floriculture. Indoor and outdoor cultivation methods, production techniques of ornamental plants (Jasmine,Rose, Marigold and chrysanthemum). Fresh and dry flower arrangements.

Extra reading/Key words: Vertical garden, Xeriscaping.

Unit-IV Commercial Floriculture **9 hrs**

Production techniques of plants (Carnation, Anthurium and orchids). Aromatherapy.Production for exhibition purposes.

Extra reading/Key words: Potted plants,Loose flowers

Unit- V. Post harvesting techniques **9 hrs**

Cut flower standards and grades, post harvesting techniques, packing, Storage &transportation, marketing, Domestic and Global Scenario of floriculture trade.

Extra reading/Key words:Floating garden.

CO No.	Course Outcomes	PSOs Addressed	Cognitive Level
CO-1	Explain the post harvesting techniques in floriculture and Writethe scope and importance of Floriculture.	PSO 1, PSO 3	R, U
CO-2	Explain the post harvesting tecniques in floriculture andWrite the scope and importance of Floriculture.	PSO 1, PSO3	R, U
CO-3	Demonstrate the fresh and dry bouquet preparations.packing, Storage & transportation, marketing,	PSO 1, PSO 6	U, An
CO-4	Develop the practical skills by learning Plantation,cultivation,post harvesting techniques, indoor and outdoor gardening, IPM, Trade of Floriculture - Domestic and Global scenario	PSO 1	U
CO-5	Explain and relate the extraction of alkaloids, antioxidants, essential oils and dyes	PSO 1, PSO 2	U, Ap
CO-6	Relate the Production techniques of Carnation, Anthurium and orchids.	PSO-1	C

Text Books:

1.Introduction to Floricuture Roy a. Larson 1980, San Diego, CA, U.S.A.: Academic Press, 1980; 2nd edition.

2.Text book of floriculture Anil K.Singh 2020, New India Publishing Agency- Nipa

3.Bhattacharjee SK. 2006. Advances in Ornamental Horticulture. Vols. I-VI. Pointer Publ.

4.Bose TK, Maiti RG, Dhua RS & Das P. 1999. Floriculture and Landscaping. Naya Prokash. Published by Naya Prokash, 1999

5.Reddy S, Janakiram B, Balaji T, Kulkarni S, & Misra RL. 2007. High tech Floriculture. Indian Society of Ornamental Horticulture, New Delhi.

6.Kurian A & Asha Sankar M. 2007. Medicinal Plants. Horticulture Science Series, New India Publ. Agency.

7.Panda H. 2002. Medicinal Plants Cultivation and their Uses. Asia Pacific Business Press.

Reference Books:

1.Floriculture in india-G.S.Randhawa and A.Mukhopadhyay-Allied PublishersPvt.Limited-2017
2.Floriculture Principles and Species(Second Edition) John M. Dole (Author), Harold F. Wilkins Professor Emeritus (Author) 2019
3.A Handbook of Floriculture –S.Prasad and U.Kumar 2022
4.Commercial Floriculture-MM.Syamal-Narendra publishing House.
5.Floriculture at a glance book Desh Raj 2008
6.Floriculture Handbook by Board Eiri 2012, Publisher · Engineers India Research Institute ; Genre · Business & Economics
7.A Handbook of Floriculture Book S.Prasad 2020,Publisher Bio-Green books.

(For Candidates admitted from the academic year 2020-21 onwards)
HOLY CROSS COLLEGE (AUTONOMOUS) TIRUCHIRAPPALLI–2
SCHOOL OF LIFE SCIENCES
PG AND RESEARCH DEPARTMENT OF BOTANY
CHOICE BASED CREDIT SYSTEM
B.Sc. BOTANY
Third Year -Semester –V

Course Title	**HERBAL ENTREPRENEURSHIP**
Total Hours	**15**
Hours/Week	**1/1**
Code	**U20BO5MCT01**
Course Type	**Theory**
Credits	**1**
Marks	**100**

GENERAL OBJECTIVE

To enable the students to understand the need assessment and herbal drug formulation, identify the plant sources and their quality assurance, processing of raw materials, quality standard for the product, packaging, pricing and marketing of the finished product.

COURSE OBJECTIVES

The learner will be able to

CO No.	Course Objectives
CO-1	Understand the herbal products demand in the market and apply the knowledge in the formulation of raw material
CO-2	Understand the identification of raw material at species level and assuring the quality and authencity of material.
CO-3	Apply the standard operating procedure for the manufacture of the product.
CO-4	Apply the knowledge in setting quality standard of the product with specific parameter.
CO-5	Understand packaging, pricing and marketing.

Unit - I Need assessment and Drug Formulation **3hrs**

Finding out product is demand and in market. Survey in local area and students. Assessment of questionnaire to find out the products. Conceptualisation and formulation of raw materials.

Extra Reading/Key words: *topical medications, pharmaceutics*

Unit - II Plant sourcing, identification and quality assurance **3hrs**

Identification of raw material at species level, sourcing and assuring their quality and authenticity of the material.

Extra Reading/Key words: *Digital herbaria, SCAR*

Unit - III Processing **3hrs**

Drawing standard operating procedure for the manufacture of the product.

Extra Reading/Key words: *Current Good Manufacturing Practice, phytonic process*

Unit - IV Quality check and Profiling of finished product **3hrs**

Setting quality standard for the product with specific parameters based on the product manufactured.

Extra Reading/Key words: *ISO, Central Drug safety and control Organization*

Unit- V Packaging, Pricing and marketing **3hrs**

Packaging materials, labeling, pricing and marketing of the finished product.

Extra Reading/Key words: *DPCO (Drug Pricing Control Organization)**, Pharma marketing channels*

COURSE OUTCOMES (CO)
The learners will be able to

CONo.	**Course Outcomes**	**PSOs Addressed**	**Cognitive Level**
CO-1	Discuss the need assessment of herbal products demand in the market	PSO1 PSO6	U
CO-2	Explain the methods for the formulation of raw materials	PSO 1 PSO 5	U
CO-3	Identify the raw material at species level	PSO 1 PSO 5	R
CO-4	Discuss the standard operating procedure for themanufacture of the product.	PSO 1 PSO 8	U
CO-5	Analyse the quality standard for the product with specific Parameters	PSO 1 PSO 8	An
CO- 6	Discuss the guidelines on packaging, pricing, labeling and marketing of herbal products	PSO 1 PSO 5	U

PO – Programme Outcomes; CO – Course Outcome; R- Remember; U- Understand; Ap Apply; An – Analyse; E- Evaluate; C – Create

Prescribed Text Books

1. Roseline, A. 2011. Phamacognosy. MJP Publishers,Chennai.
2. Kokate, C. K., Purohit, A. P. & Gokhale, S. B. 1998. Pharmacognosy.Nirali Prakashan, Pune.
3. Pandey,S.N.and Misra,S.P.2008.Taxonomy of Angiosperms. Ane Books,In NewDelhi.

Books for reference

1. Michael Heinrich, Joanne Barnes, Jose M. Prieto Garcia, Simon Gibbons and Elizabeth M. Williamson. 2018. Fundamentals of Pharmacognosy and Phytotherapy. Elsevier Publishers.
2. Edwin Jerald, E and Sheeja Edwin Jerald, 2007. Text book of Pharmacognosy and Phytochemistry.CBS Publishers and Distributors Pvt.Ltd.
3. Nigel C. Veitch, Michael Smith, 2013. Herbal Medicines Fourth edition. PharmaceuticalPress.
4. Lawrence.1955. An introduction to Plant Taxonomy. Central Book Depot. All

(For Candidates admitted from the academic year 2020-21 onwards)
HOLY CROSS COLLEGE (AUTONOMOUS) TIRUCHIRAPPALLI – 2
PG AND RESEARCH DEPARTMENT OF BOTANY
B.Sc. BOTANY
Third Year – Semester – VI

Course Title	MAJOR CORE 15 – PLANT PHYSIOLOGY AND BIOCHEMISTRY
Total Hours	90
Hours/Week	6Hrs /Wk
Code	U20BO6MCT15
Course Type	Theory
Credits	5
Marks	100

General Objectives:

To enable the students to learn the fundamentals of plant physiology and biochemistry such as physiological activities like absorption, transpiration, respiration, photosynthesis, nitrogen metabolism and plant growth regulators and structure, types, chemistry and significance of various biomolecules.

Course Objectives : The learner will be able to

CO No.	Course Objectives
CO-1	Understand, apply and analyse the concept of water and mineral absorption in plant system and their role
CO-2	Understand and analyse the various pathways involved in respiration and photosynthesis and the significance of different factors in photosynthesis
CO-3	Understand and analyze the mechanism of biological nitrogen fixation, nitrogen cycle, plant growth regulators and their applications related to various physiological acitivites.
CO- 4	Remember, understand and analyse the nature of atom, micro & macromolecules and their properties
CO- 5	Remember and understand the significance of aminoacids, proteins, enzymes, vitamins and alkaloids.

UNIT – I Physiology: **18hrs**

Diffusion, Osmosis and Imbibition- Osmotic pressure, significance of Osmosis and Plasmolysis. Water absorption – passive and active absorption. Apoplast and Symplast concept. Ascent of sap: root pressure and transpiration pull. Transpiration: types, mechanism of stomatal movement. Guttation, antitranspirants.Absorption of mineral solutes – active and passive. Mineral nutrition: Sources, functions and deficiency symptoms of essential elements. Water and sand culture experiments.

Extra reading/Key words:*Soil-Plant Atmosphere Continum (SPAC), precision farming*

UNIT – IIPhysiology: **18hrs**

Glycolysis, Kreb's cycle, Electron transport and oxidative Phosphorylation and Pentose phosphate pathway. Photosynthesis: Photosynthetic pigments. Emerson enhancement effect, photochemical

reactions- photophosphorylation, dark reactions- C_3, C_4 fixations and CAM plants. Factors affecting photosynthesis.
Extra reading/Key words:*chemiosmosis, carbon sequestration, anaerobic respiration*

UNIT – III Physiology **18hrs**
Nitrogen metabolism: Sources of nitrogen, biological nitrogen fixation, nitrogen cycle. Aminoacids – reductive amination, transamination. Protein synthesis. Growth: stages of growth and growth curve. Plant growth regulators – Indoles, gibberellins, cytokinins, ethylene, abscissic acid. Photoperiodism. Plant rhythms and Biological clock. Vernalization, Seed dormancy and senescence.
Extra reading/Key words:*Circadian rhythm, tissue culture, horticultural techniques*

UNIT – IVBiochemistry: **18hrs**
Structure of atoms, molecules and chemical bonds. Carbohydrates: Nomenclature , structure (aldoses and ketoses) of Monosaccharides, Isomerism, properties of Monosaccharides. Compounds derived from monosaccharides. Disaccharides: Structure and properties of reducing and non – reducing disaccharides. Polysaccharides: Structure of starch, cellulose and pectin. Biological significance of carbohydrates. Lipids: Composition of lipids – saturated and unsaturated fatty acids, compound lipids and derived lipids. Biological significance of lipids.
Extra reading/Key words:*Biosynthesis of fatty acids, carbohydrate metabolism*

UNIT – V - Biochemistry: **18hrs**
Classification and properties of Amino acids. Classification and structure of proteins. Properties and biological significance of proteins. Enzymes: Classification, properties, Mode of action of enzymes, Factors affecting enzyme activity. Secondary metabolites- alkaloids. Vitamins: types, sources, deficiency disorders and biological significance.
Extra reading/Key words:*Storage proteins, vitamin B17*

Note: Texts given in the Extra reading /Key wordsmust be tested only through Assignment and Seminars.

Course Outcomes:
The learner will be able to

CO No.	Course Outcomes	PSOs Addressed	Cognitive Level
CO-1	Explain the concept of water and mineral absorption in plant system and their role.	PSO 1 PSO 3	R, U
CO-2	Explain the various pathways involved in respiration and photosynthesis	PSO 1 PSO 3	R
CO-3	Differentiate C_3 and C_4 cycle	PSO 1 PSO 3	U, An
CO-4	Explain CAM plants and factors affecting photosynthesis	PSO 1 PSO 3	R
CO-5	Illustrate the mechanism of biological nitrogen fixation, nitrogen cycle, plant growth regulators and its applications related to various physiological acitivites.	PSO 1 PSO 3	An
CO-6	Outline the structure of an atom	PSO 1 PSO 3	U
CO-7	Explain the structure, properties and biological	PSO 1 PSO 3	R, U

	significance of carbohydrates		
CO-8	Describe the significance of aminoacids and proteins	PSO 1 PSO 3	U
CO-9	Discuss the importance of enzymes, vitamins and alkaloids	PSO 1 PSO 3	U
CO-10	Develop the employability skills by learning the fundamentals of plant physiology and biochemistry	PSO-1	C

References

Text Books:

1. Verma, V. 1985. A text book of Plant Physiology. Emkay Publications, New Delhi.
2. Pandey, S. N. and Sinha, B. K. 1972. Plant Physiology. Vikas Publishing House Pvt. Ltd., New Delhi.
3. Jain, J. L. and Sunjay Jain 2016. Fundamentals of Biochemistry. S. Chand and Company Ltd., New Delhi.
4. Srivastava. 1987. Introduction to biochemistry. Rastogi publications, Meerut, India.
5. Jain, V. K. 2018. Fundamentals of Plant Physiology. Nineteenth Edition. S. Chand and Company Ltd., New Delhi.

Reference Books:

1. Noggle, G. R. and Fritz, G. J. 1992. . Introductory Plant Physiology. Prentice – Hall of India Pvt. Ltd., New Delhi.
2. Conn, E. E. and Stumpf, P. K. 1976. Outlines ofBiochemistry**.** Wiley Eastern Ltd., New Delhi.
3. Hans-Walter Heldt Professor Em and Birgit Piechulla. 2019. Plant Biochemistry, Kindle edition.

HOLY CROSS COLLEGE (AUTONOMOUS) TIRUCHIRAPPALLI – 2
PG AND RESEARCH DEPARTMENT OF BOTANY
B.Sc. BOTANY
Third Year - Semester – VI

Course Title	**MAJOR CORE 16 - PLANT TISSUE CULTURE, GENETIC ENGINEERING AND NANOTECHNOLOGY**
Total Hours	**90**
Hours/Week	**5 Hrs/Wk**
Code	**U20BO6MCT16**
Course Type	**Theory**
Credits	**4**
Marks	**100**

General Objectives:

To enable the students to learn the basic and recent trends of plant tissue culture, recombinant DNA technology and nanotechnology.

Course Objectives:
The learner will be able to

CO No.	Course Objectives
CO-1	understand, apply the tissue culture techniques in mico propagation of rare and medicinal plants
CO-2	remember and understand the alternative techniques for mass propagation
CO-3	understand and apply the tools and techniques adopted in production of transgenic plants
CO- 4	understand the concept of GMOs in the field of medicine, agriculture and bioremediation.
CO- 5	understand and apply the basics of nanotechnology and its role in agriculture, medicine and environment

UNIT – I: Plant tissue culture: 18 hrs

Introduction,Cellular totipotency, basic principles, infrastructure of plant tissue culture laboratory. Sterilization of glassware, culture medium and explants. Culture medium: Definition, types, composition and preparation of MS medium. Micropropagation – methods & their significance. Organogenesis – direct and indirect methods and their significance.

Extra Readings/Key words:*Micropropagation of orchids, Germplasm conservation*

UNIT–II: Plant tissue culture: **18 hrs**

Somatic embryogenesis- Principle, types, protocol and importance. Synthetic seed preparation and its application. Haploid culture- anther and pollen culture and their significance. Cell suspension culture: Principle, methods and applications. Plant protoplast culture: principle, isolation, fusion & culture of protoplasts and its importance.

Extra Readings/Key words:*Embryo culture, Cybridization*

UNIT–III:Genetic engineering: **18 hrs**

Introduction, principle and applications of genetic engineering. Vectors: Plasmid – Ti plasmid, pBR 322 - definition, nomenclature, structure and uses. Enzymes – restriction endonucleases & DNA ligase and their applications. Gene cloning: Isolation of desired gene and vector, construction of recombinant DNA, transformation and multiplication of recombinant DNA, selection of clones by colony hybridization. PCR: Principles and applications of PCR. Gene libraries: Construction and uses of genomic and cDNA library.

Extra Readings/Key words:*Shot gun method, RT-PCR*

UNIT – IV: **Genetically Modified Organisms (GMO's):** **18 hrs**

Production of recombinant hormone (insulin), hormone (somatotropin), vaccine (Hepatitis B virus). Construction and role of superbug (*Pseudomonas putida*) in bioremediation.

Transgenic plants: *Agrobacterium* mediated gene transfer, production of herbicide resistant plants (Glyphosate), pest resistant plant (Bt toxin) and improvement of nutritional quality of crop plants (sweet protein - thaumatin).Biohazards of GMOs.

Extra Readings/Key words:*Updation of GMOs*

UNIT – V: Nanotechnology: **18 hrs**

Introduction, history, bio-nano tools, types of nano materials, applications of nanotechnology – environment, agriculture and medicine. Safety and limitations of nanotechnology.

Extra Readings/Key words:*RFID, Kuppfer cells, Nano farming*

Note: Texts given in the Extra reading /Key words must be tested only through Assignment and Seminars.

Course Outcomes:

The learner will be able to

CO No.	Course Outcomes	PSOs Addressed	Cognitive Level
CO-1	Discuss the tissue culture techniques in micro propagation of rare and medicinal plants	PSO 1 PSO 2	U
CO-2	Describe the alternative techniques for mass propagation	PSO 1 PSO 2	R
CO-3	Distinguish the tools and techniques adopted in production of transgenic plants	PSO 1 PSO 2	U,
CO-4	Explain the production of recombinant hormone, vaccine	PSO 1 PSO 2	U
CO-5	Enumerate the role of GMOs in the field of medicine, agriculture and bioremediation.	PSO 1 PSO 2	R

CO-6	Summarize the basics of nanotechnology and its role in agriculture, medicine and environment	PSO 1 PSO 2	U
CO-7	Develop the employability skills by understanding the basic and recent trends of plant tissue culture, recombinant DNA technology and nanotechnology	PSO-1	C

References

Text Books:

1. Dubey. R. C. 2006. Text book of biotechnology. S. Chand and Company Ltd. New Delhi.
2. Desmond, S and Nicholl, T. 2018. Ann Introduction to Genetic Engineering. Cambridge University Press, Cambridge, United Kingdom.
3. Kumaresan, V. Text book of biotechnology. Saras Publications.
4. Satyanarayana U. 2015. Biotechnology. Books and Allied (P) Ltd. Kolkata.
5. Kalyan Kumar de, 2020. An Introduction to Plant Tissue Culture. New Central book Agency, Pvt. Ltd.

Reference Books:

1. Gupta, P. K.1999. Elements of biotechnology. Rastogi Publications, Meerut.
2. John E. Smith. 1988. Biotechnology – II Edition. Cambridge University Press, London.
3. Jogdand, S.N. 2006. Gene Biotechnology. Himalaya Publishing House. M. Balakrishna Rao and M.Krishna Reddy, 2007. Nanotechnology and Society. Campus Books International, New Delhi.
4. Joy Deep Dutta and Anil K.Rao, 2008. Introduction to Nanoscience. CRC Press, London.

(For Candidates admitted from the academic year 2020-21 onwards)
HOLY CROSS COLLEGE (AUTONOMOUS) TIRUCHIRAPPALLI – 2
PG AND RESEARCH DEPARTMENT OF BOTANY
B.Sc. BOTANY SYLLABUS
Third Year - Semester – VI

Course Title	MAJOR CORE 17 – INSTRUMENTATION AND BOTANICAL TECHNIQUES
Total Hours	75
Hours/Week	4Hrs /Wk
Code	U20BO6MCT17
Course Type	Theory
Credits	4
Marks	100

General Objectives:
To enable the learner to undersatand the botanical techniques, working principles and applications of biological instruments.

Course Objectives:
The learner will be able to

CO No.	Course Objectives
CO-1	remember, understand and apply the instrumentation of microscopy and micrometry.
CO-2	understand and apply the working principles and applications of Colorimeter and pH meter
CO-3	understand and apply the instrumentation of centrifuge, Dialysis and chromatography
CO- 4	understand and apply the botanical techniques, microtomy, and staining for preparing permanent slides.
CO- 5	understand and apply the basic techniques of DNA and protein studies and also localization of carbohydrates, proteins and lipids

UNIT – I Instrumentation: **15 hrs**
Microscopy– working principle of light microscope – magnification, resolution, numerical aperture and refractive index. Micrometry – ocular and stage. Standardization and measurement of fibre, stomatal pore etc.
Extra Reading /Keywords: working principle of *Dark field microscope, fluorescence microscope*

UNIT – II Instrumentation: **15 hrs**
Colorimeter, spectrophotometer – working principle (Beers and Lamberts law) and their applications. pH meter – principles and application. Preparation of buffers.

Extra Reading/Keywords:*UV Spectrophotometer, flame photometer*

UNIT – III Chromatography: **15 hrs**

Working principle, types – paper, thin layer and column chromatography and their applications. Dialysis - principles and application. Centrifuge - principle, types - table top, high speed and Ultra centrifuge and their applications.

Extra Reading/ Keywords:*GCMS, industrial centrifuge, HPLC*

UNIT – IVBotanical techniques: 15 hrs

Collection, fixation (fixative FAA) and processing (dehydration, clearing, infiltration and embedding) of plant materials. Hand sectioning of plant material. Microtomy and its types, Staining - Double staining with safranin and fast green.

Extra Reading/Keywords:*Ultramicrotome, authenticity*

UNIT – VHistochemical analysis: 15 hrs

Localization and identification of carbohydrates, proteins and lipids. **Electrophoresis:** Principles and techniques. Separation of DNA – Agarose gel, Protein separation – SDS PAGE.

Extra Reading /Keywords:*genomics, proteomics, histochemistry*

Note: Texts given in the Extra reading /Key words must be tested only through Assignment and Seminars.

Course Outcomes:

The learner will be able to

CO No.	Course Outcomes	PSOs Addressed	Cognitive Level
CO-1	Explain the principle and working mechanism of light microscope	PSO 1PSO 3	R, U
CO-2	Describe the ocular and stage micrometer	PSO 1 PSO3	R, U
CO-3	Explain the working principles and applications of Colorimeter and pH meter	PSO 1 PSO 3	U
CO-4	Describe the working principle **o**f Dialysis and chromatography centrifuge	PSO 1 PSO 3	R,U
CO-5	Explain the botanical techniques, microtomy, and staining for preparing permanent slides	PSO 1 PSO 3	R, U
CO-6	Describe the basics techiques of DNA and protein studies and also localization of carbohydrates, proteins and lipids	PSO 1 PSO 2	U
CO-7	Develop the employability skills by understanding the botanical techniques, working principles and applications of biological instruments	PSO-1	C

References

Text Books:

1. Machve K. K. 2007. A text book of Bio – Instrumentation. Manglam Publishers & Distributors, Delhi.

Reference Books:

1. Keith Wilson & John Walker, 1994. Practical Biochemistry Principles & Techniques. Rekha Printers Pvt. Ltd. New Delhi.
3. Avinash U., Kakoli U. and Nirmalendu N. 1998. Biophysical Chemistry. Himalaya Publishing House, Mumbai.

(For Candidates admitted from the academic year 2020-21 onwards)
HOLY CROSS COLLEGE (AUTONOMOUS) TIRUCHIRAPPALLI – 2
PG AND RESEARCH DEPARTMENT OF BOTANY
B.Sc. BOTANY SYLLABUS
Third Year - Semester – VI

Course Title	**MAJOR CORE -18 PRACTICAL IV**
Total Hours	**90**
Hours/Week	**5 Hrs /Wk**
Code	**U20BO6MCP18**
Course Type	**Practical**
Credits	4
Marks	**100**

General Objectives:

To enable the students on the preparation of solutions, to carry out the experiments on plant physiology, biochemistry and plant tissue culture.

Course Objectives:

The learner will be able to

CO No.	Course Objectives
CO-1	Understand and analyse the mechanism of osmosis, plasmolysis, and transpiration.
CO-2	Understand and analyze the mechanism of respiration and photosynthesis.
CO-3	Understand and analyze the mechanism of ascent of sap, root pressure and remember the separation of plant pigments.
CO- 4	Remember, understand and analyse the estimation of starch, reducing sugar, total lipids, total soluble protein, ascorbic acid and enzyme activity.
CO- 5	Remember and understand the preparation of medium, sterilization and inoculation of explants and incubation.

UNIT – I Physiology: **18 Hrs**

Potato osmoscope, DPD of *Rhoeo* leaf peel by plasmolytic method, Determination of water absorption and transpiration ratio, rate of transpiration, determination of transpiration index.

UNIT – II Physiology: **18 Hrs**

Determination of respiration rate by Ganong's respiroscope. Effect of quality of light on photosynthesis, Rate of photosynthesis under varying concentrations of CO_2, Effect of intensity of light on O_2 evolution during photosynthesis using Wilmott's bubbler.

UNIT – III Physiology: **18 Hrs**

Separation of plant pigments by paper chromatography. Experiments for demonstration – Ascent of sap, Root pressure, Kuhn's Fermentation apparatus, thin layer chromatography, water culture experiments (hydroponics), growth curve.

UNIT – IVBiochemistry: **18 Hrs**

Estimation of starch by colorimetric method, Reducing sugar by Benedict's method, Total lipids by gravimetric method. Total soluble protein by Biuret's method, Ascorbic acid by titrimetric method, Enzyme activity measurement - Amylase activity. Estimation of secondary plant product – phenol by colorimetric method. Experiments for demonstration – dialysis. Working principles of centrifuge and colorimeter.

UNIT – V Plant tissue culture, Genetic Engineering and Nanotechnology: **18 Hrs**

Preparation of medium, sterilization and inoculation of explants and incubation. Callus induction with the help of different explants, plantlet production through micropropagation and synthetic seed production. Isolation of protoplast. GMOs and Nanoparticles.

Course Outcomes:
The learner will be able to

CO No.	Course Outcomes	PSOs Addressed	Cognitive Level
CO-1	Describe the mechanism of water absorption, plasmolysis, and transpiration.	PSO 1 PSO 3	R, U

CO-2	Determine the respiration rate by Ganong's respiroscope and the quality of light on photosynthesis.	PSO 1 PSO 3	R
CO-3	Identify the plant pigments by various separation techniques.	PSO 1 PSO 3	U, An
CO-4	Calculate the quantity of primary and secondary metabolites of plant by standard procedures.	PSO 1 PSO 3	An
CO-5	Demonstarte the working principle of dialysis, centrifuge and colorimeter.	PSO 1 PSO 3	An
CO-6	Describe the preparation of medium, sterilization and inoculation of explants and incubation.	PSO 1	R
CO-7	Develop the employability and practical skills by learning the experiments on plant physiology, preparation of solutions on biochemistry and plant tissue culture techniques	PSO-1	C

(For Candidates admitted from the academic year 2020-21 onwards)
HOLY CROSS COLLEGE (AUTONOMOUS) TIRUCHIRAPPALLI –2
SCHOOL OF LIFE SCIENCES
PG AND RESEARCH DEPARTMENT OF BOTANY
CHOICE BASED CREDIT SYSTEM
B.Sc. BOTANY
Third Year - Semester – VI

Course Title	**MAJOR ELECTIVE-4 –TECHNIQUES IN HORTICULTURE AND PLANT TISSUE CULTURE**
Total Hours	**60**
Hours/Week	**4 Hrs /Wk**
Code	**U20BO6MET07**
Course Type	**Theory**
Credits	**3**
Marks	**100**

General Objectives

To enable the students to learn about the scope, importance of horticulture and propagation of plants and the basic and recent trends of plant tissue culture techniques.

Course Objectives

Co. No.	Course Objectives
CO1	Understand and apply the types of horticultural crops and propagation
CO-2	Understand and apply the plant propagation practices of horticultural crops
CO-3	Remember the growth and development of horticultural crops, understand, apply the tissue culture techniques in micro propagation of rare and medicinal plants
CO-4	Remember ,understand and apply the alternative techniques of plant tissue culture for mass propagation

UNIT – I Basics of Horticulture: 12 hrs

Horticulture - Definition, scope and purpose and classification of horticultural crops. Horticultural zones in India and Tamil Nadu. Irrigation, nutrient application & Weed management in horticultural crops - Crop regulation - physical and chemical regulation.
Extra reading/Key words: *Pomology, olericulture*

UNIT – II Plant propagation practices: 12 hrs
Propagation - tools and implements, propagation media, containers. Propagation methods- Sexual preparation – preparation of nursery bed, seed treatment, sowing. Seedling production – potting, depotting and repotting of plants. Different methods and types of asexual propagation - Culture of bonsai
Extra reading/Key words: *Dappled shade, slow release fertilizers.*

UNIT –III Growth and Development: 12 hrs
Growth and development - definitions, components, photosynthetic production of horticultural crops, floriculture. Important physiological disorders and their remedial measures in fruits and vegetables. Importance of post harvest technology in horticultural crops. Post harvest management of horticultural crops.
Extra reading/Key words: *Microclimate, mulching*

UNIT – IV: Plant tissue culture: **12 hrs**
Introduction,Cellular totipotency, basic principles, infrastructure of plant tissue culture laboratory. Sterilization of glassware, culture medium and explants. Culture medium: Definition, composition and preparation of MS medium. Micropropagation – methods & their significance.
Extra Readings/Key words: *Micropropagation of orchids, Germplasm conservation*

UNIT–V: Plant tissue culture: **12 hrs**
Somatic embryogenesis- Principle, types, protocol and importance. Synthetic seed preparation and its application. Haploid culture- anther and pollen culture and their significance. Plant protoplast culture: principle, isolation, fusion & culture of protoplasts and its importance.
Extra Readings/Key words:*Embryo culture, Cybridization*

COURSE OUTCOMES (CO)
The learner will be able to

CO No.	Course Outcomes		Cognitive Level
	Describe the horticultural zones in India, tools and implements, growth and development of horticultural crops, write the principles and techniques of plant tissue culture, role of plant tissue culture in conservation of medicinal plants.	PSO 1 PSO 2	U
	Discuss the scope and importance of horticulture and compare the physiological disorders of fruits and vegetables. Explain the role of alternative techniques in plant tissue culture.	PSO 1 PSO 2	R
	Classify the types of crop regulation, propagation, asexual propagation and types of hybridization	PSO 1 PSO 2	U,
	Analyze application of the nutrients, preparation of nursery bed, seed treatment, postharvest in horticulture crops,	PSO 1 PSO 2	U

CO-6	Compile the post harvesting technology in horticulture	PSO1 PSO6	U
CO-7	Categorize the different types of isolation of protoplast and regeneration of plantlets.	PSO1 PSO5	R,An
CO-8	Apply the knowledge in the production of synthetic seed preparation. apply the culture of bonsai	PSO1 PSO5	U, An

CO – Course Outcome; R- Remember; U- Understand; Ap Apply; An – Analyse; E-Evaluate; C – Create

Text Books:

1. Mani Bhushan Rao, K.1991. Text book of Horticulture-MacMillan India Ltd., Madras.
2. Arumugam, N. and Kumaresan, V.2010. Fundamentals of horticulture and Plant breeding.Saras Publications.
3. Manibhushan Rao, K. 2002. Textbook of Horticulture, Laxmi publications: Second edition.
4. John E. Preece, Paul E. Read, 2004. The Biology of Horticulture: An Introductory Textbook, 2nd Edition
5. Dubey. R. C. 2006. Text book of biotechnology. S. Chand and Company Ltd. New Delhi.
6. Kumaresan, V. Text book of biotechnology. Saras Publications.
7. Satyanarayana U. 2015. Biotechnology. Books and Allied (P) Ltd. Kolkata.

Books for Reference:

1. Edmond J.B., Senn, T.L. and Andrews, F.S. 1964 Fundamentals of Horticulture- Tata Mc Graw – Hill Publishing Company Ltd., New Delhi.
2. Peter M. and Tessa Eve. 2007. Garden planning and Garden design. South water Publishing. London.
3. Prasad and Kumar, 2014. Principles of Horticulture 2nd Edn. Agrobios (India).
4. Neeraj Pratap Singh, 2005. Basic concepts of Fruit Science 1st Edn. IBDC Publishers.
5. Kausal Kumar Misra and Rajesh Kumar, 2014. Fundamentals of Horticulture Biotech Books.
6. Gupta, P. K.1999. Elements of biotechnology. Rastogi Publications, Meerut.
7. John E. Smith. 1988. Biotechnology – II Edition. Cambridge University Press, London.
8. Ignacimuthu, S. 1996. Applied Plant Biotechnology. Tata Mc Graw – Hill Publishing Company Ltd., New Delhi.
9. Kumar, H. D. 1993. Molecular Biology and Biotechnology. Vikas PublishingHouse Pvt. Ltd,New Delhi.

(For Candidates admitted from the academic year 2020-21 onwards)
HOLY CROSS COLLEGE (AUTONOMOUS) TIRUCHIRAPPALLI –2
SCHOOL OF LIFE SCIENCES
PG AND RESEARCH DEPARTMENT OF BOTANY
CHOICE BASED CREDIT SYSTEM
B.Sc. BOTANY
Third Year - Semester – VI

Course Title	**NON MAJOR ELECTIVE 4 – GREEN HOUSE TECHNOLOGY AND HYDROPONICS**
Total Hours	**45**
Hours/Week	**3 Hrs /Wk**
Code	**U20BO6NMT04**
Course Type	**Theory**
Credits	**3**
Marks	**100**

GENERAL OBJECTIVE
To enable the students to learn the basic principles of greenhouse technology.

COURSE OBJECTIVES
The learner will be able to

CO No.	Course Objectives
CO-1	Understand, apply and analyze the importance of Green house technology.
CO-2	Understand and apply the structure and construction of green houses and its frame work and materials needed.
CO-3	Understand and apply the plant nutrition and growth conditions inside the green house.
CO- 4	Apply and evaluate the knowledge on Hydroponics and its culture conditions
CO- 5	Understand, apply and evaluate the growing medium and its fortification of fertilizers for hydroponics

UNIT I Green House Technology **9 hrs**
Introduction to Green house technology: Definition, Concept, Importance and scope. Greenhouse Technology - Operation, maintenance, management and applications in agriculture and horticulture.
Extra reading/Key words: *Automated green houses, microcontrollers*

UNIT – II- Layout and construction of Green house **9 hrs**
Structure and construction of Green house- Location, frame work for various types of green house, covering material and construction of low cost green house structures.

Extra reading/Key words : *LDPE Film, Misting chamber*

UNIT – III : Plant nutrition for propagation structures **9 hrs**

Preparation of soil for planting - Plant nutrition- fertilizers, nutrient deficiencies, water quality and water sanitation. Humidification and advanced protected agricultural systems (various mulches, row cover,irrigation through fertigation methods)

Extra reading/Key words: *Microirrigation, Fertigation technology*

UNIT – IV Hydroponics: **9 hrs**

Methods of Soil-less cultivation and its types, Media, Grow trays, Reservoirs, Nutrient film technology, Hydroponic farms in India

Extra reading/Key words: *Floating hydroponic garden*

UNIT – V Hydroponics: **9 hrs**

Nutrients for hydroponics - pH as indicator of nutrient deficiency, Three part fertilizers, , Compost tea and worm tea, animal and plant by products.

Extra reading/Key words: *Aeroponics*

Note: Texts given in the Extra reading /Key words must be tested only through Assignment and Seminars.

COURSE OUTCOMES (CO)

The learner will be able to

CO No.	Course Outcomes	PSOs Addressed	Cognitive Level
CO-1	Write the scope and importance of Greenhouse technology	PSO 1 PSO 5	R, U
CO-2	Discuss the importance of management, maintenance and importance of green house technology.	PSO 1 PSO 5	R, U
CO-3	Explain the types of green house, frame work and its cost	PSO 1 PSO 5	U
CO-4	Explain the nutrition and propagation structures of green house technology.	PSO 1 PSO 5	U, An
CO-5	Apply the cultivation and advanced protected agricultural systems	PSO 1 PSO 5	U, Ap
CO-6	Demonstrate the cultivation of plant without soil and its practices	PSO 1 PSO 5	U, An
CO-7	Apply the practical skills by learning hydroponics and fertilizers and other manures to the plants	PSO-1	C

Prescribed Text Books:

1.Hydroponics and greenhouse gardening ,James urban,2021,Orion edition limited.
2.Green House Technology, Management operations and maintenance-N.N.Patil,2016,Universal prakashan Publication,Pune
3. Hydroponic and Greenhouse,A complete guide to build hydroponic garden,indoor and outdoor, Richard Batar,2021
4.PeterM.andTessaEve.2007.GardenplanningandGardendesign.SouthwaterPublishing.London.
5.Prasad and Kumar, 2014. Principles of Horticulture 2nd Edn. Agrobios (India).

Books for Reference:

1. Green house technology for controlled environment,G.N.Tiwari,Narosa publication,2020
2. Hydroponic and Greenhouse,A complete guide to build hydroponic garden,indoor and outdoor,Richard Batar,2021

3. Karen Phillip, 1994, Everyday Aromatherapy – Brock Hampton press,Italy. Kurian- Medicinal plants,2007.
4. Kokate,C.K.,Purohit,A.P.&Gokhale,S.B.1998.Pharmacognosy.NiraliPrakashan,Pune. http://www.thegoodtrade.com
5. Nigel C. Veitch, Michael Smith, 2013. Herbal Medicines Fourth edition. Pharmaceutical Press.
6. Green House Technology, Management operations and maintenance-N.N.Patil,2016,Universal prakashan Publication, Pune
7. Green House Management for Horticultural crops, Prasad and Kumar, second edition, Agrobios publication,2005,India.

(For Candidates admitted from the academic year 2020-21 onwards)
HOLY CROSS COLLEGE (AUTONOMOUS) TIRUCHIRAPPALLI – 2
PG AND RESEARCH DEPARTMENT OF BOTANY
B.Sc. BOTANY SYLLABUS 2020 onwards
Third Year- Semester – VI

Course Title	SBC-3-RESEARCH METHODOLOGY
Total Hours	30
Hours/Week	2 Hrs /Wk
Code	U20DS6SBC03
Course Type	Theory cum project
Credits	1
Marks	100

General Objectives:
To enable the students to develop research skills and expose the students to the concept of research and to implement a research project.

Course Objectives:
The learner will be able to

CO No.	Course Objectives
CO-1	remember and understand the definition, type, nature and scope of research.
CO-2	remember and understand the methods of data collection and processing of data.
CO-3	understand, analyze and apply the plan and execution of project work planned with graphs and statistical analysis
CO- 4	understand and apply the writing procedure for project and paper work.

Unit – I: **Introduction to research** **6 hrs**
Definition, type, nature and scope of research – Research design
Extra reading/Key words: *significance of research*

Unit – II: Data collection **6 hrs**
Types – Primary and Secondary data – Data processing – hypothesis testing.
Extra reading/Key words:*Methods of sampling, presentation of data in a suitable form*

Unit – III: Plan and execution **6 hrs**
Methodology – Plan and Execution – Analysis – Documentation.

Extra reading/Key words: *graphs and plates, spss software for analysis of data*

Unit – IV: Format and presentation of project report **6 hrs**

Art of writing and Structure of a Project Report – Viva-voce.

Extra reading/Key words: *thesis model, future prospects*

Unit – V: Project **6 hrs**

Project work.

Note: Texts given in the Extra reading /Key wordsmust be tested only through Assignment and Seminars.

Course Outcomes:
The learner will be able to

CO No.	Course Outcomes	PSOs Addressed	Cognitive Level
CO-1	Explain the types, nature and scope of research	PSO 1 PSO 5	R, U
CO-2	Describe the methods of data collection	PSO 1 PSO 5	R, U
CO-3	Discuss the processing of data.	PSO 1 PSO 5	U
CO-4	Construct the plan and execution of project work planned with graphs and statistical analysis	PSO 1 PSO 5	U, An
CO-5	Apply the writing procedure for project and paper work.	PSO 1 PSO 5	U, Ap
CO-6	Develop the employability skills by understanding the concepts of research and implementing the research project	PSO-1	C

Books for reference

1. Kothari C.R., *Research Methodology.* New Delhi: New Age International (P) Ltd Publishers, 2009. Reprint.
2. Rahim F.A. *Thesis Writing : A manual for researchers.* New Delhi: New Age International Publishers,1988.Print.
3. Gopalana. *Thesis Writing.* Chennai: Vijay Nicole, 2005. Print.
4. Oliver, Paul. Writing Your Theis. New Delhi: Sage Publication, 2008. Print

HOLY CROSS COLLEGE (AUTONOMOUS), TIRUCHIRAPPALLI – 2
PG & RESEARCH DEPARTMENT OF BOTANY
PG COURSE PATTERN 2022-23
M.Sc. BOTANY (I & II SEMESTER)

Sem	Course	Title of the course	Code	Hrs/ Week	Credits	Marks
I	Major Core – 1	Phycology, Mycology and Plant pathology	**P22BO1MCT01**	6	5	100
	Major Core – 2	Bryology, Pteridology and Gymnospermology	**P22BO1MCT02**	6	5	100
	Major Core – 3	Plant embryology, Morphogenesis and Anatomy	**P22BO1MCT03**	5	4	100
	Major Core – 4	General Microbiology	**P22BO1MCT04**	6	5	100
	Major Core – 5	Practical 1-Plant Diversity, Plant pathology, Plant embryology, Morphogenesis and Anatomy, And General Microbiology	**P22BO1MCP05**	6	3	100
		Ethics		1		
	Extra Credit	Internship/ Field Work/ Field Project 30 Hours- extra Credit	**P22EX1INT01**		2	100
		Total		**30**	**22+2**	**600**

HOLY CROSS COLLEGE (AUTONOMOUS), TIRUCHIRAPPALLI – 2
PG & RESEARCH DEPARTMENT OF BOTANY
M.Sc. BOTANY
First Year – Semester- I

Course Title	**MC 1- PHYCOLOGY, MYCOLOGY AND PLANT PATHOLOGY**
Total Hours	**90**
Hours/Week	**6 hrs /wk**
Code	**P22BO1MCT01**
Course Type	**Theory**
Credits	**5**
Marks	**100**

OBJECTIVE

To enable the students to understand the classification, thallus organization, life cycle patterns with reference to various classes of algae and fungi and plant diseases and itsdefense mechanism.

COURSE OBJECTIVES

The learner will be able to

CO No.	Course Objectives
CO-1	Understand the classification, thallus organisation and life cycle patterns of variousclasses of algae.
CO-2	Remember and understand the symbiotic association, nitrogen fixation and waterbloom toxicity in algae.
CO-3	Draw, explain and classify ecology, structure, mode of reproduction and life cyclepatterns of main groups of fungi.
CO-4	Describe, draw, explain the mode of nutrition, heterothallism, physiology of reproduction, hormonal involvement, parasexuality, heterokaryosis of fungi and
	classify the mycorrhizae and economic importance of fungi.
CO-5	Understand and explain the various kinds of plant diseases, pathogenesis, defense mechanisms in plants and impact of disease on physiological activities

UNIT – I Phycology **18 Hrs**

Classification of algae (F.E. Fritsch, 1979). Structure of prokaryotic and eukaryotic cells. Types of chloroplasts, flagellation, pigmentation & nutrition. Thallus organization – unicellular, colonial & multicellular. Reproduction & sexuality in algae. Phylogenetic importance of heterotrichy. Life cycle patterns with reference to Cyanophyceae, Chlorophyceae, Phaeophyceae,Rhodophyceae.

Extra reading/Key words:*Algal phylogeny, Macro algae nursery*

UNIT – II Phycology **18 Hrs**

Algae in symbiotic association – nitrogen fixation – enrichment of soil nitrogen. Phytoplanktons and its importance. Algal blooms – beneficial and harmful, algae as indicators of pollution and algicide. Parasitic algae. Uses of algae as food, fodder, medicine and fertilizer. Soil algae and its significance. Fossil algae. Role of algae in biogeochemistry.

Extra reading/Key words: *Endosymbiont, Algal biorefineries*

UNIT – III Mycology **18 Hrs**

Classification of fungi (Ainsworth,1973). Ecology, Structure of thallus, flagellation, asexual & sexual reproduction, and fructification in fungi. Origin and evolutionary trends & life cycle patterns in main groups of fungi – Myxomycotina, Mastigomycotina, Zygomycotina, Ascomycotina, Basidiomycotina and Deuteromycotina. Fossil fungi.

Extra reading/Key words:*Mycotoxins, fungal melanin*

UNIT – IV Mycology **18 Hrs**

Nutrition in fungi. Heterothallism in fungi. Physiology of reproduction. Hormonal involvement in sexual reproduction. Parasexuality and heterokaryosis. Classification and importance of mycorrhizae. Economic importance of fungi.

Extra reading/Key words:*Calvacin, Metarhizium pingshaense*

UNIT – V Plant pathology **18 Hrs**

Plant diseases. Concept (Koch's Postulates). Host parasite interaction – pathogenesis – entry of plant pathogen – development inside the host. Defense mechanism in plants – structural and biochemical. Role of enzymes and toxins in disease development. Effect of infection on photosynthesis and respiration under pathogenesis. Changes in nitrogen metabolism and phenol content in infected plants.

Extra reading/Key words: *Phytoalexin, integrated disease management*

Note: Texts given in the Extra reading /Key words must be tested only through Assignment and Seminars

COURSE OUTCOMES (CO)

The learners will be able to

CO No.	Course Outcomes	PSOs Addressed	Cognitive Level
CO-1	Explain the classification, thallus organisation and life cycle patterns of various classes of algae.	PSO 1,2	R
CO-2	Describe the symbiotic association, nitrogen fixation and water bloom toxicity in algae.	PSO 2	R
CO-3	Explain and classify ecology, structure, mode of reproduction and life cycle pattern of fungi.	PSO 2	R, U
CO-4	Draw, explain nutrition, parasexuality, heterothallism, physiology of reproduction, sex hormones	PSO 2	R, U
CO-5	Classify the mycorrhizae and write the economic importance of fungi	PSO 6	An, R
CO-6	Explain the various kinds of plant diseases and pathogenesis	PSO 1	R
CO-7	Describe the defense mechanisms in plants.	PSO 1	R
CO-8	Explain the physiological activities of diseased plants.	PSO 1	R

PO – Programme Outcomes; CO – Course Outcome; R- Remember; U-Understand; Ap-Apply An – Analyse; E- Evaluate; C – Create

Books for References:

Algae

1. Fritsch, F. E. 1945. The structure & reproduction of the algae Vol I & II. TheSyndics of theCambridge University Press, London.
2. Ion Morris. 1968. An introduction to algae. Hutchinson University LibraryComapany,London.
3. Kumar, H. D. 1990. Introductory Phycology. Affiliated East-West Press Pvt.Ltd.,New Delhi.
4. Prescott, C. W. 1969. The algae- a review. Butler and Tanner Ltd., London.
5. Smith, G. M. 1951. Manual of Phycology. Waltham Mass, USA, Chronica Botanica Company
6. Robert , E. L. 2018. Phycology.Cambridge University Press, London.

Bilgrami, K.S. and Saha, L.C. 2018. A text book of algae. CBS Publications. Delhi

Fungi

1. Ainsworth, G. C., Frederick K. Sparrow and Alfred S. Sussman. 1973. TheFungi – FristEdition. Academic Press, INC, New York.
2. Alexopoulos, C. J. and Mims, C. W. 1993. Introductory Mycology - ThirdEdition. WileyEastern limited, New Delhi.
3. Bilgrami, K. S. and Verma, R. N. 1978. Physiology of Fungi – First Edition.Vikas Publishinghouse Pvt. Ltd., New Delhi.
4. Mehrotra, R. S. and Aneja, K. R. 1990. An introduction to Mycology –

FirstEdition. WileyEastern limited, New Delhi.
5. Webster, J. 1993. Introduction to Fungi – Cambridge University Press, Cambridge.
6. John Webster and Roland Weber . 2007. Introduction to Fungi.
CambridgeUniversity Press;3rd edition. New York.
7. Kevin Kavanagh . Fungi: Biology and Applications, 3rd Edition. Wiley-BlackwellMoney

Plant Pathology

1. Pandey, B.P. 1997. Plant pathology. S. chand & Company Ltd. NewDelhi.
2. Sambamurty, A.V.S.S. 2006. Text Book of Plant Pathology.
I.K.
International Pvt. Ltd. NewDelhi.

3. Paul, B. 2019. Plant Diseases and Biosecurity. Oxford University Press, Oxford.

(For Candidates admitted from the academic year 2022 onwards)

HOLY CROSS COLLEGE (AUTONOMOUS) TIRUCHIRAPPALLI – 2
PG AND RESEARCH DEPARTMENT OF BOTANY
CHOICE BASED CREDIT SYSTEM

M.Sc. BOTANY
First Year – Semester- I

Course Title	**MAJOR CORE 2- BRYOLOGY, PTERIDOLOGY & GYMNOSPERMOLOGY**
Total Hours	**90**
Hours/Week	**6 hrs /wk**
Code	**P22BO1MCT02**
Course Type	**Theory**
Credits	**5**
Marks	**100**

GENERAL OBJECTIVE

To enable the students to understand the classification, characters, life cycle patternsof Bryophytes, Pteridophytes and gymnosperms.

COURSE OBJECTIVES

The student will be able to

CO. No.	Course Objectives
CO-1	Understand, apply and analyse the classification, comparative study of gametophytes and sporophytes, spore dispersal mechanism of major classes of Bryophytes and their economic importance.
CO-2	Understand, apply and analyse the classification, gametophytes and sporophytesand life cycle patterns of major classes of Pteridophytes
CO-3	Understand and analyze the evolutionary significance of major classes of pteridophytes
CO-4	Remember, analyse and apply the evolutionary significance of major classes ofGymnospermology and their economic impotance
CO-5	Understand and analyse the morphology, reproduction and phylogeny of majorclasses & evolution of gametophytes in gymnosperms

UNIT – I Bryology : 18hrs

Classification of Bryophytes (Rothmaler, 1951). General & reproductive characters of major classes. Range of structural variation in the gametophytes. Methods of vegetative and sexual reproduction. Comparative study of gametophytes and sporophytes of major classes. Spore dispersal mechanisms and evolution of the sporophytes. Ecology andeconomic importance of Bryophytes.

Extra reading/Key words: *Medicinal bryophytes, bioindicators*

UNIT – II Pteridology:
18hrs

Classification of Pteridophytes (Reimers, 1975). General characters and life cycle patterns of major classes of pteridophytes (Psilophytopsida, Psilotopsida, Lycopsida, Sphenopsida andPteropsida).

Extra reading/Key words: *Biodiversity, Paleontology,carbon dating*

UNIT – III Pteridology:
18hrs

General characters and life cycle patterns of homosporous and heterosporous ferns. Evolutionary siginificance of gametophytes and sporophytes. Spore germination in Pteridophytes. Stelar evolution in pteridophytes. Soral evolution in Pteropsida. Heterospory and seed habit.

Extra reading/Key words: *Siphonogamy, fossil pteridophytes*

UNIT – IV Gymnospermology: 18hrs

Classification (K.R. Sporne, 1965). General structure & evolutionary significance of Pteridospermales, Cycadeoideales, Pentoxylales & Cordaitales. Economic importance of Gymnosperms.

Extra reading/Key words: *paleozoic ovules, Geological time scale.*

UNIT – V Gymnospermology: 18hrs

Comparative study of morphology, reproduction and phylogeny of Ginkgoales, Coniferales,Taxales & Gnetales. Evolution of male and female gametophytes.

Extra reading/Key words: *Zamia, Living fossils.*

Note: Texts given in the Extra reading /Key words must be tested only through Assignmentand Seminars.

COURSE OUTCOMES (CO)
The learners will be able to

CO No.	Course Outcomes	PSOs Addressed	Cognitive Level
CO-1	Outline the classification of Bryophytes and their economic importance	PSO 2	An
CO-2	Compare the gametophytes and sporophytes, spore dispersal mechanism of major classes of Bryophytes	PSO 2	U
CO-3	Compare gametophytes and sporophytes and life cycle patterns of major classes of Pteridophytes	PSO 2	U
CO-4	Relate the evolutionary significance of major classes of pteridophytes	PSO 4	U
CO-5	Describe the evolutionary significance of major classes of Gymnosperms.	PSO 4	R, U
CO-6	Explain the economic impotance of Gymnosperms	PSO 2	R,U
CO-7	Compare the morphology, reproduction and phylogeny of major classes of Gymnosprems	PSO 2	An,U
CO-8	Discuss the evolution of gametophytes in gymnosperms	PSO 4	R,U

Books for References:

Bryophytes

1. Cavers, F. 1964. The interrelationship of the Bryophyta.Dawsons of Pall Mall,London.
2. Prempuri. 1981. Bryophytes – a Broad perspective. Atma Ram and Sons, Delhi.
3. Rashid, A. 1998. An introduction to Bryophyta. Vikas Publishing house Pvt. Ltd.,New Delhi.
4. Watson, E. V. 1971. The structure and life of Bryophytes. Hutchinsonand Co. (Publishers)Ltd., London.
5. Vashista, B. R. 1994. Botany for degree students- Bryophyta. Chand& Co (Publishers)Ltd.New Delhi.

URL 1. https://biologydictionary.net/bryophyte/
URL2.https://www.cliffsnotes.com/study-guides/biology/plant-biology/bryophytes-the-non- vascular-plants/a-typical-bryophyte-life-cycle.

Pteridophytes

1. Bierhorst, D. W. 1971. Morphology of Vascular plants. TheMacmillan company,New York.
2. Bower, F. D. 1963. The Ferns – Vol I, II & III. Today and Tomorrow'sbook agency, NewDelhi.
3. Campbell, D. H. 1961. The evolution of land plants.Indian Universities Press,Allahabad.
4. Rashid, A. 1976. An introduction to Pteridophyta. Vikas Publishing House Pvt.Ltd., New Delhi.
5. Sporne, K. R. 1970. The morphology of Pteridophytes (The structure of ferns and alliedplants). Hutchinson and Co

(Publishers)Ltd., London.
URL -1 http://wgbis.ces.iisc.ernet.in/biodiversity/pubs/ces_tr/TR129/life_cycle.htm
URL -2 https://bio-eleven-information.weebly.com/pteridophytes-life-cycle.html

Gymnosperms

1. Coulter, J. M. and Chamberlain, C. J. 1971. Morphology ofGymnosperms. Central BookDept, Allahabad.
2. Datta, S. C. 1984. An introduction to Gymnosperms. Kalyani Publishers, NewDelhi.
3. Sahni, K. C. 1990. Gymnosperms of India & adjacent Countries. Shiva Offset Press,Dehra Dun.
4. Sporne, K. R. 1969. The Morphology of Gymnosperms. Hutchinson andCo. (Publishers) Ltd.,London.
5. Vashista, P. C., Sinha, A. K. and Anil kumar. 2018.. Botany for degreestudent- Gymnosperms.Chand & company Ltd Publishers). New Delhi.

URL – 1. https://biologywise.com/life-cycle-of-gymnosperms
URL -2. https://sciencing.com/life-cycle-gymnosperms-5456257.html

(For Candidates admitted from the academic year 2022 onwards)

HOLY CROSS COLLEGE (AUTONOMOUS) TIRUCHIRAPPALLI – 2
PG AND RESEARCH DEPARTMENT OF BOTANY
CHOICE BASED CREDIT SYSTEM

M.Sc. BOTANY
First Year – Semester- I

Course Title	**MC 3- PLANT EMBRYOLOGY, MORPHOGENESIS AND ANATOMY**
Total Hours	**75**
Hours/Week	**5 hrs /wk**
Code	**P22BO1MCT03**
Course Type	**Theory**
Credits	**4**
Marks	**100**

GENERAL OBJECTIVE

To enable the students to learn the theories and application of different fields like Plant embryology, Morphogenesis and Anatomy

COURSE OBJECTIVES

The learner will be able to

CO No.	Course Objectives
CO-1	Remember and understand the basic structure and functions of pollen grains
CO-2	Understand the various types of endosperm and embryos
CO-3	Understand, the basics of genesis of various tissues and the role of nucleus andcells in differentiation
CO-4	Remember and understand the basic organization of root, stem, xylem and phloem
CO-5	Understand and apply the structure and function of wood

UNIT – I Embryology: 15 hrs

Morphology and cytology of pollen. Pollen germination: Pollen mitosis – vegetative and generative cell formation. Pollination biology: Types, autogamy (homogamy and cliestogamy) and allogamy and their contrivances (dichogamy and herkogamy). Pollen - pistil interaction – role of pollen wall and stigmatic surface proteins ; structure and functions of style and stigma. Barriers to fertilization. Sexual incompatibility. Methods to overcome sexual incompatibility.

Extra reading/Key words:*Palynology, Deceptive pollinator*

UNIT – II: **Embryology: 15 hrs**

Endosperm types- cellular, nuclear, helobial and ruminate. Seed and fruit development. Parthenocarpy: Definition and types. Artificial induction and application. Polyembryony: Classification, types (true, false and adventive polyembryony) and causes. Experimental induction of polyembryony and its significance. Apomixis: vegetative reproduction. Agamospermy, apospory and diplospory, causes and significance.

Extra reading/Key words:*Apomeiosis, Stenospermocarpy*

UNIT – III: Morphogenesis: 15 hrs

Morphogenesis – Definition, scope and importance. Morphogenesis at cellular level: Nuclear transplantation experiment – example – *Acetabularia*. Asymmetric division and its significance. Differentiation, dedifferentiation and redifferentiation of vascular tissues *in vivo, in vitro* and in wounds. Morphogenetic factors – polarity and growth regulators, physical- tension, bending and swaying. Plant galls and their importance in morphogenesis.

Extra reading/Key words: *Modelling plant growth, architecture*

UNIT – IV Plant Anatomy: 15 hrs

Theories related to apical organization of shoot & root. Structural diversity and phylogenetic trends of specialization of xylem & phloem. Electron microscopic structure of xylem. Electronmicroscopic structure of phloem. Root – stem transition and seedling anatomy. Vascular andcork cambium: origin, structure, function & distribution. Role of Cambium in budding andgrafting.

Extra reading/Key words:*Periodicity, Phytophages*

UNIT –V Plant Anatomy: **15 hrs**

Structure of wood, sap wood – heart wood transition, properties of wood (physical, chemical & mechanical). Processing & seasoning of wood. Reaction wood – compression and tension wood. Dendrochronology and its significance. Commercial uses of woods and Principal and diagnostic features of woods of South India - Teak (*Tectona grandis*), Neem (*Azadirachta indica*), Indian Rose wood (*Dalbergia latifolia*)and Sal tree (*Shorea robust*a).

Extra reading/Key words: Ecological wood anatomy, Ergonomics.

Note: Texts given in the Extra reading /Key wordsmust be tested only through Assignmentand Seminars.

COURSE OUTCOMES (CO)

The Learner will be able to

CO No.	Course Outcomes	PSOs Addressed	Cognitive Level
CO-1	Explain the basic structure and functions of pollen grains	PSO 2	An
CO-2	What are the methods used to overcome sexualincompatibility	PSO 2	An
CO-3	Describe the various types of endosperm and embryo	PSO 2	An
CO-4	Discuss the basics of genesis of various tissues	PSO 4	U
CO-5	Explain the role of nucleus and cells in differentiation	PSO 4	R, U
CO-6	Explain the apical organization of root and stem	PSO 2	R,U
CO-7	Compare the basic organization of xylem and phloem	PSO 2	An,U
CO-8	Relate the structure and function of wood	PSO 2, PSO 4	R,U

PO – Programme Outcomes; CO – Course Outcome; R- Remember; U-Understand; Ap -Apply; An – Analyse; E- Evaluate; C – Create

Books for References:

Embryology

1. Maheswari, P. 1963. Recent Advances in the Embryology of Angiosperms.CatholicPress, Ranchi.
2. Shivanna, K. R. and Rangasamy, N.S. 1993. Pollen Biology – A laboratorymanual.Narosa Publishing House, New Delhi.
3. Varghese, T. M. An Introduction to experimental and applied embryology ofAngiosperms. Oxford and IBH Publishing Co., New Delhi.
4. Bhojwani, S.S. Bhatnagar, S.P. and Dantu, P.K. 2015. The Embryology ofAngiosperms (6th revised and enlarged edition). Vikas Publishing House, New Delhi.

Morphogenesis

1. Elizabeth G. Cutter. 1966. Trends in Plant Morphogenesis. Longmans, Greenand Co.Ltd. London.
2. Sinnott, E. W. 1960. Plant Morphogenesis. McGraw – Hill Book Company,INC.,New York.
3. Žárský, V. (Ed), Cvrčková, F. (Ed) (2014). Plant Cell Morphogenesis. Springer –protocols.

Anatomy

1. Elizabeth G. Cutter, 1979. Plant Anatomy. The English Language BookSociety,and Edward Arnold Publishers Ltd. London.
2. Katherine Esau, 1972. Plant Anatomy. Wiley Eastern Private Limited, NewDelhi.
3. Varghese, T. M. An Introduction to the Anatomy of Angiosperms. AlliedPublishers,
4. Richard Crang, Lyons, Shiels and Robert 2018. Plant Anatomy - A Concept-Based Approach to the Structure of Seed Plants, Springer.

5. Biondi, F. 2010. Tree-ring Analysis of Environmental Change: Principlesand Applications of Dendrochronology. Springer; 1 edition.
6. Richard Crang, Sheila Lyons-Sobaski, Robert Wise , 2018. Plant Anatomy: A Concept-Based Approach to the Structure of Seed Plants, Springer 1st edn, Kindle Edition.

(For Candidates admitted from the academic year 2022 onwards)

HOLY CROSS COLLEGE (AUTONOMOUS) TIRUCHIRAPPALLI – 2

PG AND RESEARCH DEPARTMENT OF BOTANY

CHOICE BASED CREDIT SYSTEM

M.Sc. BOTANY

First Year – Semester- I

Course Title	**MAJOR CORE 4- GENERAL MICROBIOLOGY**
Total Hours	**90**
Hours/Week	**6 hrs /wk**
Code	**P22BO1MCT04**
Course Type	**Theory**
Credits	**5**
Marks	**100**

GENERAL OBJECTIVE

To enable the students to learn the diversity of microorganisms, to understand their relationships with soil, water and air.

COURSE OBJECTIVES

The learner will be able to

CO. No.	Course Objectives
CO-1	Remember, understand and analyse the structure and multiplication methods of differenttypes of microorganisms.
CO-2	Understand and apply the knowledge on staining techniques and cultivation practices ofmicrobes
CO-3	Understand and analyse the interaction of soil microbes and their role in organic matterdecomposition
CO-4	Understand, analyse and evaluate the microbial diversity in drinking water, air and theiradverse effect in human health
CO-5	Remember and understand the testing of microbes in milk, dairy products and food borneinfections.

UNIT – I Introductory microbiology: 18hrs

Types of microorganisms – Outline classification of Bergey's manual of 9th edition. General structure and multiplication methods of bacteria (eubacteria & archaebacteria), actinomycetes, protozoa, spirochetes, rickettsias, chlamydias, mycoplasmas andviruses.

Extra reading/Key words:*Phylogeny of microbes*

UNIT – II **18 hrs**

Methods of studying bacteria: Staining techniques – simple, differential (Gram staining and acid – fast staining), special staining (negative, endospore staining and flagella staining). Cultivation of aerobic and anaerobic bacteria, growth and enumeration of bacteria. Cultivation of fungi. Cultivation of viruses – in embryonated egg and in plants.

Extra reading/Key words:*Fluorescent staining, metabolomics*

UNIT – III Soil Microbiology: **18hrs**

Microbiology of soil: Microbial flora of soil and factors affecting the microbial community in soil. Positive interaction of soil microbes – symbiosis; Negative interaction of soil microbes – Antagonism (Amensalism, competition and parasitism) & with higher plants (rhizosphere & phyllosphere). Microorganisms in organic matter decomposition.

Extra reading/Key words: *Environmental reclamation, vermicomposting*

UNIT – IV Microbiology of water and air: **18hrs**

Microorganisms in water quality. Assay for drinking water (coli form tests) &purification of potable water. Aeromicroflora – sources and types. Air borne microbial diseases (fungal-Aspergillosis, bacterial – Tuberculosis, viral – H1N1). Control of microorganisms in laboratories.

Extra reading/Key words:*Multistate Foodborne Outbreaks*

UNIT – V Microbiology of food & dairy products: **18hrs**

Microorganisms in foods – cooked foods, fruits & vegetables, meats. Food poisoning and food borne infection. Microbial examination of foods. Microorganisms in milk. Pasteurization methods. Test for the quality of milk. Microorganisms in the production of milk products (yogurt,butter & cheese). Industrial production of vinegar.

Extra reading/Key words: *Microbial proteins*

Note: Texts given in the Extra reading /Key words must be tested only throughAssignmentand Seminars.

COURSE OUTCOMES (CO)
The Learner will be able to

CO No.	Course Outcomes	PSOs Addressed	Cognitive Level
CO-1	Outline the structure of different types of microbes	PSO 1, 3	R
CO-2	Compare the multiplication methods of various microorganisms	PSO 3	U
CO-3	Illustrate the staining methods used for the identification of bacteria	PSO 1, 3	R, U
CO-4	Explain the interaction of soil microbes	PSO 1, 3	R, U
CO-5	Discuss the role of microbes in organic matter decomposition	PSO 1,3, 6	An, R
CO-6	Examine the adverse effect of air borne microbes in human health	PSO 1, 3	R
CO-7	List the microbes in food and dairy products.	PSO 1, 3	R, An
CO-8	Discuss the microbial diversity in milk and milk products	PSO 1, 3	R
CO-9	Explain food borne infections and industrial production of vinegar	PSO 1, 3	R, U
CO-10	Develop the Employability skills by learning the diversity of microorganisms and to understand their relationships with soil, water and air	PSO-1	C

Prescribed Text Books:

1. Michel J. Pelczar, Chan, E. C. S. and Noel R. Krieg. 2001. Microbiology concepts &applications. Mc Graw- Hill,Inc, New York.
2. Power, C. B. and Daginawala, H. F. 2010. General Microbiology,Himalaya PublishingHouse, New Delhi.
3. Prescott and Harley. 2004. Microbiology. Irwin Mc Graw – Hill / Bos.
4. Rangaswami, G. and Bagyaraj, D. J. 1993. Agricultural Microbiology. Prentice –Hall of India private Ltd,New Delhi.

(For Candidates admitted from the academic year 2022 onwards)
HOLY CROSS COLLEGE (AUTONOMOUS) TIRUCHIRAPPALLI – 2
PG AND RESEARCH DEPARTMENT OF BOTANY
CHOICE BASED CREDIT SYSTEM

M.Sc. BOTANY

First Year – Semester- I

Course Title	**MAJOR CORE 5 –PRACTICAL – I PLANT DIVERSITY, PLANT PATHOLOGY, PLANT EMBRYOLOGY, MORPHOGENESIS AND ANATOMY AND GENERAL MICROBIOLOGY**
Total Hours	**90**
Hours/Week	**6 hrs /wk**
Code	**P22BO1MCP05**
Course Type	**Practical**
Credits	**3**
Marks	**100**

GENERAL OBJECTIVE

To enable the students to understand, dissect out, identify and draw the structure of different algal and fungal forms and to identify and study thedifferent plant diseases.

COURSE OBJECTIVES

The learner will be able to

CO. No.	Course Objectives
CO-1	Understand, dissect out, identify and draw the structure of different algal forms
CO-2	Understand, dissect out, identify and draw the structure of different fungal forms andto identify and study the different plant diseases.
CO-3	Understand, dissect out, identify and draw the structure of different Bryophyte,pteridophyte and Gymnosperms forms including fossils.
CO-4	Understand the structure of wood and the effect of growth substances on pollengermination, tube growth and viability.
CO-5	Understand the growth pattern and cultivation techniques of bacteria & fungi and totest the quality of water and milk.

Unit I: Phycology: **18hrs**

Lyngbya, Chaetomorpha, Chara, Padina, Turbinaria, Ceramium, Amphiroa.

Unit II: Mycology: **18hrs**

Saprolegnia, Taphrina, Cercospora, Erysiphe, Phyllachora, Cyathus, Alternaria.

Phytopathology: Bacterial – blight of paddy; Fungal – Ergot of Cholam; Viral –bhendi yellow leaf banding.

Unit III: Bryology: **18hrs**

Targionia, Notothylas, Pogonatum.

Pteridology: *Lepidodendron* (stem genus), *Isoetes, Gleichenia* and *Salvinia.* **Gymnospermology :** *Lyginopteris, Laginostoma, Cordaites* (stem, leaves &ovule),*Araucaria* , *Podocarpus* and *Pinus*.

Unit IV: Plant Anatomy: **18hrs**

Structure of wood : T.S., R.L.S., & T.L.S. of *Azadirachta, Tectona* and *Mangifera*. Study of above wood materials using maceration technique. Use of micrometer in the measurement of wood elements (vessel and fibre). Observation of shoot apex (*Hydrilla*).

Embryology: Effect of growth substances on pollen germination and pollen tube growth (IAA), pollen viability test (Tetrazolium salt).

Unit V: General Microbiology: **18hrs**

Preparation of serial dilution, Cultivation and growth of Bacteria. Cultivation of Fungi. Simple and Gram staining. Methylene blue reductase test for testing milk quality. Test for water quality (Coliform test-MPN). Sensitivity of microorganisms to antibiotics. Isolation of *Rhizobium* from root nodules.

COURSE OUTCOMES (CO)

The Learners will be able to

CO No.	Course Outcomes	PSOs Addressed	Cognitive Level
CO-1	Examine, dissect out, identify, draw, and explain the structureof important algal forms	PSO 2	R, U, An
CO-2	Examine, dissect out, identify, draw, and explain the structureof important fungal forms	PSO 2	R, U, An
CO-3	Categorize, identify, draw and explain the plant disease.	PSO 2	R, U, An
CO-4	Examine, dissect out, identify, draw, and explain the structureof important Bryophytes and pteridophyptic forms	PSO2	R,U,An
CO-5	Examine, dissect out, identify, draw, and explain the structureof important Gymnosperm and fossils forms	PSO2	R,U,An

CO-6	Identify and draw the radial longitudinal and tangentiallongitudinal structure of wood	PSO 2	R,U
CO-7	Examine the effect of growth substances on pollen germination, tube growth and viability.	PSO 2	R,U
CO-8	Analyse the growth pattern of Bacteria and Fungi	PSO 2	R,U,An
CO-9	Examine water quality and milk quality	PSO 2	R,U
CO-10	Develop the practical skills by understand, dissect out, identify structure of different algal and fungal forms and to identify andstudy the different plant diseases	PSO-1	R, U

II	Major Core – 6	Genetics and Molecular Biology	P22BO2MCT06	7	6	100
	Major Core – 7	Plant Biotechnology	P22BO2MCT07	6	6	100
	Major Core – 8	Environmental science, Conservation of Resources and Remote Sensing	P22BO2MCT08	6	6	100
	Major Core – 9	Practical 2- Genetics and Molecular Biology, Plant Biotechnology, Environmental science and Remote Sensing	P22BO2MCP09	4	2	100
	Non Major	Plants and Human Welfare	P22BO2NMT01	5	3	100

	Elective 1					
		Ethics		1		
		Library Online course	P22EX2ONC01	1		
	Extra Credit	Internship/ Field Work/ Field Project 30 Hours- extra Credit	P22EX2INT02		2	100
		Total		30	25	600

II M.Sc., BOTANY (III & IV SEMESTER)

III	Major Core – 10	Angiosperm Systematics	**P15BO3MCT10**	6	6	100
	Major Core – 11	Research methodology	**P15BO3MCT11**	6	6	100
	Major Core – 12	Practical 3- Angiosperm Systematics and Research Methodology	**P15BO3MCP12**	6	3	100
	Major Elective – 1	Recombinant DNA Technology/Nanotechnology	**P15BO3MET01/ P15BO3MET04**	6	5	100
	Non Major Elective -2	Man and Microbes	**P15BO3NMT02**	5	3	100
		Library		1		
	Extra Credit	Internship/ Field Work/ Field Project 30 Hours- extra Credit	**P18SP3ECC03**		2	100
		Total		**30**	**23+2**	**600**

(For Candidates admitted from the academic year 2018 onwards)

HOLY CROSS COLLEGE (AUTONOMOUS) TIRUCHIRAPPALLI – 2

PG AND RESEARCH DEPARTMENT OF BOTANY

CHOICE BASED CREDIT SYSTEM

M.Sc. BOTANY

Second Year - Semester- III

Course Title	**MC 10- ANGIOSPERM SYSTEMATICS**
Total Hours	**90**
Hours/Week	**6Hrs/week**
Code	**P15BO3MCT10**
Course Type	**Theory**
Credits	**6**
Marks	**100**

GENERAL OBJECTIVE

To enable the students to learn the importance and types of classification of angiosperms and their characters and economic importance, herbarium technique, botanical nomenclature, modern trendsin taxonomy

COURSE OBJECTIVES

The learner will be able to

CO No.	Course Objectives
CO-1	Understand and analyse the types of classification, taxonomic literature and BSI
CO-2	Understand and remember the herbarium technique, botanical nomenclature and key preparation.
CO-3	Understand and remember the recent techniques in taxonomy.
CO-4	Uunderstand and analyse the poly and gamopetalae families.
CO-5	Remember and analyse the monochlamydea and monocot families.

UNIT-I Scope and importance of plant taxonomy. 18 hrs

Purpose of classification of plants. Types of classification- Artificial (Linnaeus), natural (Bentham and Hooker). and phylogenetic systems (Engler and Prantl). Current systems of classifications- Phylogenetic system (Takhtajan's system and Dahlgren's system) with meritsand demerits. Taxonomic literature: Manuals, Monographs & revisions - need, methodology and applications. BSI - History, organization, achievements and functions.

Extra reading /Key words: *Ethnotaxonomy, IUCN red data book*

UNIT – II Plant taxonomy **18 hrs**

Specimen preparation and Herbarium management and its functions. Major botanical gardens & herbaria of India and world.History of ICBN, ranks and nomenclature of taxa, typification, principles of priority and their limitations. Effective and valid publication. Citation of authors, retention, choice and rejection of names, nomina conservanda. Nomenclature terminologies, procedure for publication of species. Key preparation-types.

xtra reading /Key words: *Biodiversity Informatics, Hierarchical and inverse modeling strategies*

UNIT-III Modern trends in taxonomy: **18 hrs**

Anatomy, palynology, embryology, cytology, in relation to taxonomy, molecular taxonomy, chemotaxonomy, serotaxonomy, numerical taxonomy. Computerized systematics- use of computers in taxonomy (numeric and word processing), converting data-card systems, paper tape system, scanning & sensing system, online system. Documented characters of plants in computers.

Extra reading /Key words: *Semantics, DELTA, DAISY, bar coding*

UNIT – IV Polypetalae & Gamopetalae: **18 hrs**

Study of the following families of flowering plants with reference to their vegetative, floral characters & economic importance

Polypetalae:- Nymphaeaceae, Menispermaceae, Portulacaceae, Rosaceae, Vitaceae, Meliaceae, Myrtaceae, Sapindaceae.

Gamopetalae:- Sapotaceae, Apocynaceae, Boraginaceae, Convolvulaceae, Scrophulariaceae, Bignoniaceae, Pedaliaceae, Verbenaceae.

Extra reading /Key words: *Rare medicinal plants in Gamopetalae and Polypetalae*

UNIT – V Monochlamydeae & Monocotyledons **18 hrs**

Study of the following families of flowering plants with reference to their vegetative, floralcharacters & economic importance:

Monochlamydeae:- Nyctaginaceae, Chenopodiaceae, Aristolochiaceae, Piperaceae,Polygonaceae, Loranthaceae,Amaranthaceae.

Monocotyledons:- Amaryllidaceae, Hydrocharitaceae, Typhaceae, Palmae, Cyperaceae.

Extra reading /Key words: *Rare medicinal plants in Monochlamydeae, endangered speciesinmonocot plants.*

Note: Texts given in the Extra reading /Key words must be tested only through Assignmentand Seminars.

COURSE OUTCOMES (CO)

The Learner will be able to

CO No.	Course Outcomes	PSOs Addressed	Cognitive Level
CO-1	Distinguish the types of classification	PSO 2, PSO 5	An
CO-2	Describe the taxonomic literature and BSI	PSO 3, PSO 5	R
CO-3	Explain the herbarium technique, botanical nomenclature and key preparation	PSO 2, PSO 5	R, An
CO-4	Describe the recent techniques in taxonomy	PSO 2, PSO 5	R,U
CO-5	Illustrate and compare the floral characters of Polypetalae	PSO 3, PSO 4	R, U
CO-6	Explain the taxonomical characters of gamopetalae families	PSO 2, PSO 5	R,U
CO-7	Identify and Differentiate the characters ofmonochlamydeae	PSO 3, PSO 4	R, U, An
CO-8	Explain the characters of monocot families	PSO 2, PSO 4	R, An
CO-9	Enumerate the economic importance of Angiosperms	PSO 1, PSO 3	U

PO – Programme Outcomes; CO – Course Outcome; R- Remember; Understand;Ap –Apply; An – Analyse; E- Evaluate; C – Create

Prescribed Text Books:

1. Sharma, O.P. 2017. Plant Taxonomy. 2nd edition. Tata Mc Graw Hill EducationPrivateLimited. New Delhi.
2. Pandey, S.N. & S.P. Misra. 2008. Taxonomy of Angiosperms. .Ane Books India, NewDelhi,Chennai, Mumbai.
3. Rendle, A. B. 1979. Classification of flowering plants (Vol I & II). Vikas PublishingHouse Pvt Ltd, Ghaziabad.
4. Lawrence, G. H. M. 1967. Taxonomy of vascular plants. Oxford and IBH PublishingCo. Pvt. Ltd, New Delhi.

Books for References:

1. Henry and Chandrabose. 1980. Botanical nomenclature. Today and Tomarrow printersand Publishers, New Delhi.
2. Heywood, V. H. 1968. Modern methods in plant taxonomy. Academic press, London.
3. Davis, P. H. and Heywood, V. H. 1973. Principles of angiosperm taxonomy.Robert E.Erieger Publishing Company, New York.
4. Heywood, V. K. and Moore, D. M. 1984. Current concepts in plant taxonomy. Academic Press, London.
5. Grant, W. F. 1984. Plant biosystematics. Academic Press, London.
6. Jeffrey, C. 1989. Botanical nomenclature. Edward Arnold, London.
7. Jeffrey, C. 1982. Introduction to plant taxonomy. Cambridge University Press,London.
8. Nashiq, A. R. 1993. An introduction to botanical nomenclature. Scientific

Publishers.Jodhpur.
9. Clive A. Stace. 1980. Biosystematics. Edward Arnold. A division of HodderandStoughton, London Melbourne, Auckland.

(For Candidates admitted from the academic year 2018 onwards)

HOLY CROSS COLLEGE (AUTONOMOUS) TIRUCHIRAPPALLI – 2

PG AND RESEARCH DEPARTMENT OF BOTANY

CHOICE BASED CREDIT SYSTEM

M.Sc. BOTANY

Second Year - Semester- III

Course Title	**MAJOR CORE 11- RESEARCH METHODOLOGY**
Total Hours	**90**
Hours/Week	**6 hrs /wk**
Code	**P15BO3MCT11**
Course Type	**Theory**
Credits	**6**
Marks	**100**

GENERAL OBJECTIVE

To enable the students to learn the application of various instruments and their function with the principle applied in research field. To enable the students to evaluate and consolidate their project work into thesis and manuscript.

COURSE OBJECTIVES

The learner will be able to

CO. No.	Course Objectives
CO-1	Remember, understand and evaluate the application of different types of microscope and the techniques of histochemistry
CO-2	Understand and apply the preparation of material for light & electron microscopy
CO-3	Understand and apply the basic principle of physical instruments
CO-4	Apply and analyse the basic principle and functions of instruments used in separation of bioactive compounds
CO-5	Remember, understand and apply the methodologies adopted to consolidate the research findings into thesis and manuscript

UNIT – I Microscopy & Histochemistry: 18 hrs Construction, working principles of Bright Field, Phase Contrast, Fluorescent, Electron (TEM,SEM & STEM) and Confocal microscopy. Micrometry. Histochemistry of starch, total proteins,lipids, DNA & RNA.

Extra Reading /Key Words*: Antioxidant, Apoptosis, structure of Nanopartilces*

UNIT - II Preparation of material for light & electron microscopy: 18 hrs

Killing and Fixing. Types of fixatives for light microscopy. Processing of materials

(dehydration,clearing, infiltration & embedding). Principles of staining, double staining and mounting ofmaterials for hand sections. Microtomy, types (Rotary & Ultra microtome) and theirapplications. Preparation of material for TEM & SEM.
Extra Reading/Key Words: *Staining, processing of DNA samples*

UNIT –III Instrumentation for qualitative and quantitative analysis of biomolecules: 18 Hrs Principle, components and applications of pH meters and preparation of buffers. Colorimeter &Spectrophotometer – principle, laws of absorption of light- uses. Principles of biophysical methods used for the analysis of biopolymer structure- X ray, ORD (optical rotary dispersion) /CD (Circular dichroism), NMR (nuclear magnetic resonance) & ESR (electron

spin resonance)spectroscopy. Centrifugation-Principle and types.
Extra Reading /Key Words: *Applications of UV-Vis Spectroscopy , FT-IR.*

UNIT- IV Separation and Tracer Techniques: 18 hrs
Principles and uses of Chromatography with reference to Ion exchange, Gas & High Performance Liquid Chromatography. Principles &uses of Atomic Absorption Spectroscopy. Electrophoresis – principles, types – paper & gel electrophoresis (SDS-PAGE, 2D-PAGE), operation and their applications.
Radioisotopes—nature of radioactivity- type ofradiations. Tracer technique, detection and measurement of radioactivity using GM counters &Scintillation counters. Autoradiography & its applications inbiology.
Extra Reading/Key Words: *Applications of GC-MS.*

UNIT-V Research manuscript writing: 18 hrs
Problem selection-preliminary survey of literature for the topic selected-project design-experimental plan for given duration. Structure, components and compilation of project report,Plagiarism and Software, Manuscript for publication and proof correction, Indexed Journalsin Life Sciences – scopus, web of sciences, UGC care list. Impact factor of Journals, Ethical issues related to publishing papers.

Extra Reading / Key Words*:* *i10 index, H index*

Note: Texts given in the Extra reading /Key words must be tested only throughAssignmentand Seminars.

COURSE OUTCOMES (CO)

The Learner will be able to

CO No.	Course Outcomes	PSOs Addressed	Cognitive Level
CO-1	Outline the construction and application of different types of microscope	PSO 2, PSO 5	An
CO-2	Explain the techniques of histochemistry	PSO 2, PSO 5	An
CO-3	Explain the preparation of material for light and electron microscopy	PSO 2, PSO 5	An
CO-4	Explain the principle and construction of the instruments used for the qualitative and quantitative of biopolymers	PSO 4, PSO 5	U

CO-5	Identify the applications of the various instruments used for the qualitative and quantitative of biopolymers	PSO 4, PSO 5	R, U
CO-6	Compare and contrast the different types of chromatographic and electrophoretic techniques mentioned in the syllabus	PSO 2, PSO 5	R,U
CO-7	Develops the techniques used to trace and quantify the Radioisotopes	PSO 2	An, U
CO-8	Discuss the methodologies adopted to consolidate the research findings into thesis and manuscript	PSO 2, PSO 4	C
CO-9	Develop the Employability skills by learning the application of various instruments and their function with the principle applied in research field.	PSO-1	C

Prescribed Text books

1. Baidyanath Mishra, 2018. Research Methodology, Chaukhambha Orientalia publication
2. Gurumani, N. 2011 Research Methodology : For Biological Sciences**,** MJP Publisher
3. Avinash Updhayay, Kakoli Updhayay and Nirmalendu Nath. 1998. Biophysicalchemistry –Principles and techniques. Himalaya Publishing House, Mumbai.
4. Dr.N.Arumugam, 2015. Research Methodology for Life Sciences.Sara's Publication.

Books for References

1. Shirish C. and Ashok T. 2009. An introduction to Research. Cambridge UniversityPress, India Pvt. Ltd. New Delhi.
2. Wilson K. & Walker J. 1994. Practical biochemistry. 4th edition, CambridgeUniversity,London.
3. Berlyn & Mische, 1976. Botanical microtechnique & cytochemistry. Iowa StateUniversity Press.
4. Gahan P.B.1984. Plant histochemistry & cytochemistry – An introduction.AcademicPress, London.
5. Krishnamurthy, K.V. 1988. Methods in Plant Histochemistry.ViswanathanPublishers,Madras.
6. Van Norman R.W. 1971. Experimental biology. Iind Edition, Prentice Hall, Inc.,New Jersey.
7. Saravanavel P. 1985 Research report writing. Emerald Publishers, Madras.

(For Candidates admitted from the academic year 2018 onwards)

HOLY CROSS COLLEGE (AUTONOMOUS) TIRUCHIRAPPALLI – 2

PG AND RESEARCH DEPARTMENT OF BOTANY
CHOICE BASED CREDIT SYSTEM

M.Sc. BOTANY
Second Year – Semester- III

Course Title	MAJOR CORE-12 PRACTICAL 3 ANGIOSPERM SYSTEMATICS AND RESEARCH METHODOLOGY
Total Hours	90
Hours/Week	6Hrs/Wk
Code	P15BO3MCP12
Course Type	Practical
Credits	3
Marks	100

GENERAL OBJECTIVE

To enable the students to identify the Angiospermic plants, prepare dichotomous key,preparepermanent slides, prepare standard graph and preparation of buffers.

COURSE OBJECTIVES
The learner will be able to

CO. No.	Course Objectives
CO-1	Understand to prepare dichotomous key, rules of nomenclature and method of preparation of herbaria
CO-2	Understand the characters and Identify local specimens of Gamopetalae**,** Polypetalae mentioned in the syllabus
CO-3	Identify local specimens of Monocotyledons and Monochlamydeae mentioned in thesyllabus
CO-4	Understand and apply the method of hand and microtome sectioning andstaining
CO-5	Understand and apply the procedure for histochemical test, buffer preparation and standard graph

UNIT -1 **18hrs**

Preparation of dichotomous keys.
Exercise in the important articles of the code.
Submission of 10 herbarium specimens (local) Field trips to identify the specimens.

UNIT - II **18hrs**

Identification of local specimens

Study of the families and technical descriptions of plant specimens included in the syllabus suchas Polypetalae:- Nymphaeaceae, Menispermaceae, Portulacaceae, Rosaceae, Vitaceae, Meliaceae, Myrtaceae, Sapindaceae.

Gamopetalae:- Sapotaceae, Apocynaceae, Boraginaceae, Convolvulaceae, Scrophulariaceae, Bignoniaceae, Pedaliaceae, Verbenaceae.

UNIT - III **18hrs**

Identification of local specimens

Study of the families and technical descriptions of plant specimens included in the syllabus suchas Monochlamydeae:- Nyctaginaceae, Chenopodiaceae, Aristolochiaceae, Piperaceae, Polygonaceae, Loranthaceae, Amaranthaceae.

Monocotyledons:- Amaryllidaceae, Typhaceae, Palmae, Cyperaceae.

UNIT - IV **18hrs**

Preparation of whole mounts. Preparation of permanent slide for hand sections using double stains.Paraffin block preparation for microtomy. Taking sections with rotary microtome & affixing ribbons.

UNIT - V **18hrs**

Histochemical tests for polysaccharides, protein, lipids & minerals.Preparation of buffers & pH measurement. Preparation of standard graphs.

PAGE – SDS for proteins (demonstration).

COURSE OUTCOMES (CO)

The Learner will be able to

CO No.	Course Outcomes	PSOs Addressed	Cognitive Level
CO-1	Analyse the characters of plants and prepare dichotomous key	PSO2,	R, U,An
CO-2	Analyse the rules of nomenclature	PSO2,	R,U,An
CO-3	Understand, analyze, Identify and describe the locally available specimens of Gamopetalae and Polypetalae	PSO2,	R,U,An
CO-4	Understand, analyze, Identify and describe local specimens of Monocotyledons and Monochlamydeae mentioned in the syllabus	PSO2,	R,U,An
CO-5	Understand and apply the method of hand and microtome sectioning and staining	PSO5	R,U, An
CO-6	Understand and apply the procedure for histochemical test, buffer preparation and standard graph	PSO5	R, U, An
CO-7	Develop the practical skills by identify the Angiospermic plants, prepare dichotomous key, prepare permanent slides, prepare standard graph and preparation of buffers	PSO-1	R.U

(For Candidates admitted from the academic year 2018 onwards)

HOLY CROSS COLLEGE (AUTONOMOUS) TIRUCHIRAPPALLI – 2
PG AND RESEARCH DEPARTMENT OF BOTANY
CHOICE BASED CREDIT SYSTEM

M.Sc. BOTANY
Second Year – Semester- III

Course Title	ME 1- RECOMBINANT DNA TECHNOLOGY
Total Hours	90
Hours/Week	6Hrs/Wk
Code	P15BO3MET01
Course Type	Theory
Credits	5
Marks	100

GENERAL OBJECTIVE

To enable the students to learn the basic principles and recent techniques of genetic engineering, DNA amplification, Pharmaceutical products of DNA and DNA in disease diagnosis and medicalforensics.

COURSE OBJECTIVES
The learner will be able to

CO. No.	Course Objectives
CO-1	understand, analyze the role of molecular tools and cloning vectors in genetic engineering.
CO-2	understand, apply and analyze the techniques of genetic engineering.
CO-3	understand and apply the tools and techniques adopted in amplification ofDNA
CO-4	remember and apply the pharmaceutical products of DNA
CO-5	analyze the disease by DNA assay

UNIT-I Introduction, history, scope and principles of genetic engineering.

18hr
s Molecular tools for genetic engineering: restriction nucleases, DNA ligases, linkers and adaptors,reverse transcriptase, alkaline phosphatases and DNA polymerase. Cloning vectors: plasmids(natural – Ti & Ri plasmids and constructed plasmids – pUC) characteristics, nomenclature anduses. Phage vectors (phage λ and M13 vectors), cosmid and shuttle vectors and yeast vectors.Construction of rDNA and applications of rDNA technology.

Extra reading /Key words: *Neurosciences*

UNIT – II Techniques in genetic engineering : 18 hrs

Agarose gel electrophoresis, PFGE and PAGE and its uses. Isolation and purification of DNA (cellular and plasmid DNA). Blotting techniques – Southern, Northern, Western, colony and plaque hybridization. DNA sequencing - Maxam & Gilbert, Sanger's and automated gene sequencing methods. DNA chips (micro arrays).

Extra reading /Key words: *Stem cell culture, Fluorescence-Activated Cell Sorting*

UNIT - III DNA amplification: 18 hrs

PCR – principle, types, techniques and its application. RFLP and RAPD. Cloning in prokaryotes and in higher organisms through Agrobacterium mediated gene transfer. Screening strategies: screening by DNA hybridization, DNA probes, immunological and protein assay.Gene libraries: construction and screening of genomic libraries, cDNA libraries and chromosome jumping libraries.

Extra reading /Key words: *Loop mediated isothermal amplification (LAMP), nucleic acidsequence based amplification (NASBA)*

UNIT - IVPharmaceutical products of DNA: 18 hrs

Production of recombinant insulin and human growth hormones. Recombinant vaccines and DNAvaccines (Herpes simplex virus, BCG and meningitis). Hybridoma technology: principles,productions, advantages and applications of monoclonal antibodies. Gene therapy methods &applications. Antisense RNA technology: principles, methods and applications.

Extra reading /Key words: *Therapeutic enzymes, immuno modulators.*

UNIT - V DNA in disease diagnosis and medical forensics: 18 hrs

Methods of DNA assay and its diagnosis in infectious diseases (Tuberculosis, AIDs and malaria),genetic diseases (cancer, diabetes and obesity). DNA finger printing: techniques andits applications. Human Genome project: approach, mile stones, achievements, applications and ethical issues.

Extra reading /Key words: *West Nile Virus, forensic dentistry.*

Note: Texts given in the Extra reading /Key words must be tested only through Assignmentand Seminars.

COURSE OUTCOMES (CO)

The Learner will be able to

CO No.	Course Outcomes	PSOs Addressed	Cognitive Level
CO-1	Explain the role of molecular tools and cloning vectors in genetic engineering.	PSO1, PSO3	R, U
CO-2	Describe the techniques of genetic engineering.	PSO4, PSO3	U
CO-3	Discuss the different types of blottingtechniques	PSO1, PSO3	U
CO-4	Explain the tools and techniques adopted in amplification of DNA	PSO1, PSO5	U
CO-5	Relate the different kinds of screening strategies	PSO1, PSO5	R,U

CO-6	Describe the pharmaceutical products of DNA	PSO1, PSO5	R, U
CO-6	Explain gene therapy methods and its application	PSO1, PSO3	R, U
CO-6	Analyze the disease by DNA assay	PSO1, PSO5	R, U, An
CO-7	Develop the Employability skills by learning the basic principles and recent techniques of genetic engineering, DNA amplification, Pharmaceutical products of DNA and DNA in disease diagnosis and medical forensics	PSO-1	C

Prescribed Text books

1. Dubey, R. C. 2001. A Text Book of Biotechnology. S. Chand and Co, New Delhi.
2. Shikha Jain, 2011.Text book of rDNA technology. Kalyani Publishers, NewDelhi.
3. Satyanarayana U. 2015. Biotechnology. Books and Allied (P) Ltd. Kolkata.
4. Keya Chaudhuri. 2013. Recombinant DNA Technology. The Energy andResources Institute (TERI) Publishers.
5. Monika Jain, 2012. Recombinant DNA Techniques: A Textbook Alpha Science InternationalPublishers.

Books for References

1. Gupta, P. K. 1999. Elements of Biotechnology – First Edition. RastogiPublication,Meerut.

2. Ignacimuthu, S. 1996. Applied Plant Biotechnology. Tata Mc Graw – HillPublishing Company Ltd., New Delhi.

3. Kumar, H. D. 1993. Molecular Biology and Biotechnology. Vikas PublishingHouse Pvt. Ltd,New Delhi.

4. John E. Smith. 1996. Biotechnology. Cambridge University Press, UnitedKingdom.

5. Sandhya Mitra. 1996. Genetic Engineering. MacMillan India Ltd., New Delhi.

6. Old, R. N. and Primrose, S. B. 1994. Principle of gene manipulation.Blackwell ScientificPublications.

7. Joshi, P. 2001. Genetic Engineering and its application. Student Edition, Jodhpur.

8. David P. Clark and Nanette Pazdernik, 2010. Academic Cell, 1st Edition,Cambridge.

(For Candidates admitted from the academic year 2018 onwards)

HOLY CROSS COLLEGE (AUTONOMOUS) TIRUCHIRAPPALLI – 2

PG AND RESEARCH DEPARTMENT OF BOTANY

CHOICE BASED CREDIT SYSTEM

M.Sc. BOTANY

Second Year – Semester- III

ourse Title	**NME 2 – MAN AND MICROBES**
Total Hours	**75**
Hours/Week	**5Hrs/Wk**
Code	**P15BO3NMT02**
Course Type	**Theory**
Credits	**3**
Marks	**100**

GENERAL OBJECTIVE

To enable the students to learn and understand the basics of microbiology and uses ofmicrobes (beneficial and detrimental).

COURSE OBJECTIVES

The learner will be able to

O. No.	Course Objectives
CO-1	understand the fundamental of microbes and their role in food processing
CO-2	understand, apply the role of microbes in agriculture
CO-3	understand and analyze the role of microbes in environment and the techniques adopted in treating waste solid and liquid
CO-4	understand and analyse the role of microbes in industry
CO-5	understand and analyse the major disease of human caused by microbes

UNIT – I Microbiology – Introduction and Food Microbiology: 15 hrs

Definition. Scope and History (Anton van Leeuwenhock, Edward Jenner, Louis Pasteur, RobertKoch and Alexander Fleming). Types of microorganisms. Role of microbes in food processing –milk and milk products (curd, butter & cheese), idli, bread & pickle.Food spoilage – foodpoisoning. Food preservation methods – physical (temperature & radiation) chemical (Potassiummeta bisulphate, Sodium benzoate).

Extra reading/Key words: *Food adulteration, Food Laws & Standards*

UNIT II Role of microbes in agriculture: 15 hrs

Enrichment of soil fertility and stability through microorganisms – use of biofertilizers – algal (*Nostoc*) bacterial (*Azospirillum*), Fungal- (*Mycorrhiza*). Use of biopesticides in the control of microbialplant diseases (*Trichoderma*– Sheath blight of paddy, *Pseudomonas fluorescens*– Citrus canker).

Extra reading/Key words: *Natural growth hormone, Vermi compost*

UNIT III Role of microbes in environment: **15 hrs**

Treatment of waste water; solid waste management and Microbial degradation of xenobiotics. Production of organic compost from plant and animal waste and its uses.Biogas production from animal waste. Use of microbes in septic tank. Microbial biodecomposition of cellulose (coconut fibre & paddy straw).

Extra reading/Key words: *Spirulina, organic manure*

UNIT IV Role of microbes in industry: **15 hrs**

Bioreactors, stock cultures of microorganisms, large scale production of ethanol, vinegar (acetic acid), antibiotic (penicillin), production of vitamin B2 and vaccines.

Extra reading/Key words: *Effect of Hydrocarbon, Streptomycin production*

UNIT V Role of microbes in human health: **15 hrs**

Microflora of intestine and stomach - Beneficial - probiotics (*Lactobacillus, Bifidobacterium, bacillus* & *Saccharomyces*), Harmful (*E.coli* & *Proteus*). Role of microbes in disease development – causes, symptoms andcontrol measures of Bacterial disease (typhoid, tuberculosis) viral disease (measles, jaundice) andprotozoan disease (amoebiosis, malaria).

Extra reading/Key words: *Dengue, Swine flu*

Note: Texts given in the Extra reading /Key words must be tested only through Assignmentand Seminars.

COURSE OUTCOMES (CO)

The Learner will be able to

CO No.	Course Outcomes	PSOs Addressed	Cognitive Level
CO-1	Explain the basic inventory of microbes and their role in food processing	PSO1, PSO3	R, U
CO-2	Analyse the role of microbes in agriculture	PSO1, PSO3	R,U
CO-3	Explain the role of microbes in environment and the techniques adopted in treating waste solid and liquid	PSO1, PSO3	R,U

CO-4	Analyse the role of microbes in industry	PSO1, PSO3	R,U
CO-5	Explain the major disease of human caused by microbes	PSO1, PSO3	R,U
CO-6	Summarize the role of beneficial microbes in human health	PSO1, PSO3	R, U, An
CO-7	Develop the Employability skills by understanding the basics of microbiology and uses of microbes (beneficial and detrimental)	PSO-1	C

Prescribed Text books

1. Ajar Nath Yadav, Jay Shankar Singh, 2020. Microbes in Agriculture and Environment Development, CRC Press
2. Reddy, S.M. 2017. Basic Fermentation Technology. New Age International Publishers.
3. R. G. Buckley, 2016. Environmental Microbiology, CBS Publishers and Distributors.

Books for References:

1. Ian L. Pepper, Charles P. Gerba, Terry J. Gentry, 2015. Environmental Microbiology,3rd edition, New York.
2. Michel J. Pelczar, Chan, E. C. S. and Noel R. Krieg. 1993. Microbiology concepts &applications. Mc Graw- Hill, Inc, New York.
3. Rangaswami, G. and Bagyaraj, D. J. 1993. Agricultural Microbiology. Prentice –Hall ofIndia private Ltd, New Delhi.
4. Power, C. B. And Daginawala, H. F. 1993. General Microbiology Vol I & II.HimalayaPublishing House, New Delhi.
4. Tauro, P., Kapoor, K. K. and Yadav, K. S. 1997. An introduction to microbiology.Wiley Eastern Company Ltd., New Delhi.

For Candidates admitted from the academic year 2015 onwards)

HOLY CROSS COLLEGE (AUTONOMOUS) TIRUCHIRAPPALLI – 2

IV	Major Core – 13	Plant Physiology, Biochemistry and Biophysics	P15BO4MCT13	7	6	100
	Major Core – 14	Practical 4- Plant Physiology, Biochemistry and Biophysics	P15BO4MCP14	4	3	100
	Major Core – 15	Project	P15BO4DIS01	6	3	100
	Major Elective -2	Biometrics and Bioinformatics/Genomics and Proteomics	P15BO4MET02/ P15BO4MET05	6	5	100
	Major Elective 3	Clinical Microbiology and Basics of Immunology/Plant diseases and Pest Management	P15BO4MET03/ P15BO4MET06	6	5	100

		Library		1		
	Extra credit self-study paper	Nursery Maintenance & Home Gardening	P18B04SST01		2	100
	Extra Credit	Internship/ Field Work/ Field Project 30 Hours- extra Credit	P18SP4ECC04		2	100
		Total		30	26	700

List of Non-Major Elective Courses

Offered by the Department of Botany to Other Students PG

Sem	Course	Title of the course	Code	Hrs/ Week	Credits	Marks
II	Non Major elective 1	1. Plants and Human Welfare	P15BO2NMT01	5	3	100
III	Non Major elective 2	2. Man and Microbes	P15BO3NMT02	5	3	100

*Online Course is mandatory either in the 1st or 2nd Semester with a transfer of credits.

PG AND RESEARCH DEPARTMENT OF BOTANY

CHOICE BASED CREDIT SYSTEM

M.Sc. BOTANY WITH SPECIALISATION IN PLANT BIOTECHNOLOGY

Second Year – Semester- IV

Course Title	MC 13 PLANT PHYSIOLOGY, BIOCHEMISTRY AND BIOPHYSICS
Total Hours	105
Hours/Week	7 hrs /wk
Code	P15BO4MCT13
Course Type	Theory
Credits	6

Marks	100

GENERAL OBJECTIVE

To enable the students to understand the water relations and types of photosynthesis of plants, mechanism of nitrogen metabolism, phytochrome acitivity, stress physiology, Chemistry of biomolecules, aminoacids, enzyme kinetics and photobiology of plants.

COURSE OBJECTIVES

The learner will be able to

CO. No.	Course Objectives
CO-1	Remember, understand and analyze the mechanism of photosynthesis and Respiration
CO-2	Understand and apply the Molecular mechanisms of biological nitrogen fixation, Phytochrome and stress physiology of plants
CO-3	Describe, illustrate and classify the biomolecules of plants.
CO-4	Summarize, classify and demonstrate amino acids, enzymes and enzyme kinetics
CO-5	Understand and analyse the energy transfer processes in plants through energy rich molecules

UNIT – I Plant physiology: 21 hrs

Water relation: Chemical potential, water potential and osmotic potential. Soil Plant Atmosphere Continuum (SPAC). Uptake, transport & translocation of water & minerals. Chelating agents. Importance of foliar nutrition. Photosynthesis: Electron flow through cyclic & non-cyclic photophosphorylation, C3& C4 cycles, types of C4 cycle. Difference between C3 and C4 cycles. CAM pathway & its adaptive advantages. Respiration: Glycolysis & Kreb's cycle. Plant

mitochondrial electron transport & ATP synthesis. Photorespiratory pathway and intermediatory metabolism.

Extra reading/ key words: CO_2 concentrating mechanism and Pseudophosphorylation

UNIT – II Plant physiology: 21 hrs

Nitrogen cycle, Molecular mechanism of biological nitrogen fixation, assimilation of nitrates: reduction phase, NR, NIR. Synthesis of amino acids: Incorporation phase, GS – GOGAT system. Phytochrome and its role in flowering. Stress physiology – response of plants to biotic (pathogen & insects) & abiotic (water, temperature & salt) stresses; mechanism of resistance to biotic stress & tolerance to abiotic stress.

Extra reading/ key words :Nif genes, hup genes, cryptochromes, stress signaling

UNIT – III Biochemistry: 21 hrs

Chemistry of biological molecules – Carbohydrates – Classification,Structure and Properties of monosaccharides, di, oligo and polysaccharides (starch, cellulose, hemicelllulose and pectin). Lipids : Biosynthesis of lipids. Alpha and Beta oxidations. Classification, occurrence, properties, structure of lipids & importance. Acyl lipids and phospholipids. Occurrence and properties of secondary metabolites, such as alkaloids, flavonoids, lignins, porphyrins, terpenes, suberins and vitamins.

Extra reading key words : Arabinogalactans, glucomannans, chemical bonds

UNIT – IV Biochemistry: 21 hrs

Amino acids: Classification and general properties- Optical activity, stereoisomers and amphoteric properties. Non – protein aminoacids and their functions. Proteins: Classification, structure and biological importance. Enzymes: Classification, enzyme as biocatalyst, mode of action, enzyme specificity, and active centers. Isozymes & ribozymes– occurrence & functions. Enzyme Kinetics - Effects of temperature, pH, inhibitors, end products, concentration of enzyme on reaction rate, concentration of substrate on enzyme action. Michaelis – Menton constant, Vmax, significance of Km, Line – Weaver Burk plot. Allosteric enzymes or feedback inhibition.

Extra reading /key words: Protein isoform, RACK protein, tau protein, Keratinases

UNIT – V Biophysics: 21 hrs

Photobiology- dual nature of light, Electromagnetic spectrum, absorption spectrum and photosynthesis. Energy states – singlet and triplet states-excitation and de-excitation and light emissions (Fluorescence, Phosphorescence and Bioluminescence), Laws of Thermodynamics (First and Second) – Entropy in Biological systems, Redox potential- Redox couples – ATP as high-energy compound.

Extra reading/ key words: Mitochondrial Bioenergetics, Chloroplast Bioenergetics and Efficiency of Photosynthesis

Note: Texts given in the Extra reading /Key words must be tested only through Assignment and Seminars

COURSE OUTCOMES (CO)

The Learner will be able to

CO No.	Course Outcomes	PSOs Addressed	Cognitive Level
CO-1	Compare the different cycles and pathways of Photosynthesis and Respiration	PSO2, PSO5	R, U
CO-2	Explain the Molecular mechanisms of biological nitrogen fixation	PSO2, PSO5	R,U
CO-3	Discuss the importance of Phytochrome and stress physiology of plants	PSO2, PSO5	R,U
CO-4	Describe and classify the biomolecules of plants.	PSO2, PSO6	R,U, An
CO-5	Explain the structure of amino acids, enzymes and enzyme kinetics	PSO2, PSO6	R, U
CO-6	Explain the energy transfer processes and energy rich molecules in Biological system	PSO2, PSO6	R, U, An
CO-7	Develop the Employability skills by understanding the water relations and types of photosynthesis and nitrogen metabolism of plants and photobiology of plants	PSO-1	C

Prescribed Text Books

Physiology

1. Devlin, R. M. 2017. Outline of Plant Physiology. CBS publishers and Distributors, New Delhi.
2. Salisbury, C. B. and Ross, C. W. 2006. Plant Physiology. CBS Publishers and Distributors, New Delhi.

Biochemistry & Biophysics

1. Murray, R. K., Granner, D. K., Mayes, P. A. and Rod Well, V. W. 1993. Harper's Biochemistrey. Prentice – Hall of International limited, London.
2. Eric E. Cohn and Stumpf. 1976. Outlines of Biochemistry. Wiley eastern limited, New Delhi.
3. Satyanarayana, U. 2003. Biochemistry. Books and Allied (P) Ltd., Kolkatta.
4. Satyanarayana, U., and U.Chakrapani. 2017. Biochemistry. Fifth edition. Elsevier.
5. Salil Bose., 1981, Elementary Biophysics, Vijaya Printers, Madurai.

Books for References

1. William G. Hopkins. 1995. Introduction to Plant Physiology – Second Edition. John Wiley and Sons, Inc. New York.
2. Noggle, G. R. and Fritz, G. J. 1992. Introductory Plant Physiology. Prentice – Hall of India Private Limited, New Delhi

3.Lincoln Teiz and Eduardo Zeiger. 2006. Plant Physiology. Benjamin/Cummings Publishing company, California

Biochemistry & Biophysics

1. Plummer, D. T. 1982. An introduction to Practical biochemistry. Tata Mc Graw – Hill publishing company, Ltd, New Delhi.
2. Voet, D. and Voet, J. G. 1990. Biochemistry. John Wiley and sons, Inc, New York.
3. Voet, D. and Voet, J. G. 2011. Biochemistry. Fourth Edition. John Wiley and sons, Inc, New York.

For Candidates admitted from the academic year 2015 onwards)
HOLY CROSS COLLEGE (AUTONOMOUS) TIRUCHIRAPPALLI – 2
PG AND RESEARCH DEPARTMENT OF BOTANY
CHOICE BASED CREDIT SYSTEM

M.Sc. BOTANY WITH SPECIALISATION IN PLANT BIOTECHNOLOGY
Second Year – Semester- IV

Course Title	MAJOR CORE 14 PRACTICAL 4 PLANT PHYSIOLOGY, BIOCHEMISTRY AND BIOPHYSICS
Total Hours	60
Hours/Week	4Hrs/Wk
Code	P15BO4MCP14
Course Type	Practical
Credits	3
Marks	100

GENERAL OBJECTIVE

To enable the students to determine and analyze the water potential, osmotic potential, pigments, rate of photosynthesis, enzyme activity, Reducing sugars, Proteins, Ascorbic acid, total phenol and enzymes, proline, ATP molecule, absorption spectrum and apply the procedure for saponification value and chromatography.

COURSE OBJECTIVES

The Learner will be able to

CO. No.	Course Objectives
CO-1	Understand determine water potential, osmotic potential
CO-2	Understand and analyze the types of pigments, rate of photosynthesis, and enzyme activity
CO-3	Understand and determine the estimation of Reducing sugars, Proteins, Ascorbic acid, total phenols and enzymes
CO-4	Understand and apply the procedure for saponification value, chromatography and estimation of proline
CO-5	Understand and analyze ATP molecule, absorption spectrum

Unit 1 **12 hrs**

Plant Physiology:

1. Determination of water potential
2. Measurement of osmotic potential and plasmolysis.
3. Sensitivities of membrane to external factors - chemicals, pH and temperature.

Unit 2 **12 hrs**

1. Separation of chloroplast pigments by column chromatography and study of absorption Spectrum.
2. Hill reaction of isolated chloroplast.
3. Effect of GA3 on Amylase activity.
4. Measurement of Nitrate reductase activity.

Unit 3 **12 hrs**

Plant Biochemistry Extraction and estimation of the following: Reducing sugars, Proteins, Ascorbic acid (titrimetric).

Estimation of the following enzymes- catalase, peroxidase, & amylase. Estimation of secondary metabolites - Phenols.

Unit 4 **12 hrs**

Demostration

1. Saponification value of vegetable oils.
2. Separation of lipids by TLC.
3. Separation of amino acids by paper chromatography.
4. Calculation of V max of enzyme.
5. Estimation of proline

Unit 5 **12 hrs**

Biophysics

COURSE OUTCOMES (CO)

The Learner will be able to

CO No.	Course Outcomes	PSOs Addressed	Cognitive Level
CO-1	Understand and determine water potential, osmotic potential In room temperature	PSO5	R, U, An
CO-2	Understand and analyze the types of pigments using chromatography, rate of photosynthesis, and amylase and Nitrate reductase activity enzyme activity	PSO5	R,U, An
CO-3	Understand and determine the estimation of Reducing sugars, Proteins, Ascorbic acid, total phenols and enzymes	PSO5	R,U, An

CO-4	Understand and apply the procedure for saponification value, chromatography and estimation of proline	PSO5	R,U, An
CO-5	Explain the structure of amino acids, enzymes and enzyme kinetics	PSO5	R, U, An
CO-6	Develop the practical skills by determining and analyzing the water potential, osmotic potential, pigments, rate of photosynthesis, enzyme activity, Reducing sugars, Proteins, Ascorbic acid, total phenol and enzymes, proline, ATP molecule, absorption spectrum and apply the procedure for saponification value and chromatography	PSO-1	C

For Candidates admitted from the academic year 2015 onwards)
HOLY CROSS COLLEGE (AUTONOMOUS) TIRUCHIRAPPALLI – 2
PG AND RESEARCH DEPARTMENT OF BOTANY
CHOICE BASED CREDIT SYSTEM

M.Sc. BOTANY WITH SPECIALISATION IN PLANT BIOTECHNOLOGY
Second Year – Semester- IV

Course Title	MAJOR ELECTIVE 2- BIOMETRICS AND BIOINFORMATICS
Total Hours	90
Hours/Week	6Hrs/Wk
Code	P15BO4MET02
Course Type	Practical
Credits	5
Marks	100

GENERAL OBJECTIVE

To enable the students to understand collection and presentation of data, measures of central location, variability, probability, correlation, regression and test of significance in biometrics.

COURSE OBJECTIVES

The learner will be able to

CO. No.	Course Objectives
CO-1	Remember, understand the collection and presentation of data and apply the measure of central location and variability
CO-2	Apply and analyze the methods of studying correlation, regression and Probability
CO-3	Understand and apply test of significance and analysis of variance
CO-4	Remember and understand the application of information technology in the field of biology
CO-5	Understand, apply and analyse the gene, protein sequences using Bioinformatics tools and softwares

UNIT – I Introduction and measures of central tendency and Dispersion: 18 hrs

Introduction – Definition & applications of statistics. Collection and presentation of data. Population and sample. Methods of sampling, advantages & disadvantages of sampling, random & non – random sampling. Measures of central location : mean, median & mode.
Measures of variability : Range, mean deviation, variance, standard deviation & coefficient of variation.
Extra reading/Key words:Manifestation, Biometric process

UNIT – II Probability, Correlation and Regression: 18 Hrs
Skewness & Kurtosis. Probability – Basic concepts. Measure of probability: addition, multiplication & conditional probabilities. Theoretical distribution: Binomial, Poisson & normal distributions. Correlation : Types, methods of studying correlation, rank correlation.
Regression : Types of regression, methods of studying regression.
Extra reading/Key words:Resemblence analysis, permutation and combination

UNIT – III Test of significance : 18 Hrs
Null hypothesis, standard error, large samples & small samples. Tests of significance of large samples, tests of significance of small samples (t-test), chi – square test. Analysis of variance : One way and two way analysis.
Designs of experiments : CRD, RBD & LSD.
Extra reading/Key words:\Duncan analysis and applications of SPSS

UNIT – IV Bioinformatics 18 hrs
Bioinformatics – introduction – need of computer in Biological research. Internet – a virtual library. Searching biological informations using internet.
Biological data base – generalized and specialized data base. Premier institutions maintaining data base - EMBL, NCBI, DDBJ.
Extra reading/Key words: OMIM, Microarray databases

UNIT - V Bioinformatics 18 hrs
Pairwise Alignment- dot matrix and BLOSUM matrix. Database Similarity search- FASTA, BLAST. Multiple sequence analysis –Logic behind MSA, softwares available and its applications. Phylogenetic analysis- construction of phylogentic tree. Gene prediction. Protein structure prediction (secondary and tertiary) and molecular visualization of proteins.
Extra reading/Key words: PASS prediction, data mining softwares

Note: Texts given in the Extra reading /Key wordsmust be tested only through Assignment and Seminars

COURSE OUTCOMES (CO)
The Learner will be able to

CO No.	Course Outcomes	PSOs Addressed	Cognitive Level
CO-1	Explain the methods of data collection and presentation of data	PSO 2, PSO 5	An
CO-2	Calculate the measure of central location and variability and co-efficient of correlation and regression	PSO 2, PSO 5	An, Ap

CO-3	Compare and apply the different theories of Probability	PSO 2, PSO 5	An
CO-4	Explain the procedure for test of significance	PSO 4, PSO 5	An
CO-5	Apply the different types of test of significance	PSO 4, PSO 5	Ap
CO-6	Recall and relate the application of information technology in the field of biology	PSO 2, PSO 5	R,U
CO-7	Make use of various bioinformatics tools to analyse molecular data	PSO 2	An,U
CO-8	Demonstrate pairwise and multiple sequence alignment using bioinformatics tools	PSO 2, PSO 4	C
CO-9	Develop the Employability skills by understanding the collection and presentation of data, measures of central location, variability, probability, correlation, regression and test of significance in biometrics	PSO-1	C

Prescribed Text books

Biostatistics

1. Palanichamy, S. and Manoharan, M. 1990. Statistical methods for Biologists. Palani Paramount, Palani.
2. Ramakrishnan, P. 2003. Biostatistics. Saras Publications, Nagercoil.

Bioinformatics

1. Lohar, P.S. 2009. Bioinformatics.MJP Publishers, Chennai.
2. Mani. K. and Vijayraj. D., 2002. Bioinformatics to beginners, Kalaikathir pathippagam, Coimbatore.
3. Jin Xiong. 2009. Essentials of Bioinformatics. Cambridge University Press, USA.

Books for References

1. Satguru Prasad. 1992. Fundamentals of Biostatistics. Emkay publications, New Delhi.
3. Khan, I. A. and Khanum, A. k. 1994. Fundamentals of BioStatistics. Ukaaz Publications, Andra Pradesh.
4. Misra, B. N. and Misra, M. K. 1992. Introductory practical Biostatistics. Darbari Prakashan, Calcutta.
5. Mahajan, B. K. 1991. Methods in Biostatistics. Jaypee Brothers Medical Publishers (Pvt) Ltd, New Delhi.
6. Kenneth Mather. 1973. Statistical analysis in Biology. Chapman and Hall and Science Paperbacks.
7. Rangaswamy, R. 1995. Agricutural statistics. New age International Publishers Ltd. Wiley Eastern Ltd., New Delhi.

8. Gupta, B. N. 1989. An introduction to mathematical statistics. Sahityabavan, Agra.
9. Normal, T. J. and Bailey. 1965. Statistical methods in Biology. The English Language Book Society and the English Universities Press Ltd, Britain.

Bioinformatics

1. Zhumur Ghosh, Bibekanand Mallick, 2008. Bioinformatics – Principles and Applications. OUP India.
2. Teresa Attwood and David Parry-Smith. 2007. Introduction to Bioinformatics. Pearson Education, India.

For Candidates admitted from the academic year 2015 onwards)
HOLY CROSS COLLEGE (AUTONOMOUS) TIRUCHIRAPPALLI – 2
PG AND RESEARCH DEPARTMENT OF BOTANY
CHOICE BASED CREDIT SYSTEM

M.Sc. BOTANY WITH SPECIALISATION IN PLANT BIOTECHNOLOGY
Second Year – Semester- IV

Course Title	**MAJOR ELECTIVE 3 – CLINICAL MICROBIOLOGY & BASICS OF IMMUNOLOGY**
Total Hours	90
Hours/Week	6 hrs /wk
Code	P15BO4MET03
Course Type	Theory
Credits	5
Marks	100

GENERAL OBJECTIVE

To enable the students to learn and remember the role of microbes (beneficial and harmful) with human, clinical safety, various techniques of diagnosis, human diaseases and basics of immunology.

COURSE OBJECTIVES

The learner will be able to

CO. No.	Course Objectives
CO -1	understand and evaluate the exact role of microbes, and learn that not all microbes are harmful
CO -2	understand and remember the pathological laboratory safety measures and safety disposal of hazardous waste generated fron the hospital
CO -3	understand and analyze the techniques for common serological test
CO -4	remember, understand and analyse the major disease of human
CO -5	understand and analyse the basics of immunology and the antigen-antibody interaction

UNIT – I:Interaction of microbes with human: 18hrs
Normal flora of human body – symbiotic relationships – importance in overall health of human. Pathogenic flora: Nosocomial and community infection. Mechanism of pathogenesis –

reservoirs, portals of entry and mode of transmission (direct – droplets ; indirect – food, water & air). Colonization & establishment. Microbial virulence – exotoxins (botulism), endotoxins (gram negative bacteria).

Extra reading/Key words:Commensals, zoonotic infections

UNIT – II : Laboratory safety& hazardous waste treatment: 18hrs

Safety in handling of infectious materials – blood collection, specimen handling and transport. Containment equipment – biological safety cabinet (HEPA). Devices for protection against infection – laboratory garments (Apron, cloves, masks, caps) – sterilization, disinfection antisepsis in clinical labs, hospitals and equipments. Infectious waste management in hospitals and laboratories and disposal of treated waste.

Extra reading/Key words:Hospital visits and case studies

UNIT – III : Techniques for diagnosis : 18hrs

Common serological tests – agglutination, immunoprecipitation, viral neutralization, complement fixation, Immunofluorescence technique, radio immuno assay, ELISA test.

Extra reading/Key words: Electro immunophoresis, biosensor

UNIT – IV: Diseases of human organs: 18hrs

Causative agent, symptoms, clinical diagnosis and control measures of the following: Skin – Varicella or chicken pox (Herpes virus), Cutaneous mycoses (Ringworm diseases). Eyes – conjunctivitis (Bacteria & Virus). Nervous system – bacterial meningitis (Neisseria meningitidis). Respiratory system – Diphtheria. Digestive system – Jaundice (Hepatitis virus) and amoebiasis. Urinogenital system – Gonorrhoea (Neisseria gonorrhoeae).

Extra reading/Key words:Dengue, Swine flu

UNIT –V: Basics of immunology: 18hrs

Natural host resistance – types of immunity – innate & acquired. The immune system – lymphocytes (T & B cells). Role of lymphocytes in specific immunity. Antigen – Antibodies. Nature of antigens – epitopes – haptens – their functions. Nature of antibodies (immunoglobulins)- types & properties. Cell mediated immunity – natural killer cells.

Extra reading/Key words: Vaccination, Stem cell

Note: Texts given in the Extra reading /Key wordsmust be tested only through Assignment and Seminars.

COURSE OUTCOMES (CO)

The Learner will be able to

CO No.	Course Outcomes	PSOs Addressed	Cognitive Level
CO-1	Discuss the exact role of microbes	PSO 2, PSO 5	An

CO-2	Explain the safety measures adopted in pathological laboratory	PSO 2, PSO 5	An, Ap
CO-3	Elaborate the safety disposal of hazardous waste generated from the hospital	PSO 2, PSO 5	An
CO-4	Listout the techniques for common serological test	PSO 4, PSO 5	An
CO-5	recall and analyse the causes, symptoms and control measures of various diseases	PSO 4, PSO 5	Ap
CO-6	Explain the pathogenicity and disease cycle of Amoebiasis	PSO 2, PSO 5	R,U
CO-7	Distinguish the basics of immunology and the antigen-antibody interaction	PSO 2	An,U
CO-8	Classify the types of antibodies	PSO 2, PSO 4	C
CO-9	Distinguish cell mediated immunity and humoral immunity	PSO 2	An,U
CO-10	Develop the Employability skills by learning and remembering the role of microbes (beneficial and harmful) with human, clinical safety, various techniques of diagnosis, human diaseases and basics of immunology	PSO-1	C

Prescribed Text Books:

1. R.C. Dubey and D.K.Maheswari. A text book of microbiology. S.Chand & Company Ltd., New Delhi.
2. Nandini Shetty. 2006. Immunology – Introductory text book, New Age International Publishers, New Delhi.
3. Subhash Chandra Parija. 2012. Textbook of Microbiology and Immunology, Elsevier India Publishers. P. 684.
4. Banerjee and Banerjee. 2008. Fundamentals of Microbiology and Immunology. New Central Book Agency (P) Limited Publishers.

Books for References:

1. Michel J. Pelczar, Chan, E. C. S. and Noel R. Krieg. 1993. Microbiology concepts & applications. Mc Graw- Hill, Inc, New York.
2. Prescott, Harley and Klein. 1999. Microbiology. Irwin Mc Graw – Hill / Bos.
3. Nester, E. W., Roberts, C. E., Pearsall, N. N. & Anderson. 1998. Microbiology – A Human Perspective. Irwin Mc Graw – Hill / Bos.
4. Albert and Balows, W.J.Hausler, JR. K.L.Herrmann, H.D. Isenberg, H.Geneshadomy. 1992. Manual of Clinical Microbiology. American society for Microbiology, Washington.
5. Sell, S. 1996. Basic immunology. North Holland, London.

(For candidates admitted from 2022 onwards)

HOLY CROSS COLLEGE (AUTONOMOUS) TIRUCHIRAPPALLI-2 PG AND RESEARCH DEPARTMENT OF BOTANY

M.Sc., BOTANY

SEMESTER IV

Course Title	**SELF STUDY PAPER- NURSERY MAINTENANCE AND HOME GARDENING**
Code	**P22B04SST01**
Course Type	**Theory**
Credits	**2**
Marks	**100**

General objectives:

To enable the students to learn about cultivation of plants at different conditions, propagation of plants by various methods and laying of kitchen garden and ornamental garden. Considerable emphasis is also given on the cultivation of vegetables and fruits, floriculture and role of growth hormones in horticulture. It also imparts knowledge on management of gardens and horticultural organizations.

Course Objectives :

The learner will be able to

CO No.	Course Objectives
CO -1	Understand and apply the different types of cultivation methods of plants for Nursery
CO -2	Understand and apply the vegetative propagation of plants for gardening
CO -3	Remember and Understand cultivation of vegetables and fruits
CO -4	Understand the different cultivation methods of ornamental plants in home Gardening
CO -5	Remember the role of growth hormones in horticulture and different horticultural organizations.

UNIT – I Establishment & maintenance of Nursery, cultivation of potted plants, bonsai culture. Green house: glass house, cloth house, plastic house and mist chamber.

UNIT-II Preparation of soil, home manures, compost and fertilizers. Propagation of plants by seeds, vegetative propagation – cutting, layering & grafting.

UNIT-III Kitchen garden, lay outs and garden designing, classification of vegetables, cultivation of tropical vegetables – Leafy vegetables – *Alternanthera*, Root vegetable –Radish, Fruit vegetable – Brinjal & Lady's finger. Cultivation of fruits - Banana and Citrus.

UNIT-IV Ornamental garden: Layout and establishment, lawns, rockery, indoor garden, terrace garden. Floriculture.

UNIT-V Role of hormones in horticulture. Plant after care. Management of common pests, diseases, and weeds in gardens. Horticultural organizations: IIHR, NHB.

Course Outcomes (CO):

The Learner will be able to

CO No.	Course Outcomes	PSOs Addressed	Cognitive Level
CO-1	Discuss the steps involved in establishment of nursery and it's maintenance	PSO3 , PSO 5	Ap
CO-2	Differentiate the various culturing methods of plants for nursery	PSO 3, PSO 5	U, Ap
CO-3	Explain different vegetative propagation of plants	PSO 3, PSO 5	U, Ap
CO-4	Outline the kitchen garden designing	PSO 3, PSO 5	U, Ap
CO-5	Describe various culture methods of fruits and vegetables	PSO 3, PSO 5	U, Ap
CO-6	Explain the method of establishing ornamental garden.	PSO 3, PSO 5	R,U
CO-7	Discuss the roles of horticultural organizations.	PSO 3	U, Ap

Text Books:

1. Mani Bhusahan Rao, K.1991. Text book of Horticulture-MacMillan India Ltd., Madras.
2. Soule, Judith D. and Piper, Jon K. 1992. Farming in Nature's Image: An Ecological Approach to Agriculture. Island Press, Washington, D. C.
3. Prasad and Kumar, 2014. Principles of Horticulture 2nd Edn. Agrobios (India).
4. Kausal Kumar Misra and Rajesh Kumar, 2014. Fundamentals of Horticulture Biotech Books.

Reference Books:

1. Edmond J.B., Senn, T.L. and Andrews, F.S. 1964 Fundamentals of Horticulture- Tata Mc Graw –Hill Publishing Company Ltd., New Delhi.
2. Masanobu Fukuoka.1985.Natural Way of Farming: The Theory and Practice of Green Philosophy.
3. Edmond J.B., Senn,T.L. and Andrews,F.S.1964 Fundamentals of Horticulture- Tata Mc Graw–Hill Publishing Company Ltd., New Delhi.
4. Peter M. And TessaEve. 2007. Garden planning and Garden design. South water Publishing. London.

HOLY CROSS COLLEGE (AUTONOMOUS)

Affiliated to Bharathidasan University
Nationally Accredited(4th Cycle) with 'A++' Grade(CGPA 3.75) by NAAC
College with Potential for Excellence.
Tiruchirapalli - 620002.

PG AND RESEARCH DEPARTMENT OF BOTANY

Programme: M.Phil. Botany with specialization in Plant Biotechnology

PO No.	Programme Outcomes Upon completion of the M.Phil. Degree Programme, the post graduate will be able to
PO-1	Obtain quality education in the advanced areas of Botany
PO-2	Write and formulate research projects/translate the research data into research p Projects and further to publicize it
PO-3	Competant enough to face the competitive exams at national /state level (UGC-NET, CSIR/ SET etc.)and acquire academic excellence with an aptitude for higher studies and research
PO-4	Develop Scientific tools to formulate phyto drugs to fulfill the needs of the society and to respect and conserve nature and the environment

PSO No.	Programme Specific Outcomes Upon completion of these courses the student would
PSO-1	Apply the acquired scientific knowledge to give solutions to lead a healthy life, protect the environment, energy need, safety, nutritious food, good environment, clean water, air and phytomedicines
PSO-2	Develop entrepreneurship skills in various fields like microbial techniques,cultivation of medicinal plants, identification of plants, cultivation of biofertilizers, mushrooms, handling of instruments and research skills through the projects
PSO-3	Carryout the field work, research projects individually and prepare herbal medicines for common ailments and traditional nutritive food
PSO-4	Apply and correlate the relationship between plant physiology, Biochemistry, Biotechnology, Biophysics and Biometrics
PSO-5	Become aware of environmental issues, environmental laws and applications of remote sensing in environmental studies

HOLY CROSS COLLEGE(AUTONOMOUS) TIRUCHIRAPPALLI – 620 002

M.Phil. Course Pattern 2019-20

M. Phil. Botany (FT / PT) PROGRAMME

(For the candidates admittedfrom 2018 onwards)

Semester I	Title of the Course	Marks IA	UE	Total	Credits	Code
Course –I	Research Methodology	25	75	100	4	MPH18BO1C01
Course – II	Plant Physiology and plant biochemistry	25	75	100	4	MPH16BO1C02
Course- III	Teaching and Learning Skills	25	75	100	4	MPH18TS1C03
Semester II						
Course – IV	Elective (Any one) a. Appied Biotechnology/ b. Pharmacognosy/ c.Bioprospecting of medicinal plants/ d. Applied Molecular Biology/	25	75	100	4	MPH16BO1E04/ MPH16BO1E05/ MPH16BO1E06/ MPH16BO1E07/
	Dissertation and Viva-Voce Viva Voce 50 marks Dissertation 150 marks	200 (150+50)			8	MPH16BO2D01

QUESTION PAPER PATTERN (Course I – IV)

Section A: 10 Questions ×2 Marks = 20 Marks
(Two questions from each unit)

Section B: 5 Question × 5 Marks = 25 Marks
(Internal choice and one set of questions from each unit)

Section C: 3 Questions × 10 Marks = 30 Marks
(Answer any three out of 5 questions and one questions from each unit)

M.PHIL. BOTANY SYLLABUS

(For the candidates to be admitted from 2018 onwards) SEMESTER 1 -
COURSE 1 - RESEARCH METHODOLOGY

Code: MPH18BO1C01 **Credits 4**

COURSE OBJECTIVE

1. Remember and Understand the basics of research designing, sources of information and report preparation.
2. Apply and analyse the basic principle and functions of instruments used in separation of bioactive compounds.
3. Understand and apply the basic principles of various techniques used in genomic and proteomic analysis.
4. Understand the principle and construction of microscopes and microtechniques in histology.
5. Apply and analyze the important statistical methods and Understand, apply and analyse the gene, protein sequences

Unit I. Introduction to Research Methodology: Selection & designing of research problem. Library and research documentation – storage and retrieval of information, source of information – journals, reviews, abstracts, monographs. Online – web browsing. Thesis writing – preparation of index card, method of editing and preparation of thesis. Research papers for presentation and publication - Preparation of abstract and manuscript, impact factor and citation index and power point presentation.

Unit II.Principle, instrumentation and applications - Atomic Absorption Spectrophotometer (AAS), Flame Photometer, Nuclear Magnetic Resonance Spectrometry (NMR) and Electron Spin Resonance spectrometry (ESR). Mass Spectroscopy.Chromatography: Principle and procedures- Functions and application of TLC, Gel Filtration and Ion exchange, Affinity Chromatography, HPLC and GCMS. Centrifugation: Principle and Types of centrifuges. Ultracentrifugation, density gradient centrifugation and differential centrifugation. Radioisotopes and their applications in biology - GM and Scintillation counter.

Unit III. Proteomic analysis - Electrophoresis: Principles, types – paper and Gel electrophoresis - Polyacrylamide gel electrophoresis – native (PAGE) & denaturing gel (SDS - PAGE). Two dimensional electrophoresis and isoelectrofocussing, Western blotting, Gel documentation.Immunological techniques – preparation of antigen and antibodies, immunodiffusion, immunoelectrophoresis, ELISA. Genomic analysis – Agarose gel electrophoresis – Dot, Southern and Northern Blotting. PCR, RFLP, RAPD.DNA micro array, DNA finger and foot printing – FISH.

Unit IV. Microscope – Principle, construction and applications of fluorescent Microscope, Phase contrast microscope and Electron microscope- TEM, SEM and STEM. Preparation of

materials for SEM & TEM. Principles and applications of photomicrography. Micro technique – Histology – fixatives and principles of fixation, tissue processing, block making, sectioning and staining, problem associated with sectioning. Histochemistry – principle of staining for protein, lipids, carbohydrates, DNA and phenol.

Unit V.Measures of central tendency-Mean, median and mode.Measures of dispersion-standard deviation. Correlation and Regression- Test of significance – Large sample test, t-test and chi-square test. Analysis of variance: One and Two way ANOVA. Principles of experimental design: CRD, RBD. Gene finding, Protein-homology modelling. Molecular visualization of protein.

COURSE OUTCOMES (CO)

1. Explain the method of designing a research and sources of information.
2. Compare and contrast the different types of chromatographic and electrophoretic techniques mentioned in the syllabus
3. Explain the various steps in different types of electrophoresis and blotting.
4. Describe the construction of different types of microscopes and principles of microtechnique.
5. Calculate the statistical constants and apply the different types of test of Significance and make use of various bioinformatics tools to analyse molecular Data

Books for References:

1. Avinash Updhayay, Kakoli Updhayay and Nirmalendu Nath. 1998. Biophysical chemistry – Principles and techniques. Himalaya Publishing House, Mumbai.
2. Berlyn & Mische, 1976. Botanical Microtechnique and Cytochemistry. IowaState, University Press.
3. Daniel, M. 1989. Basic Biophysics for Biologists. Agrobotanical Publishers (India).
4. Harborne, J.B. 1998. Phytochemical Methods. Chapman & Hall, London.
5. Krishnamurthy, K.V. 1988. Methods in Plant Histochemistry. Viswanathan Publishers, Madras.
6. Van Norman, R. W. 1971. Experimental biology. IInd Edition, Prentice Hall, Inc., New Jersey.
7. Wilson, K. and Walker, J. 1997. Practical Biochemistry: Principles and Techniques. CambridgeUniversity Press, Cambridge.
8. Palanichamy, S. & Manoharan, M. 1990. Statistical methods for biologists. Palani Paramount, Palani.
9. Ramakrishnan, P. 2003. Biostatistics. Saras Publications, Nagercoil.
10. Rangaswamy, R. 1995. Agricultural statistics. New age international publishers Ltd. Wiley Eastern Ltd. New Delhi.

M.PHIL. BOTANY SYLLABUS

(For the candidates to be admitted from 2018 onwards)

SEMESTER I- COURSE 2 - PLANT PHYSIOLOGY AND PLANT BIOCHEMISTRY

Code: MPH16BO1C02 Credits 4

COURSE OBJECTIVE

1. Remember and understand the various mechanism of absorbtion of water and photosynthesis
2. Understand and analyze the process of respiration and nitrogen metabolism
3. Understand and analyze the growth hormones and stresses in plants
4. Remember and understand structure, properties and their biological significance of Carbohydrates, lipids and secondary metabolites
5. Understand and analyze Classification, structure and properties of amino acids proteins and enzymes

Unit I. Water relations and Photosynthesis

Water relations - Absorption and translocation of water – Concept of water & chemical potential.

Inorganic nutrition: mineral ion uptake – diffusion – passive and active uptake – cotransport (symport) – counter transport (antiport) - Nernst equation – Donnan's equilibrium – role of ATPase as a carrier. Photosynthesis: Photosynthesis –Ultra structure of chloroplast and molecular structures of chlorophylls. Photosynthetic carbon reduction cycle C3, C4, variations of C4 cycle, C3& C4 intermediates and CAM pathway and its adaptive advantages.

Unit II. Respiration and Nitrogen metabolism

Respiration – glycolysis, TCA cycle and significance of electron transport system. Pentose phosphate pathway, gluconeogenesis. Photorespiration and its significance (C2 or glycolate cycle). The role of respiration in biosynthesis of cellular molecules.

Nitrogen metabolism: Nitrogen fixation – symbiotic (leguminous & nonleguminous) & non-symbiotic. Nif gene complex. Molecular mechanism of nitrogen fixation. HUP gene and their importance.

Assimilation of nitrates: reduction phase, nitrate reductase (NR), nitrite reductase (NiR). Incorporation phase , GS – GOGAT system.

Unit III. Growth and Stress physiology: Growth – definition – phases, factors affecting vegetative growth. Growth hormones (auxins, gibberellins, cytokinins, abscisic acid ethylene &Brassino steroids) - their physiological role. Phytochrome & its role in flowering.Stress -

Definition of stress – water stress , temperature stress, radiation stress , salt stress and chemical stress and their molecular mechanism of resistance in plants.

Unit IV. Carbohydrates, Lipids and Secondary metabolites

Carbohydrates - Monosaccharides, disaccharides and polysaccharides, structure, properties and their biological significance.
Lipids – Classification, properties, and biological importance. Triglycerides, phospholipids and derived lipids. Biosynthesis of lipids. Oxidation of lipids (alpha and beta).
Classification,properties, biosynthesis and importance of secondary metabolites –alkaloids, flavanoids, terpenoids and glycosides.

Unit V. Amino acids and Proteins
Amino acids – Classification, structure and properties. Non protein amino acids and their role. Proteins - Peptide bond, primary structure. Secondary structure and backbone folding. Tertiary structure and stabilizing forces in collagen. Quaternary structure of hemoglobin and its regulatory features.

Enzyme nomenclature and classification. Catalytic power and specificity of enzymes – Enzyme kinetics - Michaelis - Menton constant- General properties of enzymes. Factors affecting the activity of enzymes - effect of pH, temperature, inhibitors and concentration of enzyme and substrate. Feed back inhibition.

COURSE OUTCOMES (CO)

1. Explain the different mechanisms of absorption of water and photosynthesis
2. Compare the different types of respiration and nitrogen metabolism
3. Compare the roles of different growth hormones and stresses in plants
4. Explains the structure and biological significance of carbohydrates, lipids and secondary metabolites
5. Describe the structure and properties of amino acids, proteins and enzymes

Books for References:

1. Bray CM. 1983. Nitrogen metabolism in plants, Longman.
2. Devlin, R.M., Witham , F.H. 1986 . Plant Physiology. CBS publishers and Distributors, New Delhi.
3. Eric E. Cohn and Stump. 1976. Outlines of Biochemistry. Wiley eastern limited, New Delhi.
4. Hopkins WG. 1995. Introduction to Plant Physiology. John Wiley and Sons Inc., New York.
5. Kramer PJ. 1969. Plant and soil water relationship – A modern synthesis.
6. Lehninger AL. Nelson DL. And Cox MM. 2002. Principles of biochemistry, Macmillan Worth publishers.

7. Moore TC.1989. Biochemistry and physiology of plant hormones. Springer-Verlag, New York.
8. Murray,R.K., Granner,D.K., Mayes, P.A. and Rod Well, V.W.1993. Harper's Biochemistry. Prentice – Hall of International limited, London.
9. Noggle GR and Fritz GJ. 1999. Introductory Plant Physiology, Prentice Hall, London.
10. Plummer, D .T. 1988. An introduction to practical Biochemistry. Tata McGraw Hill Pub. Co. Ltd., New Delhi.
11. Rama Rao, A.V.S.S. 1992. A text book of biochemistry. UBS publishers and Distributors Ltd, New Delhi.
12. Salisbury, C.B. and Ross, C.W.1986. Plant physiology. CBS publishers and Distributors, New Delhi.
13. Stryer L. 2002. Biochemistry, WH Freeman and Company, New York.
14. Trevor Palmer 2004. Enzymes Biochemistry, Biotechnology and Clinical Chemistry, East – West Press Pvt. Ltd. India.
15. Voet D. and Voet JG. 2006. Fundamentals of Biochemistry, John Wiley and Sons, New York.

M.PHIL. BOTANY SYLLABUS

(For the candidates to be admitted from 2018 onwards) SEMESTER I -
COURSE 3 - TEACHING AND LEARNING SKILLS

Code: MPH18TS1C03 **Credits 4**

COURSE OBJECTIVE

- Acquaint different parts of computer system and their functions.
- Understand the operations and use of computers and common Accessories.
- Develop skills of ICT and apply them in teaching learning context and Research.
- Appreciate the role of ICT in teaching, learning and research.
- Acquire the knowledge of communication skill with special reference to its elements, types, development and styles.
- Understand the terms communication technology and computer mediated teaching and develop multimedia/ e-content in their respective subject.
- Understand the communication process through the web.
- Acquire the knowledge of instructional technology and its applications.
- Develop different teaching skills for putting the content across to targeted audience.

Unit I: Computer application skills

Information and communication technology (ICT): Definition, Meaning, Features, Trends – Integration of ICT in teaching and learning – ICT applications: Using word processors, Spread sheets, Power point slides in the class room- ICT for Research: On-line journals, e-books, Courseware, Tutorials, Technical reports, Thesis and Dissertations- ICT for professional development: Concept of professional Development; institutional efforts for competency building; individual learning for professional development using professional networks, OERs, technology for action research etc.

Unit II: Communication Skills

Communication: Definitions- Elements of Communication: Sender, Message, Channel, Receiver, Feedback and Noise –Types of Communication: Spoken and Written; Non-verbal communication- Intrapersonal, Interpersonal, Group and Mass Communication, Barriers to Communication: Mechanical, Physical, Linguistic and Cultural – Skills of Communication: Listening, Speaking, Reading and Writing- Methods of developing fluency in oral and written communication- Style, Diction and Vocabulary- Classroom communication and dynamics.

Unit III: Pedagogy

Instructional Technology: Definition, Objectives and Types- Difference between Teaching and Instruction- Lecture Techniques: Steps, Planning of a Lecture, Delivery of a Lecture- Narration in tune with the nature of different disciplines- Lecture with powerpoint presentationdn- Versatility of lecture techniques- Demonstration: Characteristics, Principles, Planning, Implementation and Evaluation-Teaching -learning Techniques: Team Teaching, Group discussion, Seminar, Workshop, Symposium and Panel Discussion.

Unit IV: E-Learning, Teaching Integration and Academic Resources in India

Concept and types of e-learning (synchronus and asynchronus instructional delivery and means), m-learning (mobile apps); blended learning; flipped learning; E-learning tools (like LMS; software for word processing, making presentations, on-line editing etc.); subject specific tools for e-learning; awareness of e-learning standards- Concept of technology, integration in teaching learning processes; frame works guiding technology integration (like TPACK; SAMR); Technology Integration Matrix- Academic Resources in India: MOOC, NMEICT; NPTEL; e-pathshala; SWAYAM, SWAYAM Prabha, National Academic Depository, National Digital Library; e-Sodh Sindhu; Virtual labs; e-Yantra, Talk to a teacher, MOODLE, mobile apps, etc.

Unit V: Skills of Teaching and Technology based assessment

Teaching Skills: Definition, Meaning and Nature-Types of Teaching Skills: Skill of set induction, Skill of Stimulus Variation, Skill of Explaining, Skill of Probing Questions, Skill of Black Board writing and Skill of Closure – Integration of Teaching Skills – Evaluation of Teaching Skills-Technology for Assessment: Concept of Assessment abd Paradigm shift in assessment; role of technology in assessment for learning; tools for self and peer assessment (recording devices; e-rubrics, etc.); online assessment(open source software's; e-portfolio; quiz makers; e-rubrics; survey tools); technology for assessment for collaborative learning like blogs, discussion forums; learning analytics.

COURSE OUTCOMES (CO)

1. apply computer skills in the respective areas
2. communicate their language with different skills
3. apply the various methods of teaching.
4. Outline learning process and integration of teaching and Academic resources
5. Explain various teaching skills and assessment technology

Books for References:

1. Bela Rani Sharma (2007), Curriculum Reforms and Teaching Methods, Sarup and Sons, New Delhi
2. Brandon Hall, E-learning, A research note by Namahn, found in: www.namahn.com/resources/.../note-e-learning.pdf, retrieved on 05/08/2011
3. Don Skinner (2005), Teacher Training, Edinburgh University Press Ltd.,Edinburgh
4. Information and Communication Technology in Education: A Curriculum for schools and programmed of Teacher Development, Jonathan Anderson and Tom Van Weart, UNESCO, 2002.
5. Jereb, E., & Smitek, B. (2006). Applying multimedia instruction in e-learning. Innovations in Education and teaching international, 43(1), 15-27.
6. Kumar, K.L. (2008) Educational Technology, Newage international Publishers, New Delhi.
7. Learning Management System :https://en.wikipedia.org/wiki/learning management system, retrieved on 05/01/2016.
8. Mangal,S.K (2002) Essential of Teaching Learning and Information Technology, Tandon Publications, Ludhiana.

9. Michael, D and Willium (2000), Integrating Technology into Teaching and Learning: Concepts and Applications, Prentice Hall, New york
10. Pandey, S.K. (2005) Teaching Communication, Commonwealth Publishers, New Delhi.
11. Ram Babu, A abd Dandapani, S (2006), Microteaching (Vol. 1 & 2), Neelkamal Publications, Hyderabad.

M.PHIL. BOTANY SYLLABUS

(For the candidates to be admitted from 2016 onwards) SEMESTER I-

COURSE 4- (Elective) (a) APPLIED BIOTECHNOLOGY

Code: MPH16BO1E04 **Credits 4**

COURSE OBJECTIVE

1. Remember and understand the basic techniques in plant tissue culture
2. Understand and analyze the various types of tissue culture methods
3. Remember and understand haploid production, invitro fertilization and synthetic seed production
4. Remember and understand applications of plant genetic transformation.
5. Remember and understand the topics GM foods, bioremediation, biomining and biodiesel.

Unit 1. Introduction – history, scope and concepts of basic techniques in plant tissue culture - laboratory requirements and organization. Sterilization – filter, heat and chemical. Composition and preparation of culture media.

Unit 2. Micropropagation, organogenesis – types, factors and importance. Somatic embryogenesis – types, method, factors and its applications. Synthetic seeds- method and application. Single cell culture – methods, factors and application.

Unit 3. Haploid production, in vitro pollination & fertilization, somatic hybridization, somaclonal variation, secondary metabolite production, cryopreservation and its significance.

Unit 4. Application of plant genetic transformation for productivity and performance – herbicide resistance, insect resistance, virus resistance, improving fat & protein, stress tolerant plants, preservation of fruits, male sterility & fertility restoration.

Unit 5. GM foods – production, safety, risks & applications. Bioremediation of contaminated soils & waste lands. Production & utility of biodiesel. Biomining – methodology & advantages.

COURSE OUTCOMES (CO)

1. Explain the basic techniques in plant tissue culture
2. Compare the different types of tissue culture methods
3. Explain the techniques like haploid production, invitro fertilization and syntheric seed production.
4. Explain the applications of plant genetic transformation.
5. Describe GM foods, bioremediation, biomining and biodiesel.

Books for References:

1. Gamborg, O.L., Phillips, G.C. 1998. Plant Cell, Tissue & Organ Culture. Fundamendal Methods. Narosa Publishing House, New Delhi.
2. Gupta,P.K. 1999. Elements of Biotechnology – First Edition. Rastogi Publications, Meerut.
3. Ignacimuthu, S.J. 1996. Applied Biotechnology. Tata Mc Graw – Hill Publishing Co. Ltd. New Delhi.
4. Jogdand, S.N. 1997. Gene Biotechnology. Himalaya Publishing House.
5. Kalyan Kumar De. 1992. Plant tissue culture, , New Central Book Agency, Calcutta.
6.Razdan, M.K. 1993. An introduction to plant tissue culture. Oxford& IBH Pub.Co. New Delhi.
7. Satyanarayana, U. 2005. Biotechnology. Books & Allied (P) Ltd, Kolkata.

M.PHIL. BOTANY SYLLABUS

(For the candidates to be admitted from 2016 onwards)

COURSE 4 (Elective) (b) PHARMACOGNOSY

CODE:MPH16BO1E05 **Credit 4**

COURSE OBJECTIVE

1. Remember and understand the classification, agro techniques, and harvesting technology of drugs.
2. Understand and analyze the various methods of drug evaluation and allergens
3. Remember and understand Therapeutic significance of phytoconsitituents
4. Remember and understand about traditional crude drugs.
5. Understand and Analyze quality control of crude drugs.

Unit 1. Definition, scope and importance of pharmacognosy. Classification of drugs from natural origin. Agro-Techniques of medicinal and aromatic plants. Harvesting technology and value addition of crude drugs.

Unit 2. Analytical pharmacognosy : Adulteration and substitution of crude drugs. Methods of crude drug evaluation. Allergenic extracts of pollen, fungal and food.

Unit 3. Phytoconstituents of therapeutic significance: Glycosides, phenolic compounds, tannins, lipids, volatile oils, Resin and resin combinations and alkaloids. Phytochemical investigations of phenolics and alkaloids.

Unit 4. Traditional crude drugs : Amla (Phyllanthus emblica – fruit, Asoka bark (Saraca indica – stem bark), Aswagandha (Withania somnifera – dried roots and stem) Bahera (Terminalia belerica – dried fruits), Brahmi (Centella asiatica – herb), Garlic (Allium sativum – bulb) Keshar (Crocus sativus – stigma), Pudina (Mentha viridis – leaves), Rasna (Alpinia officinarum – rhizome) Shankhpushpi (Clitoria ternatea – plant).

Unit 5. Standardisation and quality control of crude drugs. Current trend and market potential of Crude drugs. Sustainable Conservation and developmental strategies for medicinal plants.

COURSE OUTCOMES (CO)

1. Explain the classification, agrotechniques and harvesting technology of drugs
2. Compare the various methods of drugh evaluation and allergens.
3. Explain the therapeutic significance of phytoconstituents.
4. Explain the traditional crude drugs
5. Describe quality control of crude drugs.

Books for References:

1. Handa, S.S. and V.K. Kapoor. 1992. Pharmacognosy. Vallabh Prakashan. Raj Printing Press, New Delhi.

2. Kokate,C.K., Purohit, A.P. and Gokhale, S.B. 1990. Pharmacognosy. Nirali Prakashan. K.J.Shah, Vinayak Printers, Pune.

3. Ravindra Sharma, 2004. Agro–Techniques of Medicinal plants.Daya Publishing House. New Delhi.

M.PHIL. BOTANY SYLLABUS

(For the candidates to be admitted from 2016 onwards) COURSE IV
(Elective) (c) BIOPROSPECTING OF MEDICNAL PLANTS

Code: MPH16BO1E06 **Credits 4**

COURSE OBJECTIVE

1. Remember, understand and describe the structure, types and biological significance of carbohydrates, proteins & vitamins.

2. Understand and remember the types, properties and importance of secondary metabolites.
3. Analyse the basic principle and functions of instruments used in separation of bioactive compounds
4.Remember, understand and evaluate the application of different types of instruments used in compound identification.
5. Understand the collection, maintenance and marketing of phytoresources.

Unit 1:Plant metabolites: Primary metabolites- structure, types and biological significance of carbohydrates, proteins & vitamins.

Unit 2:Secondary metabolites: types, properties, biosynthesis and importance of lipids, alkaloids, flavonoids, terpenoids and glycosides. Polyphenols found in plants and their major function.

Unit 3: Histochemistry: Localization of starch amino acids, lipids, tannins and phenols. Separation technique: Chromatography- Principle, procedures, functions and application of TLC, PC, Gel filtration and Ion exchange, Affinity chromatography.

Unit 4: Bioprospecting: History, types, collection of materials and processing. Preparation of extracts. Bioassay of antibacterial and antifungal activity. Compound identification using H+ NMR, C+NMR, GLC, HPLC and HPTLC, GCMS and LCMS.

Unit 5: Drug Designing: Patenting – conditions and significance; IPR, IPP. Drug research institutes/ pharmaceutical companies in India.

Phytoresources – collection, maintenance conservation, business and marketing.

COURSE OUTCOMES (CO)

1. Describe the structure, types and biological significance of carbohydrates, proteins & vitamins.
2. Describe the types, properties and importance of secondary metabolites.

3. Explain the principle, procedures and applications of separation techniques.
4. Explain the principle and construction of the instruments used for compound identification.
5. Explain the collection and conservation of plant resources.

Books for References:

1. Harborne, J.B. 1977. Phytochemical methods. Chapman and Hall, London.
2. Krishnamurthy, K.V. 1988. Methods in Plant Histochemisrty. Viswanathan Publishers, Madras.
3. Nirmala, A., Sarada, R., Eliza, J. and Daisy, P. (2007). A database for medicinal plants used in the treatment of diabetes and its secondary complications. Bioinformation 2 (1): 22-23 – www.autogenic filters.com/holycross/Home.html.
4. Stumpt, P.K. and Conn, E.E. (1990). The biochemistry of plants secondary plant products.

M.PHIL. BOTANY SYLLABUS

(For the candidates to be admitted from 2016 onwards) COURSE IV
(Elective) (d)APPLIED MOLECULAR BIOLOGY

Code: MPH16BO1E07 **Credits 4**

COURSE OBJECTIVE

1. Remember and understand the molecular life of living organisms
2. Understand and analyze the concept of Genomics
3. Remember and understand the types of human genetic diseases.
4. Understand and analyze the production of transgenic plants and animals

Unit 1: Molecular life - An Introduction for experimental proof of DNA and RNA as genetic material. Structure and function of DNA and RNA. Watson and Crick model of DNA and other forms of DNA (A and Z). Functions of DNA and RNA including Ribosomal DNA. Genetic engineering – objectives, tools of gene cloning.

Unit 2: Genomics – Scope and Importance, Genomic studies in - Rice and Human. Methods and applications of DNA fingerprinting, gene therapy, stem cell therapy, genetic counselling and ethical consideration.

Unit 3: Human genetic diseases – Types, Pedigree analysis , inheritance patterns. Diagnosis – non invasive and invasive methods. Antigens, antibodies- structure, function and types, monoclonal and polyclonal antibodies. Vaccines - edible vaccines

Unit 4:Transgenic plants and animals – Microinjection of DNA into fertilized eggs, Ti plasmid of Agrobacterium tumefaciens and their applications. Transgenic plants – for biochemical production, agrochemicals, medicines, cosmetics, food additives, enzymes, biopolymers and vitamins.

COURSE OUTCOMES (CO)

1. Explain the molecular life of living organisms
2. Explain the concepts of Genomics.
3. Describe the types of human genetic diseases.

4. Explian the production of transgenic plants and animals.

Books for References

1. Cummings, M.R. 1994. Human Heredity; Principles and issues. West Publishing company.
2. Epstein,R. J.2003.Human Molecular Biology. Cambridge Univ. Press. Cambridge
3. Joblinh, M.A. Hurles and Tyler- Smith. 2004. Human Evolutionary Genetics- Origin, people and disease. Garland and Science.
4. Khoury, M.J.J. Little and W. Burke. 2004. Human Genome Epidermiology. Oxford Univ. Press Oxford.
5. Moutulsky, V. 1977. Human Genetics. Springer and Verlag, Berlin
6. Strachan.T.and A.T.Reads. 2004. Human Molecular Genetics 3. Gardland Science, London.
7. Brown ,T.A.1995. Gene cloning: An introduction. Chapman and Hall, London.
8. Brown ,T.A.2007. Genomes 3. Gardland Science Publishing, London.