HOLY CROSS COLLEGE

(AUTONOMOUS)

Affiliated to Bharathidasan University

Nationally Accredited (4th Cycle) with 'A++' Grade (CGPA 3.75/4)by NAAC

College with Potential for Excellence

Tiruchirappalli - 620002.

SCHOOL OF LIFE SCIENCES

PG AND RESEARCH DEPARTMENT OF BOTANY PROGRAMME: B.SC. BOTANY

LEARNING OUTCOMES-BASED CURRICULUM FRAMEWORK (LOCF)

Program Outcomes

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 well being 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 utilise the microbes, plants and animals for human welfare, societal behaviour, disease diagnosis, system regulations and ancestry study
PO 9	Originate into a taxonomist, horticulturist, quality analyst, drug designer and scientist.

Program Specific Outcomes

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 arming, cultivation of mushroom, bio fertilizers and nutraceuticals to become professional and entrepreneurs.

HOLY CROSS COLLEGE (AUTONOMOUS), TIRUCHIRAPPALLI-2

SCHOOL OF LIFE SCIENCES

PG AND RESEARCH DEPARTMENT OF BOTANY

PROGRAMME: B.SC. BOTANY

COURSE STRUCTURE (I & II SEMESTER)

LEARNING OUTCOMES-BASED CURRICULUM FRAMEWORK (LOCF)

(For Candidates admitted from June 2021 onwards)

Sem.	Part	Course	Title of the paper	Course Code	Hrs/ Week	Credits	Marks
I	I	Language	Tamil paper I/ Hindi paper I / French paper 1	U21TL1TAM01/ U21HN1HIN01/ U21FR1FRE01	3	3	100
	II	English	General English I	U21EL1GEN01	3	3	100
	III	Major Core -1	Plant Diversity I	U21BO1MCT01	5	5	100
		Major Core -2	Microbiology and Plant Pathology	U21BO1MCT02	4	4	100
		Major Core – 3	Main Practical I	U21BO1MCP03	4	3	100
		Allied-1	Chemistry Paper - 1 (for Botany students)	U21CH1ALT01	4	2	100
	IV	Allied – 2	Chemistry Paper - 2 (for Botany students)	U21CH1ALP02	4	2	100
			Plant Physiology and Plant Biochemistry (Botany offering to Biochemistry)	U21BO1ALT02			
		Environmental studies	Environmental studies	U21RE1EST01	2	1	100
		Value Education	Bible/Catechism/Ethics	U21VE2LVE01/ U21VE2LVB01/ U21VE2LVC01	1		-
	VI	Extension Activities					-
		Extra Credit	Internship / Field Work / Field Project 30 Hours - Extra Credit	U21SP1ECC01		2	100
			Total		**30**	**23+2**	**800+100**
II	I	Language	Tamil paper II/ Hindi paper II / French paper II	U21TL2TAM02/ U21HN2HIN02/ U21FR2FRE02	3	3	100
	II	English	General English II	U21EL2GEN02	3	3	100
	III	Major Core – 4	Cell Biology and Biostatistics	U21BO2MCT04	5	4	100
		Major Core – 5	Horticulture and Plant Breeding	U21BO2MCT05	4	4	100
		Major Elective – 1	Course within School - Home Gardening and Nursery Maintenance/ Organic farming	U21BO2MET01/ U21BO2MET02	4	3	100
		Allied – 3	Chemistry Allied – III	U21CH2ALT03	4	2	100
		Major SBE – 1	MSBE - 1 - Techniques in Botany/Urban Gardening and Cultivation of Microgreens	U21BO2SBP01/ U21BO2SBT02	2	1	100
	IV	SBC – 2	Soft Skills Development	U21RE2SBT01	2	1	100
		SBC – 3	Sustainable Rural Development and Student Social Responsibility	U21RE2SBT02	2	1	
		Value Education	Bible/Catechism/Ethics	U21VE2LVB01/ U21VE2LVC01/ U21VE2LVE01	1	1	100

	V	Extension Activities					
		Extra Credit	Internship / Field Work / Field Project 30 Hours - Extra Credit	U21SP2ECC02		2	100
			Total		**30**	**23+2**	**900+100**

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

Course Title	MAJOR CORE 1- PLANT DIVERSITY – I
Code	U21BO1MCT01
Course type	Theory
Hours/Week	5 Hrs /Wk
Credits	5
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 organisation, 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 of fungi.
- To describe the morphology, reproduction and life cycle of fungi and its economic importance.
- To comprehend 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 food, fodder, medicine, pollution indicators and fertilizer.

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

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 Assignmentand Seminars.

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

Text Book:

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.

Suggested Reading:

1.Vashishta, B. R. 2010. Botany for degree students Algae. S. Chand and Company Ltd, New Delhi. 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.

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

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

igh 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
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	U21BO1MCT02
Course Type	Theory
Credits	4
Marks	100

CONSPECTUS

The students will be able to understand the history of microbiology, structure, nutrition and reproduction ofbacteria, 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's preservation 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 of Food microbiology and its relevance to everyday life. 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 poisoning and food intoxication. Food preservation methods: Physical and Chemical. Applications of food Microbiology.

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 (*Aspergillusoryzae*). 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 andbiochemical.

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 – red rot of sugarcane, early (Cercospora arachidicola) and late (Phaeoisariopsis personata)leaf spot of ground nut, 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.

Suggested Reading:

1. Tauro, P., Kapoor, K. K. and Yadav, K. S. 1997. An introduction to Microbiology. Wiley easternCompany 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.

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

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

Course Title	**MAJOR CORE – 3 - PRACTICAL PARER-1**
Code	**U21BO1MCP03**
Course type	**Practical**
Hours/Week	**4 Hrs /Wk**
Credits	**3**
Marks	**100**

CONSPECTUS

The students will able 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

1. To remember and understand the thallus organization, internal structure and reproduction of algae.
2. To recognize the internal structure and reproduction of fungi.
3. To understand the morphology of thallus & apothecium of *Usnea*.
4. To comprehend and study the growth pattern and cultivation techniques of bacteria & fungi and totest the quality of milk
5. To realize different types of plant diseases.

UNIT – I **12 Hrs**

Algae: Observation and identification of the algal forms: *Nostoc* filament, *Chlamydomonas, Chlorella* and *Volvox* coenobium with daughter colony, *Ulva*thallus, *Cladophora* filaments, *Caulerpa* thallus, *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 & 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 – red rot of sugarcane, early (*Cercospora arachidicola*) and late (*Phaeoisariopsis personata*) leaf spot of ground nut, bacterial disease – citrus canker and Bacterial wilt of Banana viral disease – tobacco mosaic and Vein clearing of Papaya.

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	Analyse the pest of bacterial, fungal and viral diseases of plants	K4

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	M	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	H	H	H
CO4	H	H	H

igh 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

First Year - Semester – I

Course Title	**ALLIED- PAPER II - PLANT PHYSIOLOGY AND PLANT BIOCHEMISTRY**
Total Hours	**60**
Hours/Week	**4 Hrs /Wk**
Code	**U21BO1ALT02**
Course Type	**Theory**
Credits	**2**
Marks	**100**

CONSEPECTUS

To enable the students to understand the basic structure of plant cell, metabolic processes in plants and the role ofdifferent biosynthetic pathways in plants.

COURSE OBJECTIVES

- To Remember and understand the general structure of plant cell and photosynthesis
- To Remember and understand the plant respiratory processes
- To Understand, apply and analyze the mechanism of nitrogen fixation by plants
- Remember and understand the different secondary metabolites of plants

Understand and apply the different stress biochemical processes in the higherplants

UNIT – I Plant cell and photosynthesis **12 hrs**

Structure and function of plant cell and cell organelles. Structure, types, properties and biological importance of carbohydrates. Photosynthesis – Photosynthetic apparatus, light reaction (cyclic and non - cyclic) and Dark reaction (Calvin cycle).

Extra reading (Key Words):Photosynthesis and Carbon assimilation

UNIT –II Respiration: **12 Hrs**

Overview of glycolysis, Regulation of plant glycolysis, Translocation of metabolites across mitochondrial membrane, TCA cycle, Mitochondrial Electron Transport chain in plants and its regulation.

Extra reading (Key Words): Alternative NAD(P)H oxidative pathways; Cyanide resistant respiration.

UNIT – III Nitrogen metabolism: **12 Hrs**

Biological nitrogen fixation by free living organisms and in symbiotic association; Structure and function of the enzyme nitrogenase. Nitrate assimilation: Nitrate and Nitrite reductase. Primary and secondary ammonia assimilation in plants by GS-GOGAT pathway.

Extra reading (Key Words): Urea cycle, Nitrogen metabolism in biomass production.

UNIT- IV Plant hormones and Secondary metabolites: **12 Hrs**

Plant hormones: Biosynthesis, storage, breakdown, transport and role of auxins, gibberllins, cytokinins, ethylene, abscissic acid. Properties and biological functions of Alkaloids, Phenols and terpenoids.

Extra reading (Key Words): Plant secondary metabolites as toxins.

UNIT – V Plant Stress Biochemistry: **12 Hrs**

Biochemical basis of abiotic stress – Osmosis (drought, salinity), Temperature – Heat stress. Defensemechanism of plants against disease attack (enzymes and phenols).

Extra reading (Key Words): Stress physiology, Cold stress

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

COURSE OUTCOMES (CO)

The learner will be able to

CO No.	Course Outcomes	PSOs Addressed	Cognitive Level
CO-1	Recall and relate the plant cell organelles, light and dark reactions	PSO 1, PSO 3	R, U
CO-2	Relate the photosynthetic process of light and dark reactions	PSO 1, PSO 3	U
CO-3	Explain the stages involved in the process of aerobic respiration	PSO 1, PSO 3	U
CO-4	Compare the process of nitrate assimilation	PSO 1, PSO 3	U, An
CO-5	Outline the mechanism of biological nitrogen fixation	PSO3	R, U
CO-6	Explain the secondary metabolites in plants	PSO 1, PSO 3	U
CO-6	Compare the secondary phytochemical compoundsin plants	PSO 1 PSO 6	U
CO-7	Explain the biochemical stressof plants	PSO 1	U
CO-8	Explain the biochemical defense mechanism in plants	PSO 1	U

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

Prescribed Books:

1. Verma, V. 1985. A text book of Plant Physiology. Emkay Publications, New Delhi.

2. Hans Walter Heldt and Birgit Piechulla, 2016. Plant Biochemistry. Academic Press.

Books for Reference:

1. Dey P M Et Al., 2013. Plant Biochemistry. Elsevier Science.

2. Sharma, P.D. 1992. Ecology and environment. Rastogi Publication, Meerut.

3. Pandey, B. P, 2010. College Botany. Vol. III. S. Chand and Company Ltd, New Delhi

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

igh 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
LEARNING OUTCOMES-BASED CURRICULUM FRAMEWORK (LOCF)
B.Sc. BOTANY
First Year - Semester – II

Course Title	MAJOR CORE – 4 - CELL BIOLOGY AND BIOSTATISTICS
Total Hours	75
Hours/Week	5 Hrs /Wk
Code	U21BO2MCT04
Course Type	Theory
Credits	4
Marks	100

CONSPECTUS

To enable the students understand the ultra structure of plant cell, its organelles, cell cycle, cell division and the structure of genetic material, fundamental ideas about the collection of data, significance of central tendency and interpretation of data and its applications.

COURSE OBJECTIVES

- To remember and understand the cell biology through the knowledge of cell theory,ultra structure of plant cell and its organelles.
- To understand and apply the knowledge of cell cycle and cell division, evaluate thechanges in the chromosome.
- To understand and analyse the structure of genetic material and the mechanism of DNAreplication.
- To remember, understand the collection, classification and presentation of data.
- To calculate the mean, median, mode, standard deviation and standard error.

UNIT – I Cell Biology: **15hrs**

Cell theory. Structure and functions of cell wall, plasma membrane- fluid mosaic model. Ultra structure and functions of cell organelles – chloroplast, mitochondria, endoplasmic reticulum, golgi complex, ribosomes (70s and 80s). Ultrastructure of nucleus–nuclear envelope, nucleolus, chromatin reticulum, Cell inclusions (non-living).

Extra reading /Key Words: *Lysosomes, sphaerosomes*

UNIT – II Cell cycle and Cell division: **15hrs**

Cell Cycle. Cell division – mitosis, meiosis and their significance. Ultra structure and functions ofchromosomes. Changes in the chromosome – structure, number and their genetic effects. Euchromatin and Heterochromatin. Giant chromosomes – salivary and lampbrush.. Mutation- types of mutation.

Extra reading /Key Words: *Genetical disorders, causes of mutation*

UNIT – III Structure of genetic material: **15hrs**

Structure and organization of DNA double helix (Watson and Crick model). DNA replication- semi-conservative replication mechanism. Proof for DNA (A.D. Hershey and M.H. Chase), structure of RNA and its types, RNA as genetic material (Fraenkel Conrat and Stanley in TMV). and Central Dogma of Biology

Extra reading /Key Words: *Nucleosome concept, Nucleosynthesis*

UNIT – IV Introduction to Biostatistics: **15hrs**

Biostatistics – introduction – Scope and importance. Collection and classification of data. Presentation of data – Tabular, graphical and diagrammatic representation – Bar diagram,Histogram, frequency curve, frequency polygon and Ogive curve.

Extra reading /Key Words: *Questionnaire preparation, Bio-statistical tools*

UNIT – V Bio-statistical methods **15hrs**

Measures of central tendencies – mean, median and mode. Measures of dispersion – Range, standard deviation. Standard error and Co-efficient of variation. Basic principles of probability.

Extra reading /Key Words: *Correlation, Regression*

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 structure of cell wall, plasma membrane, DNA, RNA, methods of data collection, presentation and basic principles of probability.	K1
CO-2	Discuss the chemical composition of cell wall, cell organelles, central dogma of biology and compare the stages of mitotic and meiotic cycle, graphical and diagrammatic representation of data.	K2
CO 3	Illustrate the cell organelles, identify cell inclusions, giant chromosomes and different forms of DNA and RNA, classify the primary and secondary data, calculate the measures of central tendencies.	K3
CO-4	Examine the cell organelles and analyse its functions, changes in chromosome structure and number, investigate DNA and RNA as genetic material, categorize data and plot various types of graphs, analyse the measures of dispersion.	K4

Text Books:

1. Sundarajan, S. 2000. Cytogenetics. Anmol publications pvt. Ltd., New Delhi.

2. Arumugam, N. 2016. Cell biology and Molecular Biology. Saras publications, Tamil Nadu, India.

3. Gupta, P. K. 2016. Cytology, Genetics and Evolution. Rastogi publications, Meerut.

4. Ramakrishnan, P. Biostatistics. 2006. Saras publications, Tamil Nadu, India.

Suggested Readings:

1. Satguru Prasad. 1992. Fundamentals of Biostatistics. Emkay publications, New Delhi.

2. De Robertis. 2017. Cell And Molecular Biology. 2017. 8Ed .

3. Bruce, A., Alexander, J., Karen, H., Martin, R., Keith R., Julian, L. Peter, W.2019.Essential Cell Biology (5th International Student Edition).WWW .Norton & Company. London.

4. Wayne W. Daniel., Chad L. Cross.2014. Biostatistics: Basic Concepts and Methodology for the Health Sciences, 10Ed,

Web References:

1. https://en.wikipedia.org/wiki/Cell_(biology)`
2. https://www.britannica.com/science/cell-biology
3. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3165433
4. https://www.uou.ac.in/sites/default/files/slm/BSCZO-102.pdf

Mapping:

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

H-High M-Moderate L-Low

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

igh 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
First Year - Semester – II

Course Title	**MAJOR CORE – 5 - HORTICULTURE AND PLANT BREEDING**
Total Hours	**60**
Hours/Week	**4 Hrs /Wk**
Code	**U21BO2MCT05**
Course Type	**Theory**
Credits	**4**
Marks	**100**

CONSPECTUS

To enable the students to learn about the scope, importance of horticulture and propagation of plants. Considerable emphasis is given on plant propagation practices and management, conventional methods of plant breeding, role of hybridization, mutation and polyploidy in plant breeding.

COURSE OBJECTIVES

- Understand and apply the types of horticultural crops and propagation
- Understand and apply the plant propagation practices of horticultural crops
- Remember the growth and development of horticultural crops
- Remember, understand and analyse the objectives, selection methods and techniques in plant breeding

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 breeding: **12 hrs**

Introduction and objectives of plant breeding. A brief study of the selection methods (mass, clonal and pure line) in plant breeding. Principles and techniques in plant breeding. Hybridization – types and procedure. Heterosis – definition, theories of heterosis and importance.

Extra reading/Key words: *Organic breeding, plant domestication*

UNIT – V Plant breeding: **12 hrs**

Polyploidy types. Role of mutation and polyploidy in plant breeding. Anther culture and its role in hybridization. Embryo rescue techniques. Artificial seed production. Organizations for crop improvement in India – ICAR ,IARI ,CRRI.

Extra reading/ key words: *Gamma garden, somatic hybridization*

COURSE OUTCOMES (CO)

The learner will be able to

CO No.	**Course Outcomes**	**Cognitive Level**
CO-1	Describe the horticultural zones in India, tools and implements, growth and development of horticultural crops, write the principles and techniques of plant breeding, role of mutation and polyploidy in plant breeding	K1
CO-2	Discuss the scope and importance of horticulture and objectives of plant breeding; compare the physiological disorders of fruits and vegetables. Explain the role of plant breeding organizations in India	K2
CO 3	Classify the types of crop regulation, propagation, asexual propagation and types of hybridization, compile the post harvesting technology in horticulture, and apply the culture of bonsai.	K3
CO-4	Analyse application of the nutrients, preparation of nursery bed, seed treatment, post harvest in horticulture crops, categorize the different types of selection methods and polyploidy	K4

Text Books:

- Mani Bhusahan Rao, K.1991. Text book of Horticulture-MacMillan India Ltd., Madras.
- Arumugam, N. and Kumaresan, V.2010. Fundamentals of horticulture and Plant breeding.Saras Publications.
- Manibhushan Rao, K. 2002. Textbook of Horticulture, Laxmi Publications; Second edition.
- John E. Preece, Paul E. Read, 2004. The Biology of Horticulture: An Introductory Textbook, 2nd Edition

Books for Reference:

- Edmond J.B., Senn, T.L. and Andrews, F.S. 1964 Fundamentals of Horticulture- Tata Mc Graw –Hill Publishing Company Ltd., New Delhi.
- Peter M. and Tessa Eve. 2007. Garden planning and Garden design. South water Publishing.London.
- Prasad and Kumar, 2014. Principles of Horticulture 2nd Edn. Agrobios (India).
- Neeraj Pratap Singh, 2005. Basic concepts of Fruit Science 1st Edn. IBDC Publishers.
- Kausal Kumar Misra and Rajesh Kumar, 2014. Fundamentals of Horticulture Biotech Books.

Web Reference

- https://www.canr.msu.edu/resources/asexual-propagation
- http://ecoursesonline.iasri.res.in/course/view.php?id=164
- https://www.biologydiscussion.com/crops/improvement/crop-improvement-selection-methods-with-diagram/17663
- http://www.agrilearner.com/classification-horticultural-crops/

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

igh 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 OFBOTANY
LEARNING OUTCOMES-BASED CURRICULUM FRAMEWORK (LOCF)
B.Sc. BOTANY
First Year - Semester – II

Course Title	**ME- 1 - HOME GARDENING AND NURSERY MAINTENANCE**
Total Hours	**60**
Hours/Week	**4 Hrs /Wk**
Code	**U21BO2MET01**
Course Type	**Theory cum Lab**
Credits	**3**
Marks	**100**

CONSPECTUS

To enable the students learn about cultivation of plants at different conditions, propagation of plants by various methods, laying of kitchen garden and ornamental garden. Considerable emphasisis also given to 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

- To understand the propagation structures and apply the different types of establishment methods and maintenance of of plants for nursery.
- To apply the vegetative propagation methods of plants for gardening
- To study and apply the various methods of cultivation of vegetable and fruit plants and kitchen garden and its establishment
- To Understand and apply the formation of ornamental gardern, rockery and terrace garden

UNIT – I: **12hrs.**

Establishment & maintenance of nursery, cultivation of potted plants, bonsai culture, Propagation structures; green house, glass house, cloth house, plastic house, mist chamber, cold frames, hot beds; Nursery (tools & implements; Flower arrangements – dry and fresh flower arrangements.

Lab exercise: Preparation of potting mix for home garden and nursery.

Extra reading/Key words: *Modern Bonsai, Bonsai Artist*

UNIT-II: **12hrs.**

Preparation of soil, home manures from vegetable waste, compost and fertilizers. Propagation of plants by seeds, vegetative propagation – cutting (Hibiscus & Rose), layering (Jasmine) & grafting (Rose & Ixora).

Lab exercise: Vegetative propagation – cutting (Hibiscus), layering (Jasmine) & grafting (Rose).

Extra reading/Key words: *Hydroponics, Sphagnum mass*

UNIT-III: **12hrs.**

Kitchen garden, lay outs and garden designing. Classification of vegetables, cultivation of tropical vegetables – Leafy vegetable – *Amaranthus*, Root vegetable –Radish, Fruit vegetable – Brinjal & Lady's finger. Cultivation of fruits- Banana and Citrus. Post harvest management practices of fresh vegetables.

Lab exercise: Cultivation of microgreens.

Extra reading/Key words: *Healthy lawns, Landscape design*

UNIT-IV: **12hrs.**

Ornamental garden: Layout and establishment, Construction and Maintenance of Home garden, rockery garden and terrace garden. Floriculture - Production, Management and marketing.

Lab exercise: Construction and Maintenance of rockery garden.

Extra reading/Key words: *Mulching, Pruning*

UNIT-V: **12hrs.**

Role of hormones in horticulture. Importance of post harvesting technology. Management of common diseases in horticultural crops. Horticultural organizations: IIHR, NHB, NHM.

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

COURSE OUTCOMES (CO)

CO No.	Course Outcomes	Cognitive Level
CO-1	Explain various methods of cultivation and propagation of plants, vegetables and fruits, describe floriculture, role of hormones and organizations in horticulture.	K1
CO-2	Discuss the maintenance of nursery and home garden, production of home manure and fresh vegetables and management of common diseases in horticultural crops.	K2
CO-3	Compare green house and glass house; propagation method of leafy and root vegetables, apply cutting, layering and grafting techniques in home garden and terrace garden.	K3
CO-4	Analyze the various methods of cultivation of plants, production and processing of home manure from vegetable waste, kitchen garden and ornamental garden, analyze the effect of hormones in horticulture.	K4

Text Books:

1. Mani Bhusahan 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. Yumanm somi and Singh, 2017. Text book of Horticulture. Singh, Yumanm Somi *et al* Publications.
4. Vijay K. Agarwal and Prabha Parkava, 2019. Text book of Home Gardening. Pustak Mahal Publications.
5. Tommy Solomon and Cloe Wylie, 2020. Landscaping and Home gardening. Kindle Edition.
6. Sharma B.B,2010. A Guide to Home Gardening. Publications Division Ministry of Information & Broadcasting

Suggested Reading:

1. Edmond J.B., Senn, T.L. and Andrews, F.S. 1964 Fundamentals of Horticulture- Tata McGraw –Hill Publishing Compani Ltd., New Delhi.
2. Peter M. and Tessa Eve. 2007.Garden planning and Garden design. Southwater Publishing.London.

Web References:

1. https://nmpb.nic.in/content/medicinal-plants-cultivation
2. https://www.thoughtco.com/vegetative-propagation-4138604
3. https://www.gardentech.com/blog/gardening-and-healthy-living/8-easy-to-grow-fruits-and-veggies
4. http://www.gardeninginfozone.com/planning-and-building-a-rockery-garden
5. https://agritech.tnau.ac.in

PO & CO Mapping

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9
CO 1	H	M	M	M	H	H	M	M	H
CO 2	M	H	M	M	H	H	M	M	H
CO 3	M	H	H	M	H	H	M	M	H
CO 4	H	M	H	M	H	H	M	M	H

H-High M- Moderate L-Low

PSO & CO Mapping

CO/PSO	PSO 1	PSO 2	PSO 3
CO 1	H	M	H
CO 2	H	M	H
CO 3	H	M	H
CO 4	H	M	H

igh 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
First Year - Semester – II

Course Title	ME – 2 - ORGANIC FARMING
Total Hours	60
Hours/Week	4 Hrs /Wk
Code	U21BO2MET02
Course Type	Theory
Credits	3
Marks	100

CONSPECTUS

To enable the students to understand the components in Organic farming, its nutrients and its importance in human life, Worldwide and regional practices regarding organic farming, uses and policies related to organic farming.

COURSE OBJECTIVES

- To understand the basic principles behind the origin and importance of organic farming practices and need of the hour
- To analyze the models and type of organic farming practices prevailing Nationally and Internationally and its advantages and disadvantages.
- To remember the preparation of nutrients and apply in the soil for organic farming with the available resources.
- To understand the standards and agencies meant for organic farming and the health benefits of food products
- To understand and apply the organic certification process and its application in biol

UNIT – I Principles of Organic Farming **12hrs.**

The Basis of Farming- Aim,Principle and objectives. Soil types:- Alluvial, Laterite, Clay, and Loam. Difference between Soil fertility and crop productivity . Agriculture and Climate change. Differences in Life style. Forest and Agriculture – The attitude towards farming and organic Farming concept.

Extra reading /Key Words: *Diseases related to farming practices*

UNIT – II Models and types of Organic farming **12hrs.**

Organic Farming Models - Natural Farming - Fukuoka-Japan, Australian Organic Farming, Ecological Farming Palekar Model. Types of Organic farming – Pure organic farming, Integrated farming system and Mixed farming system, its definition concept and benefits. Advantages and disadvantages.

Extra reading /Key Words: *Zero budgeting organic farm* **12hrs**

UNIT – III Nutrients and soil preparation for Organic farming

Sources of nutrients - Organic Manure –FYM/Rural compost, City compost, Oil cakes, Animal wastes, and Vermi composts. Green Manure – Leguminous crops in crop rotation. *In-situ* incorporation of crop residues. Liquid Manure. Bio fertilizers and their use as nutrients. Soil preparation, soil and water conservation strategies.

Extra reading /Key Words: *Detrimental effects of chemicals in farming*

UNIT – IV Crops for organic farming and marketing **12hrs**.

Indigenous Crops – Selection & Processing, Food Crops , Cash Crops, Mono crops,Mixed Crops, Herbs and Spices. Income generation activities: Apiculture, Mushroom production, Terrace farming. Vertical gardens. Marketing, Imports and exports, Policies and incentives of Organic production.

Extra reading /Key Words: *Integrated pest management, domestic certification.*

UNIT – V – Maintenance of Standards and Agencies of Organic farming **12hrs.**

Farm inspection and certification, National and International level Agencies and institutions related to organic farming. Indian National Standards for organic products. Organic Food Quality and Human Health. Food Safety and Food Policy.

Extra reading /Key Words*: Food safety act, IFOAM*

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

CO No.	Course Outcomes	Cognitive Level
CO-1	Describe the principle of organic farming,objectives,Advantages and disadvantages of organic farming models,organic manure,liquid manure,Indigenous crops-selection and processing,farm inspection and certification.	K1
CO-2	Differentiate between soil fertility and crop productivity,Integrated farming and mixed farming,mono crops and cash crops,National and International level agencies and institutions related to organic farming.Explain the models and types of organic farming practice.	K2
CO-3	Apply the techniques of apiculture and mushroom production,Terrace farming,Vertical garden,food safety and food policy.	K3
CO-4	Analyze the quality of soil preparation,organic food,,application of green manures in leguminous crops,Marketing imports and exports.	K4

Text Books:

1.Bavec, F. and Bavec, M. (2007). Organic Production and Use of Alternative Crops.CRC Press, Boca Raton, FL.

2.Joshi, M., Setty, T.K.P. and Prabhakarasetty (2006). Sustainability through Organic farming.1st Edition.Kalyani Publishers, Ludhiana, India.

3.Lampkin Nicolas.1990.Organic Farming. The University of Wisconsin – Madison. Farming Press.

4.Altieri Miguel**.** 1987. Agroecology: The Scientific Basis of Alternative Agriculture. Westview Press. Boulder, CO.

Suggested Reading:

1.Soule, Judith D. and Piper, Jon K. 1992. Farming in Nature's Image: An Ecological Approach to Agriculture**.**Island Press, Washington, D. C.

2.Masanobu Fukuoka.1985.Natural Way of Farming: The Theory and Practice of Green Philosophy.

3. Peter V. Fossel.2014.Organic Farming: How to Raise, Certify, and Market Organic Crops and Livestock.

Web References:

1.https://en.wikipedia.org › wiki › Organic_farming
2.https://agritech.tnau.ac.in › orgfarm_introduction
3.https://www.conserve-energy-future.com › organic-far..
4. http://www.omafra.gov.on.ca › english › crops › facts

Mapping:

PO & CO Mapping

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	H	H	M	H	M	M	H	H	M
CO2	H	H	M	H	H	M	H	M	M
CO3	H	H	M	M	H	L	H	H	H
CO4	H	H	H	H	H	M	H	H	M

H-High M-Moderate L-Low

PSO & CO Mapping

CO/PSO	**PSO1**	**PSO2**	**PSO3**
CO1	H	M	M
CO2	H	H	M
CO3	H	H	H
CO4	H	M	H

igh 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
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	**U21BO2SBP01**
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)- The learner will be able to

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

Prescribed 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.

Books for Reference:

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.

Mapping

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

igh M-Moderate L-Low

CO/PSO	PSO 1	PSO2	PSO3
CO 1	H	H	H
CO2	M	H	H
CO3	H	M	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-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	U20BO2SBT02
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

The learner will be able to

- 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 benefits of Microgreens.

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

Note: Texts given in the Extra reading /Key words must be tested only throughAssignment 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 formicrogreens	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

Prescribed 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.

Books for Reference:

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 Mapping

2. https://dengarden.com/gardening/Growing-and-selling-Microgreens-An-example-of-a-commercial-urban-agriculture-operation

3. https://instagreen.eu/

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

H-High M-Moderate L-Low

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

H-High M-Moderate L-Low

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.

SCHOOL OF LIFE SCIENCES

PG AND RESEARCH DEPARTMENT OF BOTANY
PROGRAMME: B.SC. BOTANY

PO No.	*Upon completion of the B.Sc. Degree Programme, the graduate will be able to*
PO-1	Obtain quality education in the basic areas of Botany
PO-2	Acquire practical skills to gather information, assess, create and execute new ideas to develop entrepreneurial skills
PO-3	Receive training in pedagogy, research skills and methodology
PO-4	Develop a local, regional, national and international perspective and be competent enough in the area of plant science, genetic engineering and nanotechnology
PO-5	Learn to respect and conserve nature and the environment
PO-6	Identify the angiosperms by applying keys
PO-7	Learn the basic principles of food science

Programme Outcomes:

Programme Specific Outcomes:

PSO No.	*Upon completion of these courses the student would*
PSO-1	Acquire academic excellence with an aptitude for higher studies, research and to meet competitive exams
PSO-2	Become aware about plant diversity and its conservation through plant tissue Culture
PSO-3	Obtain Knowledge in the internal structure and functions of various plant components, inheritance of characters and techniques of plant breeding
PSO-4	Apply statistical skills and analyze the biological data
PSO-5	Acquire knowledge on traditional herbal plants for common ailments and aware of nutritive plant foods
PSO-6	Obtain Knowledge through taxonomical studies will help them to emerge as fundamental taxonomists
PSO-7	Acquire knowledge on food preservation, food additives and food laws
PSO-8	Analyze the phytoconstituents of plants and plant drug adulteration

HOLY CROSS COLLEGE (AUTONOMOUS), TIRUCHIRAPPALLI-2
SCHOOL OF LIFE SCIENCES
PG AND RESEARCH DEPARTMENT OF BOTANYPROGRAMME: B.SC. BOTANY
COURSE STRUCTURE (III & IV SEMESTER) – CBCS
(For Candidates admitted from June 2020 onwards)

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	U20TL3TAM03/ U20HN3HIN03/ U20FR3FRE03	3	3	100
	II	English	General English I	U20EL1GEN03	3	3	100
	III	Major Core -6	MC-6 Plant Diversity II	U20BO3MCT06	5	5	100
		Major Core -7	MC-7 Plant Anatomy	U20BO3MCT07	4	3	100
		Major Core – 8	Main Practical- II	U20BO3MCP08	4	3	100
		Major Elective-1	Home Gardening and Nursery Maintenance/Organic Farming(Course Outside School)	U20B03MET01/ U20BO3MET02	4	2	100
		Allied-4	Paper I -Plant Diversity, Taxonomy,Anatomy, Embryology, Ecology and Physiology	U20BO3ALT01	4	2	100
	IV	NME	NME – 1 Food Science & Technology	U20BO3NMT01	3	2	100
		MSBE –II (Star College paper)	MSBE - 2 - Botanical Techniques for Chemistry/ Botanical Techniques for Physics	U20BO3SBP03/ U20BO3SBP04	2	1	100
		Gender	Gender Studies	U20WS3GST01	1	1	100
		Value Education	Bible/Catechism/Ethics	U20VE3LVE02/ U20VE3LVB02/ U20VE3LVC02	1		-
	VI	Extension Activities					-
		Extra Credit	Internship / Field Work / Field Project 30 Hours - Extra Credit	U20SP3ECC03		2	100
			Total		**30+4**	**23+2+3**	**900+100+100**
IV	I	Language	Tamil paper II/ Hindi paper II / French paper II	U20TL4TAM04/ U20HN4HIN04/ U20FR4FRE04	3	3	100
	II	English	General English II	U20EL4GEN04	3	3	100
	III	Major Core – 9	Embryology & seed Technology	U20BO4MCT09	4	4	100
		Major Core – 10	Phytogeography & Forestry	U20BO4MCT10	4	4	100
		Major Elective – 2	Course within School - Phytomedicine /Biofertilizer	U20BO4MET03/ U20BO4MET04	4	3	100
		Allied - 5	Paper-II Bioprospecting and Plant Biotechnology	U20BO4ALT02	4	2	100
		Allied - 6	Paper-III.Practical-1	U20BO4ALP06	4	2	100
		NME- 2	Herbal Remedies	U20BO4NMT02	3	2	100
		Value Education	Bible/Catechism/Ethics	U20VE4LVB02/ U20VE4LVC02/ U20VE4LVE02	1	1	100
	V	Extension Activities					

		Extra Credit	Internship / Field Work / Field Project 30 Hours - Extra Credit	U20SP4ECC04		2	100
			Total		**30**	**24+2**	**900+100**

(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 – III

Course Title	**MAJOR CORE 6- PLANT DIVERSITY – II**
Total Hours	**75**
Hours/Week	**5 Hrs /Wk**
Code	**U20BO3MCT06**
Course Type	**Theory**
Credits	**5**
Marks	**100**

GENERAL OBJECTIVE

To enable the students to understand the classification, morphology, structure, reproduction and life cycle of Bryophytes, Pteridophytes and Gymnosperms.

COURSE OBJECTIVES

The learner will be able to

CO No.	Course Objectives
CO-1	Remember and understand the classification, structure and reproduction, ecology and economic importance of the main classes of bryophytes.
CO-2	Classify the pteridophytes by their characteristic features.
CO-3	Remember and understand the stelar evolution, types of fossils, geological time scale and apply the economic importance of pteridophytes.
CO-4	Remember and understand the salient features of Gymnosperm morphology and reproductive characters of important genus of gymnosperm.
CO-5	Understand the significance of 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: *Comparative study of gametophyte and sporophyte, spore dispersal*

UNIT–II Pteridophytes **15 Hrs**

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

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

UNIT–III Pteridophytes **15 Hrs**

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

Extra reading/Key words: *Phytoremediation, environmental fluctuations*

UNIT–IV Gymnosperms **15 Hrs**

Classification of gymnosperms (K.R.Sporne, 1965). Salient features of main classes of gymnosperms. Morphology, structure and reproduction 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- Metasequia, Zoidogamy 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	PSOs Addressed	Cognitive Level
CO-1	Explain the classification, structure and reproduction of the main classes of bryophytes.	PSO-1, PSO-3	R, U
CO-2	List the economic importance of bryophytes.	PSO-1	R
CO-3	Classify the pteridophytes by their charecteristic features	PSO-1	U, Ap
CO-4	Describe the stelar evolution, types of fossils, geological time scale	PSO-1, PSO-3	R, U
CO-5	List the economic importance of Pteridophytes	PSO-1	R
CO-6	Discuss the salient features of Gymnosperm morphology	PSO-1, PSO-3	U
CO-7	Illustrate the reproductive characters of important genus of gymnosperm	PSO-1, PSO-3	R, U
CO-8	Explain the significance of important genus of fossil gymnosperm	PSO-1	R, U
CO-9	Develop the Employability skills by learning the life cycle patterns of Bryophytes, Pteridophytes and Gymnosperms	PSO-1	C

Prescribed 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.

Books for Reference:

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.

(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
First Year - Semester – III

Course Title	**MAJOR CORE – 7 PLANT ANATOMY**
Total Hours	**60**
Hours/Week	**4 Hrs/Wk**
Code	**U20BO3MCT07**
Course Type	**Theory**
Credits	**3**
Marks	**100**

GENERAL OBJECTIVE

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

The learner will be able to

CO No.	Course Objectives
CO-1	Remember and understand knowledge of plant anatomy through tissue systems and analyze the structure of stomata, sclereid, raphide and laticifers.
CO-2	Understand and analyze the structure of root, shoot and nodal types of dicot plants.
CO-3	Remember and understand the knowledge of anatomy of floral parts and wood.
CO- 4	Remember and understand the adaptive anatomical features of xerophyte, halophyte, hydrophyte and epiphyte.
CO- 5	Remember and understand the concepts of anatomy in relation to taxonomy and wood anatomy in relation to taxonomy

UNIT – I Plant Tissue systems: **12hrs**

Tissue systems in plants: Introduction of various tissue systems in plants. Simple and complex tissues. Meristems – characteristics of meristem, classification based on origin, position and function. Developmental anatomy: Organisation and importance of Shoot apex (Tunica Corpus theory) and Root apex (Korper – Kappe theory). Microscopic studies on the distribution, structure, types and functions of stomata (dicots and monocots), epidermal hairs, sclereids, raphides (*Colocasia*), cystolith (*Ficus* leaf) and starch grains (rice). Laticifers: Distribution, structure and types.

Extra reading /Key Words: *Origin of root, Origin of shoot*

UNIT-II: Anatomy of vegetative parts: **12hrs**

Study of the primary structure of dicot stem (*Vernonia*)**,** root (*Cicer*), leaf (Sunflower), monocot stem (*Bambusa*) and root (*Canna*). Nodal types of dicot plants - Uni, tri and multi lacunar. Study of normal secondary growth in dicot stem and root (*Vernonia*). Study of Anomalous secondary growth in the dicot stem of *Bignonia* and *Boerhaavia* and anomalous structure of *Nyctanthes, Aristolochia* stem.

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

UNIT – III Anatomy of floral parts and wood: **12hrs**

Floral meristem and ontogeny of floral parts. Vascular anatomy. Structure of wood, early and late wood, tyloses, sap wood – heart wood transition, development and composition of periderm, rhizoderm and lenticels. Properties of wood -physical, chemical & mechanical. Processing & seasoning of wood. Commercial uses of woods.

Extra reading /Key Words: *Determinate inflorescence, Endothelium*

UNIT – IV: Ecological anatomy: **12hrs**

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.

Extra reading /Key Words: *Phyllode, Phylloclade*

UNIT – V: Applied plant anatomy: **12hrs**

Anatomy in relation to taxonomy-hairs, stomata, epidermal cells and hypoderm, sclerenchyma of pericycle, medullary rays, bicollateral bundles and secondary thickening. Wood anatomy in relation to taxonomy-vessels, parenchyma, rays, fibres and intercellular canals. Applications of anatomical studies in climatology, pharmacognosy, forensic science and archaeology.

Extra reading /Key Words: *Differences between protophloem and metaphloem, Apomixis*

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	Explain the tissue systems, structure of stomata, sclereid, raphide and laticifers.	PSO 1 PSO 3	R, U
CO-2	Describe the structure of root, shoot and nodal types of dicot plants.	PSO 1 PSO 3	R, U
CO-3	Illustrate the anamolous structure of *Bignonia* stem.	PSO 1 PSO 3	R, U
CO-4	Illustrate the anamolous structure of *Nyctanthes* stem.	PSO 1 PSO 3	R, U
CO-5	Discuss the floral meristem and its ontogeny.	PSO 1 PSO 3	R, U
CO-6	Explain the properties of wood.	PSO 1 PSO 3	R, U
CO-7	Describe the anatomical features of -*Cuscuta* haustoria and *Rhizophora* stem.	PSO 1 PSO 3	R, U
CO-8	Explain the structure of *Vanda* root.	PSO 1 PSO 2 PSO 5	R, U
CO-9	Discuss the concept of anatomy in relation to taxonomy.	PSO 1 PSO 2 PSO 5	R, U
CO-10	Develop the employability skills by learning the application of anatomical studies in climatology, pharmacognosy, forensic science, archaeology.	PSO-1	C

Prescribed 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.

Books for Reference:

1. Cutter, E. G. 1978. Anatomy part I – The English Language Book Society and EdwardArnolds Ltd. London.
2. Eames, A. J. and Mac Daniels, l. H. 1947. An introduction to plant Anatomy. MC Grawand Hill Book Company, INC., New York, London.
3.Varghese, T. M. An Introduction to the Anatomy of Angiosperms. Allied Publishers,
4.Richard Crang**,** Lyons, Shiels and Robert 2018. Plant Anatomy - A Concept-

BasedApproach to the Structure of Seed Plants, Springer.

(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 – III

Course Title	**MAJOR CORE 8- MAIN PRACTICAL-1I**
Total Hours	**60**
Hours/Week	**4 Hrs /Wk**
Code	**U20BO3MCP08**
Course Type	**Practical**
Credits	**3**
Marks	**100**

GENERAL OBJECTIVE

To enable the students to understand thallus organization, internal and the reproductive structures of algae, fungi, lichen, bryophytes, pteridophytes and gymnosperms.

COURSE OBJECTIVES
The learner will be able to

CO No.	Course Objectives
CO-1	Understand the morphology of thallus and structure of bryophytes
CO-2	Remember and understand the morphology, anatomy and reproductive structures of pteridophytes and fossil forms.
CO-3	Understand the morphology and anatomical features in Gymnosperms.
CO-4	Understand and analyze the structure of stomata types and the root, shoot of dicot plants.
CO-5	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* and *Calamites*.

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*)**,** Monocot stem (*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, Aristolochia* stem. 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	PSOs Addressed	Cognitive Level
CO-1	Observe and identify the morphological structure of bryophytes	PSO-1, PSO-3	R, U
CO-2	Describe the morphology, anatomy and reproductive structures of Pteridophytes	PSO-1, PSO-3	R
CO-3	Examine the structure of stem of *Rhynia* and *Calamites*.	PSO-1, PSO-3	U
CO-4	Illustrate the morphological and anatomical structures of gymnosperms	PSO-1, PSO-3	R, U
CO-5	Develop the practical skills by observing the morphological, anatomical and reproductive structures of	PSO-3	R

	plant diversity-II		
CO-6	Describe the structure of stomata of dicot plants	PSO-1, PSO-3	U
CO-7	Describe the microscopical study of epidermal hairs, sclereids and starch grains	PSO-1, PSO-3	R, U

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

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

PG AND RESEARCH DEPARTMENT OF BOTANY

CHOICE BASED CREDIT SYSTEM B.Sc. BOTANY

First Year - Semester – II

Course Title	**ME- 1 - HOME GARDENING AND NURSERY MAINTENANCE**
Total Hours	**60**
Hours/Week	**4 Hrs /Wk**
Code	**U20BO2MET01**
Course Type	**Theory cum Lab**
Credits	**3**
Marks	**100**

GENERAL OBJECTIVE

To enable the students learn about cultivation of plants at different conditions, propagation of plants by various methods, laying of kitchen garden and ornamental garden. Considerable emphasisis also given to 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 and flower arrangements
CO-2	Understand and apply the vegetative propagation methods 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 and Production methodology of floriculture
CO- 5	Remember the role of growth hormones in horticulture, importance of post harvesting techniques, common diseases and different horticultural organizations.

UNIT – I: **12hrs.**

Establishment & maintenance of nursery, cultivation of potted plants, bonsai culture, Propagation structures; green house, glass house, cloth house, plastic house, mist chamber, cold frames, hot beds; Nursery (tools & implements; Flower arrangements – dry and fresh flower arrangements.

Extra reading/Key words: *Modern Bonsai, Bonsai Artist*

UNIT-II: **12hrs.**

Preparation of soil, home manures from vegetable waste, compost and fertilizers. Propagation of plants by seeds, vegetative propagation – cutting (Hibiscus & Rose), layering (Jasmine) & grafting (Rose & Ixora).

Extra reading/Key words: *Hydroponics, Sphagnum mass*

UNIT-III: **12hrs.**

Kitchen garden, lay outs and garden designing. Classification of vegetables, cultivation of tropical vegetables – Leafy vegetable – *Alternanthera*, Root vegetable –Radish, Fruit vegetable – Brinjal & Lady's finger. Cultivation of fruits- Banana and Citrus. Post harvest management practices of fresh vegetables.

Extra reading/Key words: *Healthy lawns, Landscape design*

UNIT-IV: **12hrs.**

Ornamental garden: Layout and establishment, Construction and Maintenance of Home garden, rockery garden and terrace garden. Floriculture - Production, Management and marketing.

Extra reading/Key words: *Mulching, Pruning*

UNIT-V: **12hrs.**

Role of hormones in horticulture. Importance of post harvesting technology. Management of common diseases in horticultural crops. Horticultural organizations: IIHR, NHB, NHM.

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

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

COURSE OUTCOMES (CO)

The learner will be able to

CO No.	Course Outcomes	PSOs Addressed	Cognitive Level
CO-1	Discuss the steps involved in the establishment of nursery and the propagating structures	PSO3, PSO5	Ap
CO-2	Differentiate the various types of flower arrangements	PSO3, PSO5	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 the various culture methods of fruits and vegetables	PSO 3, PSO 5	U, Ap
CO-6	Explain the method of establishing ornamental garden	PSO 5	R,U
CO-7	Explain the production methodology of floriculture technology	PSO 5	U, Ap
CO-8	Discuss the construction and maintenance of home garden.	PSO 3, PSO 5	U, Ap
CO-9	Describe the importance of Post harvesting technology in horticultural crops	PSO 3, PSO 5	U, Ap
CO-10	Discuss the role of Horticultural organizations	PSO 3, PSO 5	U, Ap
CO-11	Discuss the common diseases in horticultural crops	PSO 3, PSO 5	U, Ap

Prescribed Books:

1. Mani Bhusahan 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.

Books for Reference:

1. Edmond J.B., Senn, T.L. and Andrews, F.S. 1964 Fundamentals of Horticulture- Tata McGraw –Hill Publishing Compani Ltd., New Delhi.
2. Peter M. and Tessa Eve. 2007.Garden planning and Garden design. Southwater Publishing.London.

(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
First Year - Semester – II

Course Title	**ME – 2 - ORGANIC FARMING**
Total Hours	**60**
Hours/Week	**4 Hrs /Wk**
Code	**U20BO2MET02**
Course Type	**Theory**
Credits	**3**
Marks	**100**

GENERAL OBJECTIVE

To enable the students understand the components in Organic farming, its nutrients and its importance in human life, Worldwide and regional practices regarding organic farming, uses and policies related to organic farming.

COURSE OBJECTIVES

The learner will be able to

CO No.	**Course Objectives**
CO-1	Understand the basic principles behindtheorigin andimportance of organic farmingpractices and need of the hour
CO-2	Understand the models and type of organic farming practices prevailing Nationally and Internationally and its advantages and disadvantages.
CO-3	Preparation of nutrients and soil for organic farming with the available resources.
CO-4	Understand the standards and agencies meant for organic farming and the health benefits of food products
CO-5	Understand the bioinformatics basics and its application in biology.

UNIT – I Principles of Organic Farming 12hrs.

The Basis of Farming- Life and Farming, Ecology and the Fertility of the soil, Food and the soil organic cycle, Crop, Pest and Fertilizers. Agriculture and Climate change. Differences in Life style. Forest and Agriculture – The attitude towards farming and organic Farming concept.

Extra reading /Key Words: *Diseases related to farming practices,*

UNIT – II Models and types of Organic farming 12hrs.

Organic Farming Models - Natural Farming - Fukuoka-Japan, Australian Organic Farming, Ecological Farming Palekar Model. Types of Organic farming – Pure organic farming, Integrated farming system and Mixed farming system, its definition concept and benefits. Advantages and disadvantages.

Extra reading /Key Words: *Zero budgeting organic farm*

UNIT – III Nutrients and soil preparation for Organic farming 12hrs.

Sources of nutrients - Organic Manure –FYM/Rural compost, City compost, Oil cakes, Animalwastes,and Vermi composts. Green Manure – Leguminous crops in crop rotation. *In-situ* incorporation of crop residues. Liquid Manure. Bio fertilizers and their use as nutrients. Soil preparation, soil and water conservation strategies.

Extra reading /Key Words: *Detrimental effects of chemicals in farming*

UNIT – IV Crops for organic farming and marketing 12hrs.

Indigenous Crops – Selection & Processing, Food Crops , Cash Crops, Mono crops,Mixed Crops,Herbs and Spices. Income generation activities: Apiculture, Mushroom production, Terrace farming. Vertical gardens. Marketing, Imports and exports, Policies and incentives of Organic production,

Extra reading /Key Words: *Integrated pest management, domestic certification.*

UNIT – V – Maintenance of Standards and Agencies of Organic farming 12hrs.

Farm inspection and certification,National and International level Agencies and institutions related to organic farming. Indian National Standards for organic products. Organic Food Quality and Human Health. Food Safety and Food Policy limited Use of Resources,

Extra reading /Key Words*: Food safety act, IFOAM*

Note: Text given in the Extra reading /Key words must be tested only throughAssignment and Seminars.

COURSE OUTCOMES (CO)

The learner will be able to

CO No.	Course Outcomes	PSOs Addressed	Cognitive Level
CO-1	Describe the importance of organic farming and its positive effects	PSO 1, PSO 3	R, U
CO-2	Explain the models and types of organic farming practice.	PSO 1, PSO 3	R, U
CO-3	Discuss the nutrients and soil types for organic farming with the resources available	PSO 1, PSO 3	R, U
CO-4	Explain the soil preparation and conservation strategies for this farming .	PSO 1, PSO3	R, U
CO-5	Describe the crops, its selection and maintenance	PSO 1, PSO 4	R, U
CO-6	Describe the income generation activities and its marketing strategies	PSO 1 PSO 4	R, U
CO-7	Explain the maintenance and agencies responsible for inspection and certification and also the food quality of products from organic farming.	PSO-1	C

Practical

1. Prepare vermi-compost at lab scale from various kinds of agro-waste.
2. Estimation of heavy metals.
3. Maintenance of biofertilizer strains, culture of biofertilizers and their applications.
4. Visit to Apiculture area
5. Visit to terrace farming area
6. Cultivation and submission of 10 plants grown out of organic farming individually at theend of the semester.

Books for Reference:

1. Bavec, F. and Bavec, M. (2007). Organic Production and Use of Alternative Crops.CRCPress, Boca Raton, FL.
2. Joshi, M., Setty, T.K.P. and Prabhakarasetty (2006). Sustainability through Organicfarming.1st Edition.Kalyani Publishers, Ludhiana, India.
3. Lampkin Nicolas.1990.Organic Farming. The University of Wisconsin – Madison. FarmingPress.
4. Altieri Miguel**.** 1987. Agroecology: The Scientific Basis of AlternativeAgriculture. Westview Press.

Boulder, CO.
5. Soule, Judith D. and Piper, Jon K. 1992. Farming in Nature's Image: An EcologicalApproach to Agriculture**.** Island Press, Washington, D. 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
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	**U20BO3ACT04**
Course Type	**Theory**
Credits	**2**
Marks	**100**

GENERAL OBJECTIVE:
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:
The learner will be able to

CO No.	**Course Objectives**
CO-1	Remember and understand the general characteristics of algae and fungi
CO-2	Remember and understand the life cycle pattern of bryophytes, pteridophytes and gymnosperms
CO-3	Understand, apply and analyse the internal structure of dicot plants and development of embryo
CO- 4	Understand and analyse the floral taxonomy of angiosperms
CO- 5	Understand and apply the different physiological and biochemical reactions in the 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* and *Volvox*. Structure, reproduction and life cycle of fungi – *Penicillium* and *Agaricus and Puccinia*. Economic importance of algae and fungi.
Extra reading (Key Words): (Key words): SCP production, mushroom cultivation
UNIT –II Bryophyte, Pteridophyte and Gymnosperm: 12 Hrs
General characteristics of Bryophyte, Pteridophyte and Gymnosperm. Structure, reproduction and life cycle of Bryophyte - *Funaria*. Pteridophyte - *Nephrolepis*. Gymnosperm - *Cycas*.
Extra reading (Key Words): (Key words): Stelar evolution, molecular phylogeny

UNIT – III Anatomy and Embryology: 12 Hrs

Anatomy- Primary and secondary structure of dicot stem and root, 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): (Key words): Wood anatomy, poly embryony

UNIT – IV Taxonomy of Angiosperms: 12 Hrs

General outline classification of Bentham and Hooker. Detailed study of the following families and their economic importance: Annonaceae, Rutaceae, Rubiaceae, Amaranthaceae and 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 transport chain). 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	PSOs Addressed	Cognitive Level
CO-1	Recall and relate the general characters of algae and fungi	PSO 1, PSO 3	R, U
CO-2	Explain the life cycle patterns of bryophyte and pteridophytes	PSO 1, PSO 3	U
CO-3	Compare the reproductive patterns of cryptogamic plants	PSO 1, PSO 3	U, An
CO-4	Outline the internal structure of dicot plants	PSO3	R, U
CO-5	Explain the developmental process of dicot embryo	PSO 1, PSO 3	U
CO-6	Compare and contrast the floral characters of different families	PSO 1 PSO 6	U, An
CO-7	Explain the photosynthetic system of plants	PSO 1	U
CO-8	Explain the respiration process of plants.	PSO 1	U

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

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 Company Ltd., New Delhi.
6. Pandey, B. P, 2010. College Botany. Vol. III. S. Chand and Company 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
Second Year - Semester – III

Course Title	**NON MAJOR ELECTIVE 1 – FOOD SCIENCE AND TECHNOLOGY**
Total Hours	**45**
Hours/Week	**3 Hrs /Wk**
Code	**U20BO3NMT01**
Course Type	**Theory**
Credits	**2**
Marks	**100**

GENERAL OBJECTIVE
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, safety measures and food laws.

COURSE OBJECTIVES
The learner will be able to

CO No.	Course Objectives
CO-1	Understand, apply and evaluate the major classes of food, and their nutrients of selected examples
CO-2	Remember and understand the different types of cooking, and apply the knowledge of loss of nutrients
CO-3	Apply, analyse and evaluate the types of food additives, food safety, hazards and risks and role of international agencies.
CO- 4	Understand various methods of food preservation and principles of food packing.
CO- 5	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), fats and oils (vanaspathi and sunflower oil), fruits and vegetables (vitamins A, C and minerals), Milk and milk products (pasteurized milk, butter and paneer).

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, importance and advantages of food processing. 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	PSOs Addressed	Cognitive Level
CO-1	List the major classes of food, and their nutrients.	PSO 1	R, U
CO-2	Differentiate types of cooking.	PSO 1	U, An
CO-3	Explain the loss of nutrients during cooking.	PSO 1 PSO 7	U
CO-4	Classify the types of food additives.	PSO 1 PSO 7	U
CO-5	List the different role of international agencies.	PSO 1 PSO 7	R, U
CO-6	Summarize various methods of food preservation.	PSO 1 PSO 7	U
CO-7	Describe the requirements for effective food packing.	PSO 1	R, U
CO-8	Discuss food preservation techniques in various food preparation	PSO 1 PSO 7	U, Ap

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

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 inFood Science & 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 recipesto savor and share. Hoboken, N.J: John Wiley & Sons Publishers.
5.Norman N. Potter and Joseph H. Hotchkiss.1996. Food science. Fifth edition. S. K. Jain for CBS publishers and distributors. 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
Second Year - Semester – III

Course Title	**MSBE- 2 BIOLOGICAL TECHNIQUES FOR CHEMISTRY**
Total Hours	**30**
Hours/Week	**2 Hrs /Wk**
Code	**U20BO3SBP03**
Course Type	**Theory cum Lab**
Credit	**1**
Marks	**100**

GENERAL OBJECTIVE

To enable the students 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 entrepreneur

COURSE OBJECTIVES
The learner will be able to

CO No.	Course Objectives
CO-1	Understand the basic build of plants
CO-2	Understand and apply the structure and function of plant anatomy with practical skills
CO-3	Understand the basic Physiological function of plants
CO- 4	Apply the knowledge and skills in production of protein rich products
CO- 5	Understand, apply the tissue culture techniques in micro propagation

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

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: Monocot leaves, stem, root

UNIT II – Cytology: **6 hrs**

Cell cycle, Cell division- mitosis- Prophase, Metaphase, Anaphase & Telophase.

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

Extra reading/Key words: Meiosis, Karyogamy

UNIT III –Physiology: **6 hrs**

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

Lab exercise: Ascent of sap, Thistle Funnel Experiment.

Extra reading/Key words: Transpiration, Respiration

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

SCP algal protein – Spirulina cultivation- Fungal protein- Mushroom cultivation

Lab exercise: Spirulina & mushroom cultivation

Extra reading/Key words: Industrial visit, establishment of small units

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

Methods- Micropropagation, Callus culture and Synthetic seed preparation-

Lab exercise: Callus induction, Synthetic seed preparation.

Extra reading/Key words: Somatic hybridization, Germplasm conservation

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

COURSE OUTCOMES (CO)

The learner will be able to

CO No.	Course Outcomes	PSOs Addressed	Cognitive Level
CO-1	Explain the basic organization in plants	PSO 1	R, U
CO-2	Illustrate the structure of dicot root and stem	PSO 1 PSO 3	U
CO-3	Explain the basic Physiological function of plants	PSO 1 PSO 3	R, U
CO-4	Explain the steps involved in production of protein rich organism	PSO 1 PSO 2	U
CO-5	Bring out the salient features of tissue culture techniques in micro propagation	PSO 1 PSO 2	U, An

CO-6	Develop the practical skills by learning the fundamental organization of plants and cultivation of protein rich products to become an entrepreneur	PSO-1	C

Prescribed 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. V. Kumaresan, 2005. Text book of Biotechnology, Saras Publication, Nagercoil, Tamilnadu.

Books for Reference:

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. Sharma, B.B. 1993. A Guide to home Gardening. Ministry of information and broadcasting, Govt. of 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
Second Year - Semester – III

Course Title	MSBE- 2 BIOLOGICAL TECHNIQUES FOR PHYSICS
Total Hours	30
Hours/Week	2 Hrs /Wk
Code	U20BO3SBP04
Course Type	Theory cum Lab
Credit	1
Marks	100

GENERAL OBJECTIVE

To enable the students 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 entrepreneur.

COURSE OBJECTIVES

The learner will be able to

CO No.	Course Objectives
CO-1	Understand the basic build of plants
CO-2	Understand and apply the structure and function of plant anatomy with practical skills
CO-3	Understand the basic Physiological function of plants and biochemcial nature & phytoconstituents
CO- 4	Apply the knowledge and skills in production of protein rich products
CO- 5	Understand, apply the tissue culture techniques in micro propagation

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

Organization of Plant system- structure of a plant cell and cell organelles – tissues -types and functions –Internal structure of dicot stem and root.

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

Extra reading/Key words: *Monocot leaves, stem, root*

UNIT II – Cytology **6 hrs**

Cell division- mitosis- Prophase, Metaphase, Anaphase, Telophase and Cytokinesis. Structure of DNA.

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: **6 hrs**

Absorption of water and minerals, Transpiration & Guttation. Phytoconstituents- Alkaloids, tannins & Polyphenols.

Lab exercise: Ascent of sap, Tests for the presence of Alkaloids, Tannins & Polyphenols in plant extract.

Extra reading/Key words: *Transpiration, Respiration*

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

SCP algal protein – Spirulina cultivation- Fungal protein- Mushroom cultivation

Lab exercise: Spirulina & mushroom cultivation

Extra reading/Key words: *Industrial visit, establishment of small units*

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

Methods- Micropropagation, Callus culture- Synthetic seed preparation-

Lab exercise: Callus induction, Synthetic seed preparation.

Extra reading/Key words: *Somatic hybridization, Germplasm conservation*

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	Explain the basic organization plants	PSO 1	R, U
CO-2	Illustrate the structure of dicot root and stem	PSO 1 PSO 3	U
CO-3	Explain the basic Physiological function of plants	PSO 1 PSO 3	R, U
CO-4	Explain the steps involved in production of protein rich organisms	PSO 1 PSO 2	U
CO-5	Bring out the salient features of tissue culture techniques in micro propagation	PSO 1 PSO 2	U, An

CO-6	Develop the practical skills by learning the fundamental organization of plants and cultivation of protein rich products to become an entrepreneur	PSO-1	C

Prescribed 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. V. Kumaresan, 2005. Text book of Biotechnology, Saras Publication, Nagercoil, Tamilnadu.

Books for Reference:

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. Sharma, B.B. 1993. A Guide to home Gardening. Ministry of information and broadcasting, Govt. of India.

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

HOLY CROSS COL LEGE (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	**U20BO4MCT10**
Course Type	**Theory**
Credits	**4**
Marks	**100**

GENERAL OBJECTIVE

To enable the students 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
The learner will be able to

CO No.	Course Objectives
CO-1	Remember and understand the knowledge of embryology through microsporogenesis and megasporogenesis.
CO-2	Remember and understand the pollination, fertilization and types of endosperm.
CO-3	Understand and analyse the structure and development of embryo.
CO- 4	Remember and understand the structure of seed, reserve food, longevity through selected seed technologies.
CO- 5	Remember and understand 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	PSOs Addressed	Cognitive Level
CO-1	Illustrate the structure of anther.	PSO 1 PSO 3	R, U
CO-2	Discuss the microsporogenesis and megasporogenesis.	PSO 1 PSO 3	R, U
CO-3	Discuss the types of pollination, endosperm and embryo.	PSO 1 PSO 3	R, U
CO-4	Explain the process of fertilization.	PSO 1 PSO 3	R, U
CO-5	Describe the structure of monocot and dicot seed.	PSO 1 PSO 3	R, U
CO-6	Expalin the reserve food, longevity and viability.	PSO 1 PSO 2 PSO 5	R, U
CO-7	Discuss the concept of seed certification, inspection and legislation.	PSO 1 PSO 2 PSO 5	R, U
CO-8	Develop the employability skills by learning the anatomical features of different parts of plant and developmental stages of reproductive parts of plant.	PSO-1	C

Prescribed 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.

Books for Reference:

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

(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	**MAJOR CORE 10- PHYTOGEOGRAPHY AND FORESTRY**
Total Hours	**60**
Hours/Week	**4 Hrs /Wk**
Code	**U20BO4MCT09**
Course Type	**Theory**
Credits	**4**
Marks	**100**

GENERAL OBJECTIVE:

To enable the students 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:

The learner will be able to

CO No.	Course Objectives
CO-1	Understand the principle and types of phytogeographical distribution and Factors influencing plant distribution
CO-2	Remember and understand the vegetation types, migration and evolution of floras, floristic regions of the world and vegetation zones related to latitudes and altitudes
CO-3	Remember and understand the Biodiversity hotspots, conservation and seed banks.
CO- 4	Understand the concept of forest ecosystem, forest types in India and restoration ecology
CO- 5	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. 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. 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 importance: **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: *Neoendemics, paleoendemics, pseudoendemics, National parks*

UNIT – IV Forest ecology **12hrs**

Definition - biotic and abiotic components - forest ecosystem - forest community - concepts - succession - primary productivity - nutrient cycling.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, Silviculture, Hydrology*

UNIT- V Forest Policies and Legislations: **12hrs**

Forest policies - Necessity - Formulation of National Forest Policy. History of forest development in India.Forest Organizations and Institutes - National - FRI, IGNFA, - International - ICRAF, ITTO. Forest laws - necessity - general principles - Indian Forest Act 1927, Forest Conservation Act 1980.

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	PSOs Addressed	Cognitive Level
CO-1	Explains the different types of phytogeographical distribution and theories of phytogeography.	PSO 1, PSO2	R, U
CO-2	Describes the Methods of dispersal, factors influencing plant distribution.	PSO1, PSO2	R
CO-3	Explains the Floristic regions of the world: Vegetation Zones in relation to latitudes and altitudes	PSO 1	U
CO-4	Explains the biodiversity hotspots in India, conservation of biodiversity and seed banks.	PSO 1	R
CO-5	Describe the Role of forest protection in Indian Forestry and agencies that cause damage to forest and protective measures.	PSO 1	R,U
CO-6	List out the protective measures and benefits due to chemical and biological control.	PSO 1	U
CO-7	Discuss the policies and laws related to forestry	PSO-1	U

Prescribed Text Books:

1. McManus B. Collins and Fred M White, 1981. ElementaryForestry. 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.

(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	**MAJOR ELECTIVE-2 PHYTOMEDICINE**
Total Hours	**60**
Hours/Week	**4 Hrs /Wk**
Code	**U20BO4MET03**
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 o 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.

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-2 BIOFERTILIZER
Total Hours	60 Hrs
Hours/Week	4 Hrs /Wk
Code	U20BO4MET04
Course Type	Theory
Credits	3
Marks	100

GENERAL OBJECTIVE

To enable the students to understand isolation, mass cultivation and field applications of bacterial, fungal, algal and fern biofertilizers.

COURSE OBJECTIVES

The learner will be able to

CO No.	Course Objectives
CO-1	Understand the need, advantages and types of bio fertilizer and acquire knowledge about the bio fertilizer centres.
CO-2	Remember and understand the bacterial bio fertilizers and evaluate the techniques related to the mass cultivation.
CO-3	Remember and understand the isolation, mass cultivation and field application of algal bio fertilizer.
CO- 4	Describe the mycorrhizal association and mass culturing of fungal bio fertilizer.
CO- 5	Remember and understand ferns and organics as biofertilizer.

UNIT –I Biofertilizer **12 Hrs**

Introduction: Definition and types, Advantages of biofertilizers over chemical fertilizers in

agriculture, carrier materials - storage, shelf life, Applications - field and tree crops, nursery plants and seedlings. National and Regional Biofertilizer Production and Development centres (Ghaziabad, Bangalore and Nagpur).

Extra reading/Key words: *Biofertilizer projects in India, Unigrow*

UNIT –II Bacterial biofertilizer **12Hrs**

Mass cultivation and field application of *Rhizobium, Azospirillum, Azotobacter,* Phosphate solubilizing microorganism (Pseudomonas and *Bacillus*)

Extra reading/Key words: *N_2-Fixing Stem-Nodulating Sesbania Biofertilizer*

UNIT –III Algal biofertilizer **12Hrs**

Algalization, Mechanism of N2 fixation in hererocystous BGA. Isolation, mass cultivation and field application of *Nostoc, Tolypothrix*. Brown macro algae – *Laminaria*.

Extra reading/Key words: *Marine algae as biofertilizers, fish emulsion -organic fertilizer*

UNIT –IV Fungal biofertilizer **12Hrs**

Mycorrhizal association – types. VAM - isolation and inoculum production, colonization and its influence on growth and yield of crop plants. Frankia - isolation and inoculum production and mass cultivation.

Extra reading/Key words: *Piriformospora indica as fungal biofertilizer, Trichoderma*

UNIT – V Ferns and organics as biofertilizers **12Hrs**

Ferns as biofertilizers- *Azolla* and Anabaena as a biofertilizer- cultivation, processing and field application. Organics as biofertilizers- Production, processing and manufacture of FYM, vermicompost and green manure, recycling of organic residues, benefits of organic biofertilizers.

Extra reading/Key words: *Biotizer, Alfaafa meal-organic fertilizer*

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	Explain the types and benefits of biofertilizer.	PSO-1, PSO-3	R, U
CO-2	Describe the mass cultivation and field application of *Rhizobium*	PSO-1, PSO-3	R, U
CO-3	Discuss the techniques related to the cultivation of *Azospirillum*.	PSO-1	U
CO-4	List the salient features of mycorrhizal association.	PSO-1	R
CO-5	Describe the phosphate solubilizing microorganism	PSO-1, PSO-3	U
CO-6	Discuss the Isolation, mass cultivation and field application of *Nostoc*, *Tolypothrix*	PSO-1	U
CO-7	Explain the Mycorrhizal association and its types	PSO-1	R, U
CO-8	Summarize the Azolla and Anabaena association and organic biofertilizer	PSO-1	U
CO-9	Develop the employability skills by cultivating biofertizers	PSO-1	C

Prescribed Text Books:

1. Dubey, R.C., 2005 A Text book of Biotechnology S.Chand & Co, New Delhi.
2. Kumaresan, V. 2005, Biotechnology, Saras Publications, New Delhi.

Books for Reference:

1. John Jothi Prakash, E. 2004. Outlines of Plant Biotechnology. Emkay Publication, New Delhi.
2. Sathe, T.V. 2004 Vermiculture and Organic Farming. Daya publishers. Subha Rao, N.S. 2000, Soil Microbiology, Oxford & IBH Publishers, New Delhi.
3. Vayas,S.C, Vayas, S. and Modi, H.A. 1998 Bio-fertilizers and organic Farming Akta Prakashan, Nadiad.

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 CORE 5 – PAPER II – BIOPROSPECTING AND PLANT BIOTECHNOLOGY**
Total Hours	**60**
Hours/Week	**4 Hrs /Wk**
Code	**U20BO4ACT05**
Course Type	**Theory**
Credits	**2**
Marks	**100**

GENERAL OBJECTIVE:
To enable the students to understand the utilization of plants as food, medicine and cosmetics. It also emphasizes the various biotechnological tools involved in plant biotechnology.

COURSE OBJECTIVES:
The learner will be able to

CO No.	Course Objectives
CO-1	Understand and apply their knowledge on cultivation practices, economic products and uses of various plants.
CO-2	Understand, apply and analyze the sources and uses of vegetables, fruits, fibre, wood and rubber
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 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 grace 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

CO No.	Course Outcomes	PSOs Addressed	Cognitive Level
CO-1	Recall, relate and explain the general characters of algae and fungi, the life cycle patterns of bryophyte and pteridophytes	PSO 1, PSO 3	R, U
CO-2	Outline and explain the internal structure of dicot plants, the developmental process of dicot embryo	PSO 1, PSO3	R, U
CO-3	Compare and contrast the floral characters of different families	PSO 1 PSO 6	U, An
CO-4	Explain the photosynthetic system of plants and the respiration process of plants.	PSO 1	U
CO-5	Explain and Utilize the, economic products and uses of various plants, biotechnological methods to develop plants using *in vitro* propagation	PSO 1 PSO 2	U, Ap
CO-6	Develop the practical skills by observing the basic structure and life cycle patterns of plant diversity and morphological and anatomical features of higher plants	PSO-1	C

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.

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 PAPER – I**
Total Hours	**60**
Hours/Week	**4 Hrs /Wk**
Code	**U20BO4ACP06**
Course Type	**Practical**
Credits	**2**
Marks	**100**

GENERAL OBJECTIVE:
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

CO No.	Course Objectives
CO-1	Remember and understand the general characteristics of algae and fungi, life cycle pattern of bryophytes, pteridophytes and gymnosperms
CO-2	Understand, apply and analyse the internal structure of dicot plants and development of embryo
CO-3	Understand and analyse the floral taxonomy of angiosperms
CO- 4	Understand and apply the different physiological and ecological adaptations in the higher plants
CO- 5	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):
The learner will be able to

CO No.	Course Outcomes	PSOs Addressed	Cognitive Level
CO-1	Recall, relate and explain the general characters of algae and fungi, the life cycle patterns of bryophyte and pteridophytes	PSO1,PSO3	R, U
CO-2	Outline and explain the internal structure of dicot plants, the developmental process of dicot embryo	PSO1, PSO3	R, U
CO-3	Compare and contrast the floral characters of different families	PSO1,PSO6	U, An
CO-4	Explain the photosynthetic system of plants and the respiration process of plants.	PSO 1	U

CO-5	Explain and Utilize the, economic products and uses of various plants, biotechnological methods to develop plants using *in vitro* propagation	PSO1,PSO2	U, Ap
CO-6	Develop the practical skills by observing the basic structure and life cycle patterns of plant diversity and morphological and anatomical features of higher plants	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
Second Year - Semester – IV

Course Title	**NON MAJOR ELECTIVE 2 - HERBAL REMEDIES**
Total Hours	**45**
Hours/Week	**3 Hrs /Wk**
Code	**U20BO4NMT02**
Course Type	**Theory**
Credits	**2**
Marks	**100**

GENERAL OBJECTIVE

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

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	Understand and apply the alternate herbal remedies for common ailments.
CO-3	Understand and apply the skin, hair care, kidney, uterus problems by natural ways & Herbal remedies for glycemia.
CO- 4	Apply and evaluate the knowledge on cultivation and processing of herbs
CO- 5	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.

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 herbal medicine	PSO 1 PSO 5	R, U
CO-2	Discuss the importance of Indian system of medicine.	PSO 1 PSO 5	R, U
CO-3	Explain the alternate herbal remedies for common ailments.	PSO 1 PSO 5	U
CO-4	Relate the skin, hair care; kidney and uterus problems by natural ways.	PSO 1 PSO 5	U, An
CO-5	Apply the cultivation and processing of herbs	PSO 1 PSO 5	U, Ap
CO-6	Demonstrate the herbal preparations.	PSO 1 PSO 5	U, An
CO-7	Develop the practical skills by learning herbal medicine, home remedies for common ailments and apply the cultivation and processing of herbs	PSO-1	C

Prescribed Text Books:

1. Girija Khanna.1986. Herbal Remedies –Vikas Publishing house Ltd, New Delhi.

Roseline, A. 2011. Phamacognosy. MJP Publishers, Chennai.

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.

http:// www.thegoodtrade.com

4. Nigel C. Veitch, Michael Smith, 2013. Herbal Medicines Fourth edition. Pharmaceutical Press.

HOLY CROSS COLLEGE (AUTONOMOUS)

Affiliated to Bharathidasan University
Nationally Accredited(4th Cycle) with 'A++' Grade (CGPA3.75) by NAAC
College with Potential for Excellence.
Tiruchirapalli - 620002.

PG AND RESEARCH DEPARTMENT OFBOTANY

PROGRAMME: B.SC. BOTANY

PO No.	*Upon completion of the B.Sc. Degree Programme, the graduate will be able to*
PO-1	Obtain quality education in the basic areas of Botany
PO-2	Acquire practical skills to gather information, assess, create and execute new ideas to develop entrepreneurial skills
PO-3	Receive training in pedagogy, research skills and methodology
PO-4	Develop a local, regional, national and international perspective and be competent enough in the area of plant science, genetic engineering and nanotechnology
PO-5	Learn to respect and conserve nature and the environment
PO-6	Identify the angiosperms by applying keys
PO-7	Learn the basic principles of food science

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Programme Specific Outcomes:

PSO No.	*Upon completion of these courses the student would*
PSO-1	Acquire academic excellence with an aptitude for higher studies, research and to meet competitive exams
PSO-2	Become aware about plant diversity and its conservation through plant tissue Culture
PSO-3	Obtain Knowledge in the internal structure and functions of various plant components, inheritance of characters and techniques of plant breeding
PSO-4	Apply statistical skills and analyze the biological data
PSO-5	Acquire knowledge on traditional herbal plants for common ailments and aware of nutritive plant foods
PSO-6	Obtain Knowledge through taxonomical studies will help them to emerge as fundamental taxonomists
PSO-7	Acquire knowledge on food preservation, food additives and food laws
PSO-8	Analyze the phytoconstituents of plants and plant drug adulteration

HOLY CROSS COLLEGE (AUTONOMOUS) TIRUCHIRAPPALLI – 2

PG AND RESEARCH DEPARTMENT OF BOTANY

CHOICE BASED CREDIT SYSTEMCOURSE PATTERN 2020-21

Sem	Part	Course	Title of the course	Code	Hrs/ week	Credi T	Mar k
V	**III**	Major Core – 7	Genetics and Plant Breeding	U15BO5MCT07	5	4	100
		Major Core - 8	Morphology, Taxonomy of Angiosperms and Ethnobotany	U15BO5MCT08	5	4	100
		Major Core – 9	Pharmacognosy	U15BO5MCT09	5	4	100
		Major Core – 10	Practical 3- Genetics, Plant Breeding, Morphology, Taxonomy of Angiosperms,Ethnobotany and Pharmacognosy	U17BO5MCP10	5	4	100
		Major Elective 2	Food and Nutrition /Horticulture and Integrated Pest Management	U19BO5MET02/ U15BO5MET05	5	5	100
	IV	NME –1	Food Science & Technology	U15BO5NMT01	2	2	100
		Skill Based Elective-4	Botanical skills for Physical Sciences (Lab cum Theory for Physics students)	U17BO5SBT04	2	2	100
	IV	Value Education	Ethics /Bible studies / Catechism		1	-	-
		Extra Credit	Online Course	U19BO5OCT01			
		Extra Credit	Internship/ Field Work/ Field Project 30 Hours- Extra Credit	U18SP5ECC05		2	100
					30	**27**	**800**

			TOTAL				
VI	**III**	Major Core - 11	Plant Physiology and Biochemistry	U15BO6MCT11	6	5	100
		Major Core - 12	Plant Tissue Culture, Genetic Engineering and Nanotechnology	U15BO6MCT12	6	5	100
		Major Core - 13	Practical 4 - Plant Physiology, Biochemistry,Plant tissue culture, Genetic Engineering and Nanotechnology	U15BO6MCP13	6	5	100
		Major Elective 3	Instrumentation and Botanical Techniques / Plants in Human Health Care	U15BO6MET03/ U15BO6MET06	5	5	100
	IV	Non Major Elective –2	Herbal Remedies	U15BO6NMT02	2	2	100
		Skill Based Elective-5	Computer Literacy for Botany	U19BO5SBT05	2	2	100
		Skill based Elective - 6	Research Methodology	U15DS6SBT06	2	2	100
		Value Education	Ethics /Bible studies / Catechism		1	-	-
	V	Extension Activity	RESCAPES-Impact Study of Project		-	1	100
		Extra Credit	Internship/ Field Work/ Field Project 30 Hours- Extra Credit	U18SP6ECC06		2	100
			TOTAL		**30**	**29**	**900**

List of Non-Major Elective Courses

Offered by the Department of Botany to Other StudentsUG

Sem	Part	Course	Title of the Course	Code	Hrs/ week	Credits	Marks
V	**IV**	Non Major Elective -1	Food Science & Technology	U15BO5NMT01	2	2	100
VI		Non Major Elective -2	Herbal Remedies	U15BO6NMT02	2	2	100

Certificate Course offered by the Department of Botany

Title of the course	Hrs/week	Marks
Certificate Course on Urban Gardening and Cultivation of Microgreens	2	100

(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

B.Sc. BOTANY

Third Year-SEMESTER V

Course Title	**MAJOR CORE -7 GENETICS AND PLANT BREEDING**
Total Hours	**75**
Hours/Week	**5 Hrs/Wk**
Code	**U15BO5MCT07**
Course Type	**Theory**
Credits	**4**
Marks	**100**

GENERAL OBJECTIVE

To enable the students to understand Mendel's ratios and deviation, blood groups, linkage and crossing over, the conventional methods of plant breeding, role of hybridization, mutation, and polyploidy in plant breeding.

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 linkage, crossing over and sex determination
CO-4	understand and apply the concepts of cytoplasmic inheritance and mutation, evaluate the significance of Hardy Weinberg law.
CO-5	remember, analyse and apply the principle involved in conventional methods of plant breeding, polyploidy, and the organizations involved in plant improvement.

UNIT- I Classical genetics: **15 hrs**

Mendel's experiments. Law of segregation, law of Independent assortment (mono, di and trihybrid crosses). Back cross-dominant and recessive. Biological significance of Mendel's law Deviations from Mendelian ratios: Incomplete dominance - flower colour in *Mirabilis jalapa*. Codominance - coat colour in cattle. Lethality: dominant lethal – coat colour in mice, recessive lethal – leaf colour in maize.

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

UNIT – II Gene interaction: **15hrs**

Complementary factor - flower colour in sweet pea, Epistasis: dominant epistasis - fruit colour in *Cucurbita*, recessive epistasis – petiole length in Tobacco, Duplicate factor - seed shape in shepherd's purse. Multiple alleles -coat colour in rabbit and blood grouping. Polygenic or quantitative inheritance - kernel colour in wheat.

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

UNIT – III Linkage, crossing over and sex determination: **15hrs**

Linkage -complete and incomplete linkage, linkage groups. Crossing over and recombination -cytological basis of crossing over, types, theories, significance and factors affecting crossingover. Chromosome mapping. Sex determination in plants (*Melandrium* and *Zea mays*), Sex linkage: Inheritance of X – linked genes - *Drosophila* (eye colour) & human being (colourblindness and Haemophilia).

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

UNIT – IV Cytoplasmic inheritance and mutation: **15hrs**

Cytoplasmic inheritance in diploid organisms (plastid transmission in plants, kappa particles transmission in *Paramecium*), Cytoplasmic inheritance in haploid organisms (yeast), Significance of cytoplasmic inheritance. Mutation- Types, induction of mutation (physical and chemical mutagens) and detection of mutation (*Neurospora*). Hardy Weinberg law & its significance.

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

UNIT – V Plant breeding: **15hrs**

Objectives (Breeding for crop improvement to increase yield, quality, adaptation to different environment and disease resistance). A brief study of conventional methods of plant breeding (mass selection and pure line selection). Principles and techniques in plant breeding. Hybridization types. Polyploidy – Types. Heterosis – theories of heterosis. Role of mutation and polyploidy in plant breeding. Role of ICAR, IARI and CRRI in crop improvement.

Extra reading/Key words:*Somatic hybridization, plant domestication*

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 laws of Mendel in classical genetics and deviations from Mendelian ratios.	PSO 1	U
CO-2	Describe the complementary factor,epistasis and duplicate factor.	PSO 1	R
CO-3	Discuss linkage, crossing over and sex determination.	PSO 1 PSO 3	U
CO-4	Explain the concepts of cytoplasmic inheritance and mutation	PSO 1 PSO 3	U
CO-5	Evaluate the significance of Hardy Weinberg law.	PSO 1 PSO 3	U
CO-6	Paraphrase the conventional methods of plant breeding.	PSO 1 PSO 3	U
CO-7	Summarise the types of polyploidy	PSO 3	,U
CO-8	Describe the role of organizations involved in plant improvement.	PSO 3	R
CO-9	Develop the employability skills by understanding Mendel's ratios and deviation, linkage and crossing over and the conventional methods of plant breeding	PSO-1	C

Prescribed Text Books:

1. Verma, P.S. and Agarwal, V.K. 2007. Cell Biology, Genetics, Molecular Biology,Evolution and Ecology. S. Chand & Company Ltd. New Delhi.
2. Gupta, P.K. 2002. Cytology, Genetics and Evolution. Rastogi Publications, Meerut,India.
3. Leland Hartwell and Michael, L.Goldberg, 2018. Genetics: From Genes to Genomes-Access 6th edition. Mc Graw – Hill Publishing Company.

Books for References:

1. Gardner, F. J. 1972. Principles of Genetics. Wiley Eastern Pvt. Company Ltd., New Delhi.
2. Gupta, P. K. 1974. Cytology, Genetics and Evolution. Rastogi publications, Meerut.
3. Allard. R. W. 1960. Principles of plant breeding. John Wiley and Sons, Inc., New York,London.
4. Sarin, C. 2001. Genetics. Tata McGraw – Hill Publishing Company Limited, New Delhi

(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

B.Sc. BOTANY

Third Year - Semester – V

Course Title	**MAJOR CORE – 8 MORPHOLOGY, TAXONOMY OF ANGIOSPERMS AND ETHNOBOTANY**
Total Hours	**75**
Hours/Week	**5 Hrs /Wk**
Code	**U15BO5MCT08**
Course Type	**Theory**
Credits	**4**
Marks	**100**

GENERAL OBJECTIVE

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, in addition, ethnobotanical applications and traditional medicine

COURSE OBJECTIVES

The learner will be able to

CO No.	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 herbariums and its importance
CO-3	Apply the knowledge gained in studying the classification of Bentham and Hooker and 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: 15hrs

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*. Leaf tendril – *Gloriosa*. Leaf pitcher -*Nepenthes*. Inflorescence types with examples. Flower – Technical description of flower. Fruit - types with examples.

Extra reading/Key words:*General morphological characters of leaf, stem*

UNIT - II Taxonomy of Angiosperms: 15hrs

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

Extra reading/Key words: *Digital herbaria, Kew botanical garden, PLANTS Databases*

UNIT- III Taxonomy: 15hrs

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

Extra reading/Key words:*Mimosaceae, Key preparation, field note book*

UNIT–IV Taxonomy: 15hrs

Rubiaceae, Asteraceae, Asclepiadaceae, Acanthaceae, Lamiaceae, Amaranthaceae, Euphorbiaceae, Orchidaceae, Liliaceae, and Poaceae.

Extra reading/Key words:*Musaceae, National tropical botanical garden, field note book*

UNIT –V Ethnobotany **15 hrs**

Definition and Scope of Ethnobotany. Interdisciplinary approaches in Ethnobotany. 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.

Extra reading/Key words:*Ecotourism, validation of ethnomedicine*

Note: Texts given in the Extra reading /Key wordsmust 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	Differentiate the morphological variation of the plant parts	PSO 1 PSO 6	R, U
CO-2	List the importance of botanical nomenclature	PSO 1 PSO 6	R
CO-3	Indicate the importance of herbariums	PSO 1 PSO 6	U
CO-4	Outline the classification of Bentham and Hooker and others	PSO 1 PSO 6	R
CO-5	Illustrate the salient features of plants belonging to the families Annonaceae to Apiaceae	PSO 1 PSO 6	An
CO-6	Distinguish the plants belonging to the families rubiaceae to poaceae	PSO 1 PSO 6	U
CO-7	Correlate relationship and human and plants	PSO 1 PSO 5	R, An
CO-8	Evaluate the origin and application of traditional medicine system	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. Pandey, S.N. and Misra, S.P. 2008. Taxonomy of Angiosperms. Ane Books, India, NewDelhi.
2. Singh and Jain. 1987. Taxonomy of Angiosperms. Rastogi Publications, Meerut, India.
3. Jain, S.K. 1987. A Manual of Ethnobotany- Scientific publishers , Jodhpur.

Books for References:

1. Lawrence. 1955. An introduction to Plant Taxonomy. Central Book Depot. Allahabad.
2. Paul and Jain 1998. Tribal Medicine – Oxford and IBH Publishing Co., New Delhi.
3. Sharma, O.P. 2017.Plant Taxonomy. 2nd Edition. McGraw Hill Education.

(For candidates admitted from 2015 onwards)
HOLY CROSS COLLEGE (AUTONOMOUS)
TIRUCHIRAPPALLI – 2PG AND RESEARCH
DEPARTMENT OF BOTANY
B.Sc. BOTANY
Third Year - Semester – V

Course Title	**MAJOR CORE – 9 PHARMACOGNOSY**
Total Hours	**75**
Hours/Week	**5 Hrs /Wk**
Code	**U15BO5MCT09**
Course Type	**Theory**
Credits	**4**
Marks	**100**

GENERAL OBJECTIVE

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

COURSE OBJECTIVES

The learner will be able to

CO No.	Course Objectives
CO-1	Understand the types of natural drugs, it's collection and processing
CO-2	Analyse the phytoconstituents of therapeutic values
CO-3	Analyse and evaluate the drug adulteration
CO- 4	Remember the indegenous traditional drugs
CO- 5	Understand and apply the pharmaceutical aids of plants

UNIT – I Pharmacognosy: **15hrs**

Definition and importance. Sources of natural drugs. Classification of crude drugs – morphological, therapeutical and chemical. Collection and processing of crude drugs. Aroma therapy and its significance.

Extra reading/Key words:*History of pharmacognosy in china, Forensic and eco pharmacognosy*

UNIT – II Drug constituents: **15hrs**

Carbohydrates, glycosides, lipids – fixed oils, volatile oils, resins, gums, alkaloids, tannins and polyphenols.

Extra reading/Key words:*Plant metabolomics,harmones.*

UNIT –III Drug adulteration: **15hrs**

Definition and types. Methods of drug evaluation– physical, morphological and microscopical. Preliminary detection of Alkaloids, glycosides and tannins.

Extra reading/Key words:*Drug Quality control, detection of flavanoids*

UNIT – IVIndigenous traditional drugs of India: **15hrs**

A study on the 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*), Sandal wood (*Santalum album*), Cinchona (*Cinchona officinalis*) and Lemon grass oil (*Cymbopogon citratus*).

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

UNIT – V Plant resources as technical products and Pharmaceutical aids: **15 hrs**

Natural plant pesticides (Pyrethrum and Neem). Allergenic extracts and their effects (pollen and fungal extracts). Sea weeds- *Ulva reticulata* ; Fibers: Vegetable fibres - Cotton and Jute; Animal fibre -Silk. Surgical dressings & sutures.

Extra reading/Key words: *Hemp, wool, garlic inseticide spray, tomato leaf insecticide spray.*

Note: Texts given in the Extra reading /Key wordsmust 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	Define the types of natural drugs	PSO 1 PSO 5	R, U
CO-2	Explain the collection and processing of crude drugs.	PSO 1 PSO 5	U
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 medicinal properties of traditional drug	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 plants as pharmaceutical aids	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 References:

1. Wallis, T. E. Text book of Pharmacognosy. CBS Publishers & Distributers. JainBhawan, New Delhi.
2. Hill.A.F, 1996. Economic Botany –Tata Mc Grew –Hill publishing companyLimited,New Delhi.
3. Mohammed Ali. Text book of Pharmacognosy. CBS Publishers & Distributers, NewDelhi.
4. Edwin Jerald, E and Sheeja Edwin Jerald, 2007. Text book of Pharmacognosy andPhytochemistry. 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 2015 onwards)

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

B.Sc. BOTANY
Third Year – Semester – V

Course Title	**MAJOR CORE 10 – PRACTICAL III GENETICS, PLANT BREEDING, MORPHOLOGY, TAXONOMY OF ANGIOSPERMS, ETHNOBOTANY AND PHARMACOGNOSY**
Total Hours	**75**
Hours/Week	**5 Hrs /Wk**
Code	**U15BO5MCP10**
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 and basic aspects of pharmacognosy.

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	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 Monocot
CO- 5	Understand and apply the pharmaceutical aids of plants

UNIT – I Genetics **15hrs**

Simple problems in monohybrid and dihybrid ratios, back cross-dominant and recessive, incomplete dominance, lethal gene, gene interaction, multiple allele, codominant allele. Plant breeding – hybridization technique.

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.* Leaf tendril – *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, Sterculiaceae, Rutaceae, Anacardiaceae, Leguminosae (Fabaceae, Caesalpiniaceae, Mimosaceae), Cucurbitaceae,

UNIT – IV Taxonomy **15hrs**

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

UNIT – V Ethnobotany and Pharmacognosy **15hrs**

The traditional usage of few medicinal plants. Preliminary phytochemical detection of alkaloids, glycosides and tannins. Detection of adulterants of market samples of mustard seeds, coriander powder, pepper, tea dust, coffee powder, chilli powder, turmeric powder and sooji.

COURSE OUTCOMES (CO)
The learner will be able to

CO No.	Course Outcomes	PSOs Addressed	Cognitive Level
CO-1	Explain the laws of Mendel in classical genetics and deviations from Mendelian ratios.	PSO 1 PSO2	R, U
CO-2	Describe the morphological variation of the plant parts	PSO 1 PSO 2	U
CO-3	Illustrate the salient features of plants belonging to Polypetalae.	PSO 1 PSO 2	U
CO-4	Illustrate the salient features of plants belonging to Gamopetalae.	PSO 1 PSO 2	U
CO-5	Illustrate the salient features of plants belonging to Monocotyledons.	PSO 1 PSO 3	U
CO-6	Analyse the drug adulteration	PSO 1 PSO 3	An
CO-7	Evaluate the origin and application of traditional medicine system	PSO 5 PSO 6	R
CO-8	Describe the medicinal properties of traditional drug	PSO 5 PSO 6	R, U
CO-9	Develop the practical skills by learning problems in genetics with examples, technical description of vegetative and floral parts of various families and basic aspects of pharmacognosy	PSO-1	C

(For candidates admitted from 2019 onwards)
HOLY CROSS COLLEGE (AUTONOMOUS) TIRUCHIRAPPALLI – 2
PG AND RESEARCH DEPARTMENT OF BOTANY
B.Sc. BOTANY
Third Year - Semester – V

Course Title	**MAJOR ELECTIVE – 2 FOOD AND NUTRITION**
Total Hours	**75**
Hours/Week	**5 Hrs /Wk**
Code	**U19BO5MET02**
Course Type	**Theory**
Credits	**5**
Marks	**100**

GENERAL OBJECTIVE

To enable the students to learn the various aspects of foods, their nutritive value, preservation, processing of food and food-adulteration, laws and standard.

COURSE OBJECTIVES

The learner will be able to

CO No.	Course Objectives
CO-1	Understand, apply the knowledge on different classes of food and their functions
CO-2	Remember the nutritive value and sources of food products
CO-3	Understand various methods of food preservation
CO- 4	Apply and evaluate the toxic substances in food and food adulteration,types of additive
CO- 5	Outline food safety measures.

UNIT – I Food as a source of energy: 15hrs

Energy value of food, major classes of food – carbohydrates, proteins, fats, oils, minerals (Ca, Fe & I) & vitamins – fat soluble (A,D,E, K) & water soluble (Vit – C, Vit- B - riboflavin, niacin& thiamine) – sources, requirements, recommended Dietary allowances for nutrients, functions& deficiency symptoms.

Extra reading/Key words:*Human milk oligosaccharides(HMO)*

UNIT – II Food & food products : **15 hrs**

Nutritive value. Plant as source of food: Cereals- rice, wheat & their products. Pulses – black & green gram. Fruits - Banana, Guava & Citrus. Vegetables – *Amaranthus*, Brinjal, lady's finger & oils – sun flower oil, bran oil & vanaspathi. Cooked foods: types of cooking, loss of nutrients in cooking.

Extra reading/Key words:*Millets, olive oil, musturd oil*

UNIT – III Food preservation: 15hrs

Importance, principles of preservation. Methods of preservation- low, high temperature, drying, concentration, fermentation & radiation. Uses of oil & spices. Salt & sugars as preservatives. Preparation of Jam, Jellies, Pickles & squashes.

Extra reading/Key words:*Ultrasonics, cold plasma*

UNIT – IV Food additives: 15 hrs

Definition, need & types. Food toxicants: Naturally occurring toxicants in food, fluorosis. Food adulteration: Toxic substances in certain foods. Simple physical tests for detection of food adulterants. Fast foods –problems and diseases.

Extra reading/Key words: *Packed junk foods, nanopacking*

UNIT – V Food safety: 15 hrs

Sanitation & hygiene, Food borne diseases – microorganisms and moulds. Food poisoning. Food laws & Food standards. Knowledge about consumer council & consumer protection. Food allergy. Role of International & National Agencies like FAO, WHO, UNICEF, CFTRI & FSSAI.

Extra reading/Key words*:**Food safety acts*

Note: Texts given in the Extra reading /Key wordsmust 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	Distinguish the different classes of food.	PSO 1PSO 6	R, U
CO-2	Summarize the functions of food	PSO 1 PSO 7	U,An
CO-3	Describe the nutritive value and sources of food products	PSO 1 PSO 5	U
CO-4	Discuss the various methods of food preservation	PSO 1 PSO 5	R, U
CO-5	Classify the toxic substances in food and food adulteration	PSO 1 PSO 7	An
CO-6	Describe the different types of food additives	PSO 1 PSO 5	R, U
CO-7	Discuss the role of International & National Agencies	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. Sumathi, R., Madambi & Rajagopal, M. v. 1997. Fundamentals of foods & nutrition. New AgeInternational Pvt. Ltd., New Delhi.

Books for References:

1. Swaminathan, M. 1985. Advanced text book in food & nutrition Vol. I & II. The BangalorePrinting & Publishing Co. Ltd., Bangalore.
2. The art & Science of Cooking – A student manual. 1993. Department of food & nutrition.Blackwell publisher, New Delhi.
3. Sree Lakshmi, B. 1997. Food Science. New Age International Pvt. Ltd., New Delhi.

(For candidates admitted from 2019 onwards)

HOLY CROSS COLLEGE (AUTONOMOUS) TIRUCHIRAPPALLI – 2

PG AND RESEARCH DEPARTMENT OF BOTANY

B.Sc. BOTANY

Third Year - Semester – V

Course Title	**NON MAJOR ELECTIVE 1 – FOOD SCIENCE AND TECHNOLOGY**
Total Hours	**30**
Hours/Week	**2 Hrs /Wk**
Code	**U15BO5NMT01**
Course Type	**Theory**
Credits	**2**
Marks	**100**

GENERAL OBJECTIVE

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

COURSE OBJECTIVES

The learner will be able to

CO No.	Course Objectives
CO-1	Understand, apply and evaluate the major classes of food, and their nutrients of selected examples
CO-2	Remember and understand the different types of cooking, and apply the knowledge of loss of nutrients
CO-3	Apply, analyse and evaluate the types of food additives and role of international agencies.
CO- 4	Understand various methods of food preservation

CO- 5	Apply food preservation techniques in various food preparation

UNIT – I Major classes of food, and their nutrients: **6 hrs**

Cereals and products (Rice- carbohydrates), Pulse (red gram - protein), fats and oils (vanaspathiand sunflower oil), fruits and vegetables (vitamins A, C and minerals).

Extra reading/Key words:*Macro nutrients, micro nutrients.*

UNIT – II Types of cooking: **6 hrs**

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 additives: **6 hrs**

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

Extra reading/Key words:*Role of IFAD, WF*

UNIT – IV Food preservation technology: **6 hrs**

Definition, importance, principles of preservation, methods of preservation – low, high temperature and drying. Oil, spices, salt and sugars as preservatives. Food laws and standards.

Extra reading/Key words:*ultrasonics, cold plasma*

UNIT – V Food processing technology: **6 hrs**

Introduction, importance and advantages of food processing. Preparation of jam - mixed fruitjam and pineapple jam. Preparation of squashes - orange squash and grape crush.

Extra reading/Key words:*Fermentation, radiation*

COURSE OUTCOMES (CO)

The learners will be able to

CO No.	Course Outcomes	PSOs Addressed	Cognitive Level
CO-1	List the major classes of food, and their nutrients.	PSO 1	R, U
CO-2	Differentiate types of cooking.	PSO 1	U, An
CO-3	Explain the loss of nutrients during cooking.	PSO 1 PSO 7	U
CO-4	Classify the types of food additives .	PSO 1 PSO 7	U
CO-5	List the different role of international agencies.	PSO 1 PSO 7	R, U
CO-6	Summarize various methods of food preservation	PSO 1 PSO 7	U
CO-7	Discuss food preservation techniques in various food preparation	PSO 1 PSO 7	U, Ap

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

Prescribed Text books:

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

Books for References:

1. Swaminathan, M. 1985. Advanced text book in food and nutrition Vol. I and II. TheBangalore Printing and Publishing Co. Ltd., Bangalore.
2. Visakh P. M., Laura B. Iturriaga., Pablo Ribotta and Sabu Thomas. 2013.Advances inFood Science & 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 long term health. Woodhead publishers.
5. Wolfert, Paula, 2009. Mediterranean clay pot cooking. Traditional and modern recipes tosavor and share. Hoboken, N.J: John Wiley & Sons Publishers.

(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

B.Sc. BOTANY
Third Year – Semester – VI

Course Title	**MAJOR CORE 11 – PLANT PHYSIOLOGY AND BIOCHEMISTRY**
Total Hours	**90**
Hours/Week	**6Hrs /Wk**
Code	**U15BO6MCT11**
Course Type	**Theory**
Credits	**5**
Marks	**100**

GENERAL OBJECTIVE

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 – Vbiochemistry: **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 Assignmentand Seminars.

COURSE OUTCOMES (CO)
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 significance of carbohydrates	PSO 1 PSO 3	R, U
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

Prescribed 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, V. K. 1990. Fundamentals of Plant Physiology. S. Chand and Company Ltd., NewDelhi.
4. Jain, J. L. and Sunjay Jain 2016. Fundamentals of Biochemistry. S.

Chand and CompanyLtd., New Delhi.
5. Srivastava. 1987. Introduction to biochemistry. Rastogi publications, Meerut, India.
6. Jain, V. K. 2017. Fundamentals of Plant Physiology. Nineteenth Edition. S. Chand andCompany Ltd., New Delhi.

Books for References:

1. Noggle, G. R. and Fritz, G. J. 1992. . Introductory Plant Physiology. Prentice – Hall ofIndia Pvt. Ltd., New Delhi.
2. Conn, E. E. and Stumpf, P. K. 1976. Outlines ofBiochemistry**.** Wiley Eastern Ltd., NewDelhi.
3. Hans-Walter Heldt Professor Em and Birgit Piechulla. 2010. Plant Biochemistry, Kindleedition.

(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

B.Sc. BOTANY

Third Year - Semester – VI

Course Title	**MAJOR CORE 12 - PLANT TISSUE CULTURE, GENETIC ENGINEERING AND NANOTECHNOLOGY**
Total Hours	**90**
Hours/Week	**6 Hrs/Wk**
Code	**U15BO6MCT12**
Course Type	**Theory**
Credits	**5**
Marks	**100**

GENERAL OBJECTIVE

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 wordsmust be tested only through Assignmentand Seminars.

COURSE OUTCOMES (CO)
The learner will be able to

No.	Course Outcomes	PSOs Addressed	Cognitive Level
CO-1	Discuss the tissue culture techniques in mico 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

Prescribed 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.

Books for References:

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. Kumaresan, V. Text book of biotechnology. Saras Publications.
5. Joy Deep Dutta and Anil K.Rao, 2008. Introduction to Nanoscience. CRC Press, London.

(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

B.Sc. BOTANY
Third Year - Semester – VI

Course Title	**MAJOR ELECTIVE 3 – INSTRUMENTATION AND BOTANICAL TECHNIQUES**
Total Hours	**75**
Hours/Week	**5Hrs /Wk**
Code	**U15BO6MET03**
Course Type	**Theory**
Credits	**5**
Marks	**100**

GENERAL OBJECTIVE

To enable the learner to undersatand the botanical techniques, working principles andapplications 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 techiques 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, flourescence 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 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 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

Prescribed Text Books:

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

Books for References:

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

(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

B.Sc. BOTANY

Third Year - Semester – VI

Course Title	**MAJOR CORE -13 PRACTICAL IV PLANT PHYSIOLOGY, BIOCHEMISTRY, PLANT TISSUE CULTURE, GENETIC ENGINEERING AND NANOTECHNOLOGY**
Total Hours	**90**
Hours/Week	**6 Hrs /Wk**
Code	**U15BO5MCP13**
Course Type	**Practical**
Credits	**5**
Marks	**100**

GENERAL OBJECTIVE

To enable the students on the preparation of solutions, to carry out the experiments onplant 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 (CO)

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 secondarymetabolites of plant by standard procedures.	PSO 1 PSO 3	An
CO-5	Demonstarte the working principle of dialysis, centrifugeand 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 learningthe experiments on plant physiology, preparation of solutions on biochemistry and plant tissue culture techniques	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

B.Sc. BOTANY

Third Year NME - Semester – VI

Course Title	**NON MAJOR ELECTIVE 2 - HERBAL REMEDIES**
Total Hours	**30**
Hours/Week	**2 Hrs /Wk**
Code	**U15BO6NMT02**
Course Type	**Theory**
Credits	**2**
Marks	**100**

GENERAL OBJECTIVE

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

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	Understand and apply the alternate herbal remedies for common ailments.
CO-3	Understand and apply the skin, hair care and uterus problems by natural ways.
CO- 4	Apply and evaluate the knowledge on herbal gardening.
CO- 5	Understand, apply and evaluate the herbal preparations.

UNIT I Indian system of medicine: 6 hrs

Introduction and scope. Basic principles of Indian system of medicine. Ayurveda, Siddha andUnani.

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

UNIT – II Herbal home remedies for the common ailments: **6 hrs**

Herbal home remedies for the common ailments of intestine, mouth affections and respiratoryproblems.

Extra reading/Key words*:**FenguFu Therapy, easy releive of pain*

UNIT – III Herbal home remedies: **6 hrs**

Skin and hair care by natural means. Herbal remedies for uterus problems.

Extra reading/Key words:*Guide for breast cancer*

UNIT – IV Herbal gardening **6 hrs**

Essentials of herbal gardening. Harvesting, drying and storage of herbs.

Extra reading/Key words:*Kitchen gardening, terrace gardening*

UNIT – V Herbal preparations: **6 hrs**

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

Extra reading/Key words:*Ethnobotany, policies*

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	Write the scope and importance of herbal medicine	PSO 1 PSO 5	R, U
CO-2	Discuss the importance of Indian system of medicine.	PSO 1 PSO 5	R, U
CO-3	Explain the alternate herbal remedies for common ailments.	PSO 1 PSO 5	U
CO-4	Relate the skin, hair care and uterus problems by natural ways.	PSO 1 PSO 5	U, An
CO-5	Design the herbal garden.	PSO 1 PSO 5	U, Ap
CO-6	Demonstrate the herbal preparations.	PSO 1 PSO 5	U, An
CO-7	Develop the practical skills by learning herbal medicine, home remedies for common ailments and designing the herbal garden	PSO-1	C

Prescribed Text Books:

1. Girija Khanna.1986. Herbal Remedies –Vikas Publishing house Ltd, New Delhi.
2. Roseline, A. 2011. Phamacognosy. MJP Publishers, Chennai.

Books for References:

1. Karen Phillip, 1994, Everyday Aromatherapy – Brock Hampton press, Italy.
2. Kurian- Medicinal plants, 2007.
3. Kokate, C. K., Purohit, A. P. & Gokhale, S. B. 1998. Pharmacognosy. Nirali Prakashan,Pune.
4. http:// www.thegoodtrade.com
5. Nigel C. Veitch, Michael Smith, 2013. Herbal Medicines Fourth edition. PharmaceuticalPress.

(For candidates admitted from 2019 onwards)

HOLY CROSS COLLEGE (AUTONOMOUS) TIRUCHIRAPPALLI – 2

PG AND RESEARCH DEPARTMENT OF BOTANY

THIRD YEAR - SEMESTER V

Course Title	**SBE – 5 COMPUTER LITERACY**
Total Hours	**30**
Hours/Week	**2**
Code	**U19BO6SBT05**
Course Type	**Theory**
Credits	**2**
Marks	**100**

COURSE OBJECTIVES

The student will be able to

CO 1	apply the office packages to gain a better understanding of the computer.
CO 2	understand the functions of smart devices and online transactions
CO 3	Analyse the purpose of social networking and cyber security in the e-world
CO 4	apply the statistical packages in data analysis and processing
CO 5	Apply information technology in Biological research

Unit I: Office Packages: 6hrs

MS- Word : Creation of Documents (letters, Bio- data, etc).Creation of Tables, Formatting Tables (Time table, Calendar, etc).Working with Mail Merge(Circular letters).

MS – Excel: Creation of Worksheet (Mark Sheet, Pay Slip, PF Contribution list, etc). Excel Function (Date, Time, Statistical, Mathematical, Financial Functions). Creating charts (Line, Pie, Bar, etc).

MS- Power Point : Creation of Presentations(Duplicate and New slides, Layouts, View, Slide show, etc.,). Working with objects (Movie, Sound, Word, Excel, etc.,)

Working with Transition and Animation effects(Text, Object, Pictures)

Extra Reading/Key words: *Units of Data Storage.*

Unit II: Smart Devices and Online Transactions: 6hrs

Smart phone – Types : Tablet PC , Smart TV, Smart Camera, Smart Watch and Smart Oven.Operating system for Smart phones- Apple iOS, Android, Windows 10, Blackberry, Synbian and Bada. Benefits of Smart Phones.

E-Commerce and M-Commerce: Components of E-Commerce- history, types, and benefits of each (B2B, B2C, C2B, C2C). Business to Government E-Commerce. M-Commerce-History, customers point of view and the provider point of view. Applications of M-Commerce- Mobile ticketing, mobile money transfer, mobile banking, mobile marketing and advertising. Payment methods in M-Commerce- Premium rate telephone numbers, Direct mobile dealing , Macro, Micro payment services and mobile wallets.

Extra Reading/Key words: *Google play for Android Phones.*

Unit III: Social Networking and Cyber Security 6hrs

Social Networking Sites: Characteristics of Social Networking Website- Examples of Social Networking Services (Facebook, SnapChat, Instagram, Whatsapp, Pinterest, Tumblr, Linkedin, Twitter, Quora and Patreon). Advantages and Disadvantages of Social Network.

Cyber law: Evolution and Historical events in cyber law. Case studies- Article taken from Media. Building blocks of cyber law(Netizens, Cyber space and Technology). Cyber Crime, Electronic and Digital devices, Intellectual Property, Data Protection and Privacy. Merits and Demerits of Cyber crime.

Extra Reading/Key words: *How to stay out of trouble from Social Network.*

Unit IV: Statistical Packages: 6hrs

SPSS Data File: Data Editor- Variable view, Data view, Entering data, Saving data, Editing and Manipulating data. SPSS output. Changing from Portrait to Landscape, Printing from SPSS.

Descriptive Statistics: Measures of Average, Measures of Dispersion, Correlation and Test of Significance.

Extra Reading/Key words: *Entering nominal and ordinal data.*

Unit V: Bio-informationTechnology **6hrs**

Need of computer in biological research. Virtual Library. Searching Biological informationsusing Internet – Search Engines. E-journals.

Extra Reading/Key words: *BLAST, FASTA.*

CO No.	Course Outcomes	PSOs Addressed	Cognitive Level
CO-1	Describe the office packages for better understanding of the computer.	PSO 1 PSO 5	R, U
CO-2	Explain the functions of smart devices and online transactions	PSO 1 PSO 5	R, U
CO-3	Analyse the purpose of social networking and cyber security in the e-world	PSO 1 PSO 5	U
CO-4	Calculate the measures of mathematical and positional average	PSO 1 PSO 5	U, An
CO-5	Recall and relate the application of information technology in the field of biology.	PSO 1 PSO 5	U, Ap

Books for Reference:

1. Mastering Ms-Office by Bittu Kumar
2. https://www.webopedia.com/DidYouKnow/Hardware_Software/mobile-operating-systems- mobile-os-explained.html
3. https://makeawebsitehub.com/social-media-sites/
4. https://www.tutorialspoint.com/information_security_cyber_law/information_security_cyber_law_tutorial.pdf
5. https://www.tutorialspoint.com/information_security_cyber_law/information_security_cy ber_law_tutorial.pdf
6. https://www.irjet.net/archives/V4/i6/IRJET-V4I6303.pdf
7. Rajathi, A and Chandran, P. 2010. SPSS for you. MJP Publishers.
8. Mani ,K. And Vijayaraj. D. 2012. Bioinformatics to Beginners, Kalaikathir Pathippagam,Coimbatore.

(For Candidates admitted from the academic year 2017 onwards)

HOLY CROSS COLLEGE (AUTONOMOUS) TIRUCHIRAPPALLI– 2

PG AND RESEARCH DEPARTMENT OF BOTANY

CHOICE BASED CREDIT SYSTEM

B.Sc. BOTANY

Third Year- Semester – VI

Course Title	SBE-6-Research Methodology
Total Hours	30
Hours/Week	2 Hrs /Wk
Code	U15BS6SBT06
Course Type	Theory
Credits	2
Marks	100

GENERAL OBJECTIVE

To enable the students to develop research skills and expose the students to the concept ofresearch 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 ofdata.
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 Assignmentand Seminars.

COURSE OUTCOMES (CO)

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) LtdPublishers, 2009. Reprint.
2. Rahim F.A. *Thesis Writing : A manual for researchers.* New Delhi: New AgeInternational Publishers,1988.Print.
3. Gopalana. *Thesis Writing.* Chennai: Vijay Nicole, 2005. Print.
4. Oliver, Paul. Writing Your Theis. New Delhi: Sage Publication, 2008. Print

(For Candidates admitted from the academic year 2017 onwards)

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

B.Sc. BOTANY
Second Year – Semester – III

Course Title	**SBE- 3 BOTANICAL SKILLS FOR CHEMICAL SCIENCES (THEORY CUM LAB) FOR CHEMISTRY STUDENTS**
Total Hours	**30**
Hours/Week	**2 Hrs /Wk**
Code	**U17BO3SBT03**
Course Type	**Theory cum Lab**
Credits	**2**
Marks	**100**

GENERAL OBJECTIVE

To enable the students 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 entrepreneur

COURSE OBJECTIVES

The learner will be able to

CO No.	Course Objectives
CO-1	Understand the basic build of plants
CO-2	Understand and apply the structure and function of plant anatomy with practical skills
CO-3	Understand the basic Physiological function of plants and biochemcial nature & phytoconstituents
CO- 4	Apply the knowledge and skills in production of protein rich products
CO- 5	Understand, apply the tissue culture techniques in micro propagation

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

Organization of Plant system- Cells – cell organelles – tissues –Internal structure of dicot stemand root.

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

Extra reading/Key words: *Monocot leaves, stem, root*

UNIT II – **Cytology:** **6 hrs**

Cell division- mitosis- Prophase, Metaphase, Anaphase & Telophase.

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

Extra reading/Key words: *Meiosis, Karyogamy*

UNIT III –Physiology: **6 hrs**

Translocation of water and minerals, Osmosis and its significance.

Lab exercise: Ascent of sap, Thistle Funnel Experiment.

Extra reading/Key words: *Transpiration, Respiration*

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

SCP algal protein – Spirulina cultivation- Fungal protein- Mushroom cultivation

Lab exercise: Spirulina & mushroom cultivation

Extra reading/Key words: *Industrial visit, establishment of small units*

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

Methods- Callus culture- Synthetic seed preparation-

Lab exercise: Callus induction, Synthetic seed preparation.

Extra reading/Key words:*Somatic hybridization, Germplasm conservation*

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 organization in plants	PSO 1	R, U
CO-2	Illustrate the structure of dicot root and stem	PSO 1 PSO 3	U
CO-3	Explain the basic Physiological function of plants	PSO 1 PSO 3	R, U
CO-4	Explain the steps involved in production of protein rich organism	PSO 1 PSO 2	U
CO-5	Bring out the salient features of tissue culture techniques in micro propagation	PSO 1 PSO 2	U, An
CO-6	Develop the practical skills by learning the fundamental organization of plants and cultivation of protein rich products to become an entrepreneur	PSO-1	C

Books for References:

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. Jain, V. K. 1990. Fundamentals of Plant Physiology. S. Chand and Company Ltd., NewDelhi.
4. Dubey. R. C. 2006. Text book of biotechnology. S. Chand and Company Ltd. New Delhi.
5. Sharma, B.B. 1993. A Guide to home Gardening. Ministry of information andbroadcasting, Govt. of India.

(For Candidates admitted from the academic year 2017 onwards)

HOLY CROSS COLLEGE (AUTONOMOUS) TIRUCHIRAPPALLI – 2

PG AND RESEARCH DEPARTMENT OF BOTANY

CHOICE BASED CREDIT SYSTEM

B.Sc. BOTANY

Third Year - Semester – V

Course Title	SBE- 4 BOTANICAL SKILLS FOR PHYSICAL SCIENCES (THEORY CUM LAB) FOR PHYSICS STUDENTS
Total Hours	30
Hours/Week	2 Hrs /Wk
Code	U17BO5SBT04
Course Type	Theory cum Lab
Credits	2
Marks	100

GENERAL OBJECTIVE

To enable the students 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 entrepreneur.

COURSE OBJECTIVES

The learner will be able to

CO No.	Course Objectives
CO-1	Understand the basic build of plants
CO-2	Understand and apply the structure and function of plant anatomy with practical skills
CO-3	Understand the basic Physiological function of plants and biochemcial nature & phytoconstituents
CO- 4	Apply the knowledge and skills in production of protein rich products
CO- 5	Understand, apply the tissue culture techniques in mico propagation

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

Organization of Plant system- Cells – cell organelles – tissues –Internal structure of dicot stemand root.

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

Extra reading/Key words: *Monocot leaves, stem, root*

UNIT II – **Cytology**: **6 hrs**

Cell division- mitosis- Prophase, Metaphase, Anaphase & Telophase.

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: **6 hrs**

Translocation of water and minerals, Osmosis and its significance.Phytoconstituents- Tannins &Polyphenols.

Lab exercise: Ascent of sap, Tests for the presence of Tannins & Polyphenols in plant extract.

Extra reading/Key words: *Transpiration, Respiration*

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

SCP algal protein – Spirulina cultivation- Fungal protein- Mushroom cultivation

Lab exercise: Spirulina & mushroom cultivation

Extra reading/Key words: *Industrial visit, establishment of small units*

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

Methods- Callus culture- Synthetic seed preparation-

Lab exercise: Callus induction, Synthetic seed preparation.

Extra reading/Key words: *Somatic hybridization, Germplasm conservation*

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 organization plants	PSO 1	R, U
CO-2	Illustrate the structure of dicot root and stem	PSO 1 PSO 3	U
CO-3	Explain the basic Physiological function of plants	PSO 1 PSO 3	R, U
CO-4	Explain the steps involved in production of protein rich organisms	PSO 1 PSO 2	U
CO-5	Bring out the salient features of tissue culture techniques in mico propagation	PSO 1 PSO 2	U, An
CO-6	Develop the practical skills by learning the fundamental organization of plants and cultivation of protein rich products to become an entrepreneur	PSO-1	C

Books for References:

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. Jain, V. K. 1990. Fundamentals of Plant Physiology. S. Chand and Company Ltd., NewDelhi.
4. Dubey. R. C. 2006. Text book of biotechnology. S. Chand and Company Ltd. New Delhi.
5. Sharma, B.B. 1993. A Guide to home Gardening. Ministry of information andbroadcasting, Govt. of India.
6. Mohammed Ali. Text book of Pharmacognosy. CBS Publishers & Distributers, NewDelhi.
7. Roseline, A. 2011. Phamacognosy. MJP Publishers, Chennai.

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. Sc. Botany with specialization in Plant Biotechnology

PO No.	Programme Outcomes *Upon completion of the M. Sc. Degree Programme, the post graduate will be able to*
PO-1	Obtain quality education in the advanced areas of Botany
PO-2	Acquire practical skills in plant diversity and its related subjects
PO-3	Write and formulate research projects/translate the research data into research p Projects and further to publicize it
PO-4	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-5	Develop Scientific tools to formulate phyto drugs to fulfill the needs of the society and to respect and conserve nature and the environment
PO-6	Identify the angiosperms by applying keys and obtain technical skills for start –up programme

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	Become aware about plant diversity, development, anatomical, molecular mechanism, inheritance characters, mechanism of physiological functions, biomolecular structure, changes and their consequences and recent techniques

PSO-3	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-4	Carryout the field work, research projects individually and prepare herbal medicines for common ailments and traditional nutritive food
PSO-5	Design and carryout the biological experiments and to interpret data to give meaningful solution and recommendations
PSO-6	Apply and correlate the relationship between plant physiology, Biochemistry, Biotechnology, Biophysics and Biometrics
PSO-7	Become aware of environmental issues, environmental laws and applications of remote sensing in environmental studies

HOLY CROSS COLLEGE (AUTONOMOUS),
TIRUCHIRAPPALLI – 2DEPARTMENT OF BOTANY
PG COURSE PATTERN 2020-21

M.Sc. BOTANY WITH SPECIALIZATION IN PLANT BIOTECHNOLOGY

Sem	Course	Title of the course	Code	Hrs/ Week	Credits	Marks
I	Major Core – 1	Phycology, Mycology and Phytopathology	**P15BO1MCT01**	6	5	100
	Major Core – 2	Bryology, Pteridology and Gymnospermology	**P15BO1MCT02**	6	5	100
	Major Core – 3	Plant Anatomy, Developmental Biology and Morphogenesis	**P15BO1MCT03**	5	4	100
	Major Core – 4	General Microbiology	**P15BO1MCT04**	6	5	100
	Major Core – 5	Practical 1-Plant Diversity, Phytopathology, PlantAnatomy, Developmental Biology andGeneralMicrobiology	**P15BO1MCP05**	6	3	100
		Ethics		1		
	Extra Credit	Internship/ Field Work/ Field Project 30 Hours- extra Credit	**P18SP1ECC01**		2	100
		Total		**30**	**24**	**600**
II	Major Core – 6	Inheritance Biology and Molecular Biology	**P15BO2MCT06**	7	6	100
	Major Core – 7	Plant Biotechnology	**P15BO2MCT07**	6	6	100
	Major Core – 8	Environmental Biotechnology, Conservation of Resources and Remote Sensing	**P19BO2MCT08**	6	6	100
	Major Core – 9	Practical 2- Inheritance Biology, Molecular Biology, Plant Biotechnology, Environmental Biotechnology and Remote Sensing	**P15BO2MCP09**	4	2	100
	Non Major	Plants and Human Welfare	**P15BO2NMT01**	5	3	100

	Elective 1					
		Ethics		1		
		Library		1		
	Extra Credit	Internship/ Field Work/ Field Project 30 Hours- extra Credit	**P18SP2ECC02**		2	100
		Total		**30**	**25**	**600**
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**	**25**	**600**
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 StudentsPG

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.

(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

First Year – Semester- I

Course Title	**MC 1- PHYCOLOGY, MYCOLOGY AND PHYTOPATHOLOGY**
Total Hours	**90**
Hours/Week	**6 hrs /wk**
Code	**P15BO1MCT01**
Course Type	**Theory**
Credits	**5**
Marks	**100**

OBJECTIVE

To enable the students to understand the classification, thallus organization, life cycle patternswith reference to various classes of algae and fungi and plant diseases and its defense 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 various classes of algae.
CO-2	Remember and understand the symbiotic association, nitrogen fixation and water bloom toxicity in algae.
CO-3	Draw, explain and classify ecology, structure, mode of reproduction and life cycle patterns 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.

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 Phytopathology **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 Assignmentand 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-ApplyAn – Analyse; E- Evaluate; C – Create

Books for References:

Algae

1. Fritsch, F. E. 1945. The structure & reproduction of the algae Vol I & II. The Syndics of theCambridge University Press, london.
2. Ion Morris. 1968. An introduction to algae. Hutchinson University Library Comapany,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 BotanicaCompany.
6. Robert , E. L. 2018. Phycology.Cambridge University Press, London.

Fungi

1. Ainsworth, G. C., Frederick K. Sparrow and Alfred S. Sussman. 1973. The Fungi – FristEdition. Academic Press, INC, New York.
2. Alexopoulos, C. J. and Mims, C. W. 1993. Introductory Mycology - Third Edition. 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 – First Edition. 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. Cambridge University Press;3rd edition. New York.

8. Kevin Kavanagh . Fungi: Biology and Applications, 3rd Edition. Wiley-Blackwell

Money

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 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

First Year – Semester- I

Course Title	**MAJOR CORE 2- BRYOLOGY, PTERIDOLOGY & GYMNOSPERMOLOGY**
Total Hours	**90**
Hours/Week	**6 hrs /wk**
Code	**P15BO1MCT02**
Course Type	**Theory**
Credits	**5**
Marks	**100**

GENERAL OBJECTIVE

To enable the students to understand the classification, characters, life cycle patterns ofBryophytes, 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 sporophytes and 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 of Gymnospermology and their economic impotance
CO-5	Understand and analyse the morphology, reproduction and phylogeny of major classes & 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 and economic 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 ofGymnosperms.

Extra reading/Key words: *Theories regarding origin of paleozoic ovules,*

Geological time scale&Fossilization.

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:*Sexual reproduction in gymnosperms, Evolution of sporophytes inGymnosperms.*

Note: Texts given in the Extra reading /Key wordsmust 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. Hutchinson and 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. The Macmillan company,New York.
2. Bower, F. D. 1963. The Ferns – Vol I, II & III. Today and Tomorrow's book 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 of Gymnosperms. Central BookDept, Allahabad.
2. Datta, S. C. 1984. An introduction to Gymnosperms. Kalyani Publishers, New Delhi.
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 and Co. (Publishers) Ltd.,London.
5. Vashista, P. C., Sinha, A. K. and Anil kumar. 2007. Botany for degree student- 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 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
First Year – Semester- I

Course Title	**MC 3- PLANT ANATOMY, DEVELOPMENTAL BIOLOGY AND MORPHOGENESIS**
Total Hours	**75**
Hours/Week	**5 hrs /wk**
Code	**P15BO1MCT03**
Course Type	**Theory**
Credits	**4**
Marks	**100**

GENERAL OBJECTIVE

To enable the students to learn the theories and application of different fields *viz.*, Plant Anatomy,Developmental Biology and Morphogenesis

COURSE OBJECTIVES

The learner will be able to

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

UNIT – I 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. Electron microscopic structure of phloem. Root – stem transition and seedling anatomy. Vascular and cork cambium: origin, structure, function & distribution.

Extra reading/Key words:*Periodicity, Phytophages*

UNIT – II 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 robusta*).

Extra reading/Key words: ***E****cological wood anatomy, Ergonomics.*

UNIT – III Developmental Biology (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 – IV: **Developmental Biology (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 – V : Morphogenesis: 15 hrs

Morphogenesis at cellular level: Sachs & Erner's Law-Role of cytoplasm and nucleus in morphogenesis. 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*

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 apical organization of root and stem	PSO 2	An
CO-2	Compare the basic organization of xylem and phloem	PSO 2	An
CO-3	Relate the structure and function of wood	PSO 2	An
CO-4	Explain the basic structure and functions of pollen grains	PSO 4	U
CO-5	What are the methods used to overcome sexual incompatibility	PSO 4	R, U
CO-6	Describe the various types of endosperm and embryo	PSO 2	R,U
CO-7	Discuss the basics of genesis of various tissues	PSO 2	An,U
CO-8	Explain the role of nucleus and cells in differentiations	PSO 2, PSO 4	R,U

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

Books for References:

Anatomy

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

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 laboratory manual.Narosa Publishing House, New Delhi.
3. Varghese, T. M. An Introduction to experimental and applied embryology of Angiosperms. Oxford and IBH Publishing Co., New Delhi.

Morphogenesis

1. Elizabeth G. Cutter. 1966. Trends in Plant Morphogenesis. Longmans, Green and 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.*

(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
First Year – Semester- I

Course Title	MAJOR CORE 4- GENERAL MICROBIOLOGY
Total Hours	90
Hours/Week	6 hrs /wk
Code	P15BO1MCT04
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 different types of microorganisms.
CO-2	Understand and apply the knowledge on staining techniques and cultivation practices of microbes
CO-3	Understand and analyse the interaction of soil microbes and their role in organic matter decomposition
CO-4	Understand, analyse and evaluate the microbial diversity in drinking water, air and their adverse effect in human health
CO-5	Remember and understand the testing of microbes in milk, dairy products and food borne infections.

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 and viruses.

Extra reading/Key words:*Phylogeny of microbes*

UNIT – II **18 hrs**

Methods of studying bacteria: Staining techniques – simple, differential (Gram staining andacid – fast staining), negative and endospore staining. Cultivation, 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. Interaction among soil microbes (positive and negative interactions) & 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 ofpotable water. Microorganisms in air – sources and types. Air borne microbial diseases (fungal-Aspergillosis, bacterial – Tuberculosis, viral – H_1N_1). 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 through Assignmentand 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.

Books for References:

1. James, G. Cappuccino and Sherman, N. 1999. Microbiology – A Laboratory manual -4th edition. Addison Wesley Longman, Inc,

England.
2. Adam Schikora, 2018. Plant-Microbe Interactions in the Rhizosphere. Caister AcademicPress, Braunschweig, Germany.
3. James, M. Jay. 1986. Modern Food Microbiology. Van Nostrand Reinhold, New York.
4. Kannan, N. 1996. Laboratory manual in general microbiology. Palani paramountPublications, Palani.

(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
First Year – Semester- I

Course Title	**MAJOR CORE 5 –PRACTICAL – I PLANT DIVERSITY, PHYTOPATHOLOGY, PLANT ANATOMY, DEVELOPMENTAL BIOLOGY AND GENERAL MICROBIOLOGY**
Total Hours	**90**
Hours/Week	**6 hrs /wk**
Code	**P15BO1MCP05**
Course Type	**Practical**
Credits	**3**
Marks	**100**

GENERAL OBJECTIVE

To enable the students to understand, dissect out, identify and draw the structure of differentalgal and fungal forms and to identify and study the different 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 and to 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 pollen germination, tube growth and viability.

CO-5	Understand the growth pattern and cultivation techniques of bacteria & fungi and to test 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: PlantAnatomy: **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*).

Developmental Biology (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 structure of important algal forms	PSO 2	R, U, An
CO-2	Examine, dissect out, identify, draw, and explain the structure of 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 structure of important Bryophytes and pteridophyptic forms	PSO2	R,U,An
CO-5	Examine, dissect out, identify, draw, and explain the structure of important Gymnosperm and fossils forms	PSO2	R,U,An
CO-6	Identify and draw the radial longitudinal and tangential longitudinal 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 and study the different plant diseases	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
First Year – Semester- II

Course Title	**MAJOR CORE 6 INHERITANCE BIOLOGY AND MOLECULAR BIOLOGY**
Total Hours	**105**
Hours/Week	**7 hrs /wk**
Code	**P15BO2MCT06**
Course Type	**Theory**
Credits	**6**
Marks	**100**

GENERAL OBJECTIVE

To enable the students to understand gene interaction, regulation of gene action, Microbial genetics, population genetics, genetic mechanism of evolution, molecular biology and DNAreplication, transcription and translation.

COURSE OBJECTIVES

The learner will be able to

CO. No.	Course Objectives
CO-1	Understand and analyse the gene interaction, gene regulation in prokaryotes and eukaryotes and environmental effects and gene expression.
CO-2	Remember, understand and apply the microbial genetics through quantitative, population genetics and genetic mechanisms of evolution.
CO-3	Remember and understand the forms of DNA, chromosomal protein, C – value paradox, and advances in the study of hereditary material.
CO-4	Remember and understand the mechanism of DNA replication and mutation
CO-5	Understand the mechanism of transcription, translation and protein targeting – signal hyphothesis

UNIT – I Inheritance Biology: **21hrs**

Allelic and non allelic gene interactions, linkage, recombination (homologous and non- homologous) and chromosome mapping - Sex linkage in diploids. Multiple alleles and blood group systems - Male sterility. Bio chemical genetics (Drosophila, Neurospora). Regulation of gene action in prokaryotes – Role of operators, repressors, co-repressors and inducers – lac. Operon, trp. Operon. An outline of gene regulation in eukaryotes. Environmental effects and gene expression :- effects of external & internal environment.

Extra Reading /Key words:*Fluorescent and photoactive proteins*

UNIT – II Microbial genetics: **21hrs**

Transduction, transformation, conjugation, sexduction. Recombination in viruses.

Quantitative genetics :- Multiple gene concepts, analysis of quantitative characters, componentsof phenotypic variance.

Population genetics :- Hardy – Weinberg's principle & application, changes in gene frequencies.Genetics behavior of E. coli.

Genetic Mechanisms of evolution :- Mutation, differential selection, recombination, kinds ofreproductive systems and adaptability.

Extra Reading /Key words:*Cytoplasmic inheritance in haploid, diploid organisms*

UNIT – III Molecular biology: **21hrs**

Organization of Genetic elements: Chromosome: Alternative forms of chromosomal DNA – A,B, C and Z forms. Palindromic DNA, Repetitive DNA, circular and super helical DNA. Chromosomal proteins : Histones and Protamines, Nucleosome concept, Assembly of nucleosomes, C – value paradox.

Extra chromosomal structures - Plasmids, chloroplast and mitochondrial genomes.Mobile Genetic element : Transposons in yeast (Ty), Bacteria (Tn elements).

Application of recent advances in the study of hereditary material – RFLP, PCR, DNA fingerprinting.

Extra Reading /Key words:*AFLP,RAPD*

UNIT – IV DNA Replication : **21hrs**

Unit of replication, Enzymology of DNA replication, Discontinuous & bidirectional replication, initiation, elongation, termination of replication. Models of replication, correction of mistakes during replication, DNA polymerases.

Mutation: Molecular basis of mutation, detection of mutation in Drosophila. Reverse mutation, random mutation, para mutation. Induced mutation - Mutagens – physical and chemical.

DNA damage and repair mechanisms (photoreactivation, excision repair and recombinationrepair & mismatch repair).

Extra reading/Key words:*Junk DNA, Diversification*

UNIT – V Transcription : **21hrs**

Mechanism of transcription in prokaryotes (Initiation, elongation and termination) and transcription in eukaryotes, RNA polymerases.

Post transcriptional modification – capping, methylation, polyadenylation. RNA splicing withreference to exons, introns, reverse transcription.

Structure of tRNA, mRNA and rRNA and their promoters – TATA BOX, CAAT. GC and SOSBOX. Editing RNA.

Translation :-Genetic code, Antisense RNA. Mechanism of translation in prokaryotes, eukaryotes and post translation modification. Protein targeting – signal hypothesis.

Extra reading/Key words:*Impersonation, Rendering process*

Note: Texts given in the Extra reading /Key wordsmust 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	Differentiate gene interaction, gene regulation in prokaryotes and eukaryotes.	PSO 1,2,	An, R
CO-2	Explain the environmental effects and gene expression.	PSO 1,7	R,U
CO-3	Describe the microbial genetics,population genetics.	PSO 1, 2	R, U
CO-4	Outline the genetic mechanisms of evolution	PSO 1, 2	R, U
CO-5	Illustrate the forms of DNA	PSO 1, 2	U
CO-6	Explain the chromosomal protein, C – value paradox and advances in the study of hereditary material	PSO1, 2	U
CO-7	Describe the mechanism of DNA replication and mutation	PSO 1, 2	R, An
CO-8	Explain the mechanism of transcription, translation and protein targeting – signal hypothesis	PSO 1, 2	R
CO-9	Develop the Employability skills by understanding the gene interaction, regulation of gene action, Microbial genetics, population genetics, genetic mechanism of evolution, molecular biology and DNA replication, transcription and translation	PSO-1	C

Prescribed Text Books:

1. David Freifelder. 1990. Molecular Biology. Narosa Publishing House, New Delhi.
2. De Robertis, E. D. P., Francisco A. Salny and De Robertis, E. M. F. 1995. Cell Biology. W. B.Saunders company, London (International Edition).
3. Gardner / Simmons / Smustad. 1984. Principles of Genetics. John Wiley and Sons,Inc, New York.
5. Gupta, P. K. 1996. Genetics. Rastogi Publication, Meerut, India.

Books for References:

1. Power, C. B. 1997. Cell Biology – Third Edition. Himalaya Publishing house, Mumbai.
2. Sarin. 1994. Genetics. Tata McGrew-Hill Publication Co., New Delhi.
3. Sheeler, P and Blanchi, D. E. 2002. Cell and Molecular Biology. John Wiley and Sons,Singapore.

(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
First Year – Semester- II

Course Title	**MAJOR CORE 7 PLANT BIOTECHNOLOGY**
Total Hours	**90**
Hours/Week	**6** Hrs/**Wk**
Code	**P15BO2MCT07**
Course Type	**Theory**
Credits	**6**
Marks	**100**

GENERAL OBJECTIVE

To enable the students to understand various plant tissue culture techniques, transgenic plantsand molecular pharming and the principles of proteomics and genomics.

COURSE OBJECTIVES

The learner will be able to

CO. No.	**Course Objectives**
CO-1	Understand, apply the plant tissue culture techniques to produce clones and secondary metabolites.
CO-2	Understand and apply the importance of protoplast and cytoplasm in biotechnology
CO-3	Understand, apply and evaluate the significance of tranagenic crops
CO-4	Understand and apply the techniques of molecular pharming in the production medical and non-medical compounds.
CO-5	Apply the principles of genomics and proteomics and their molecular mechanisms

UNIT – I- Plant Tissue Culture : 18 hrs

Introduction, history and scope of biotechnology. Brief history of plant tissue culture. Basic techniques of plant tissue culture. Types of culture – callus culture, organ culture and embryo culture. Micropropagation and its importance. Somaclonal variation. Single cell culture. Commercial production of secondary metabolites in plant cell cultures. Elicitors induced production of secondary metabolites, biotransformation using plant cell culture.
Extra reading/Key words:*Thidiazuron, immobilizattion, hyperdricity, recalcitrance*

UNIT- II Plant Tissue Culture Techniques : 18 hrs
Protoplast isolation, culture and methods of fusion of protoplast and its applications. Haploidproduction & its significance. Somatic hybridization and applications. Cybridization and itsapplications.Somatic embryogenesis and synthetic seed production
Extra reading/Key words: *Cell signalling, Stem cell analysis*

UNIT – III Transgenic plant 18hrs
Strategies and production of trangenics for crop improvement – herbicide resistance (sulphonyl urease), insect resistance (gene for Bt toxin). Disease resistant plants, stress tolerant plants(drought and salt). Crops with improved yield and quality (long shelf life, delayed softening, ripening – tomato). Golden rice and mustard for rich vitamin A. GM crops and their impacts on agriculture, human health and environment.
Extra reading/Key words:*IPR, Ethics of GMOs, nanofarming*

UNIT – IV Molecular Pharming: **18 hrs**
Types – medical and non-medical. Medical pharming – pharmaceutical, production, properties, advantages and application of plantibodies. Edible vaccines and their importance. Non- medical pharming – production and application of industrial enzymes (cellulase and amylase). Bioplastics and biopolymers from higher plants. Terminator seed technology – mechanism and applications.
Extra reading/Key words:*Biobetter, green biofactory, molecule medicine.*

UNIT – V Plant genomics and proteomics: 18 hrs
Principles, structural and functional genomics. Genome sequencing of Arabidopsis thaliana, geneannotation and insertional mutagenesis. Analysis of gene function by employing transcriptanalysis. Phytohormone action and signal transduction in tissue cultures. Phosphoinositidesignaling in plants.
Extra reading/Key words:*Quorum sensing systems, mutagenesis trouble shooting.*

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	Describe the plant tissue culture techniques to produce clones	PSO 1,2,	An, R
CO-2	Explain the commercial production of secondary metabolites.	PSO 1,7	R, U
CO-3	Explain the importance of protoplast and cytoplasm in biotechnology	PSO 1, 2	R, U
CO-4	Evaluate the significane of tranagenic crops	PSO 1, 2	R, U
CO-5	Explain and apply the molecular pharming to produce commercial products.	PSO 1, 2	U, A
CO-6	Explain the principles of genomics and proteomics and their molecular mechanisms	PSO1, 2	U
CO-7	Discuss the Phytochrome action and signal transduction.	PSO 1, 2	R, An
CO-8	Summarize phosphoinositide signaling in plants.	PSO 1, 2	R
CO-9	Develop the Employability skills by understanding various plant tissue culture techniques, transgenic plants and molecular pharming and the principles of proteomics and genomics	PSO-1	C

Prescribed Text Books

1. Satyanarayana, U. 2008. Biotechnology. Books Allied (P) Ltd, Kolkata.
2. Razdan, M. K. 1993. An Introduction to Plant Tissue culture. The Mac Millan Co. ofIndia Ltd. Bombay
3. Nirmala, C. B, Rajalakshmi, G and Chandra Karthick. 2009. Plant Biotechnology. MJPPublishers.

Books for References:

1. Gamborg, O. L., Phillips, G. C. 1998. Plant Cell, Tissue & Organ culture. Fundamental methods. Narosa Publishing House , New Delhi.
2. Gupta, P.K. 1999. Elements of Biotechnology - First Edition. Rastogi Publication,Meerut.
3. Kalyan Kumar De. 1992. An Introduction to Plant Tissue Culture. New CentralBook Agency, Calcutta.
4. Jogdand, S. N. 1997. Gene Biotechnology. Himalaya Publishing House.
5. Dubey, R.C. 2007. A text book of Biotechnology. S. Chand & Company Ltd. NewDelhi.
6. Gupta, P.K. 2001. Elements of Biotechnology. Rastogi Publications, Meerut.
7. Adrian Slater, Nigel Scott and Mark Fowler. 2003. Plant biotechnology. Oxford UniversityPress.

(For Candidates admitted from the academic year 2019 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
First Year – Semester- II

Course Title	**MC 8 ENVIRONMENTAL BIOTECHNOLOGY, CONSERVATION OF RESOURCES AND REMOTE SENSING**
Total Hours	**90**
Hours/Week	**6 hrs /wk**
Code	**P19BO2MCT08**
Course Type	**Theory**
Credits	**6**
Marks	**100**

GENERAL OBJECTIVES
To enable the students to aware of natural resources, environmental pollution and monitoring. It also imparts knowledge on reclamation of polluted land, conservation of bioresources, environmental social issues and remote sensing

COURSE OBJECTIVES
The learner will be able to

CO No.	Course Objectives
CO-1	Remember the types of natural resources, their uses and impact of their degradation
CO-2	Remember and understand environmental pollution, environmental monitoring and abatement.
CO-3	Analyse the soil and water samples.
CO-4	Understand the ex-situ and in-situ conservation of biodiversity
CO-5	Understand and apply the social issues of environment and applies the knowledge of
	remote sensing in environmental issues

UNIT – I Natural Resources and their depletionand Environmental pollution, monitoring and abatement: 18hrs

Natural resources: Classification – renewable and non-renewable. Types of natural resources – water, land, forest & energy. Pollution – types, causes and effects (air, water, sea, noise, thermal and nuclear radiation). Global environmental problems: Green house effect, ozone depletion, UV radiation, Acid rains and their impact on climate. Pollution monitoring – Bioassay (algal, bacterial, lichens, higher plants and fishes) and use of biosensors in environmental monitoringand pollution abatement.

Extra reading /Key words: *Atmotube, airmonitoring softwares, Assessment and management of biological resources*

UNIT – II Restoration and reclamation of land: 18hrs

Restoration through micro propagation, reforestation, use of microbes in restoration of soilfertility, role of microbes in biogeocycles. Waste as a resource: organic compost, vermicompostand biogas. Waste water (sewage) treatment: primary, secondary (biological treatment) – aerobic
(oxidation pond, trickling filters and activated sludge) and anaerobic treatment (anaerobic digestion) and tertiary treatments. Role of GMOs in biodegradation and bioremediation – types and techniques.

Extra reading /Key words:*Future energy scenario of the world*

UNIT – III Biodiversity and its conservation: 18hrs

Introduction, definition, levels of biodiversity (Genetic and species), types (alpha, beta andgamma). Values of biodiversity (ethical, aesthetic and optional). Biodiversity at global, nationaland local levels. India as a mega diversity nation. Importance of Hot spots of biodiversity at
global, and hot spots in India. Threats and loss of biodiversity – habitat loss, poaching of wild life and man – wild life conflicts. Endangered and endemic plant species of India. Conservation of biodiversity – definition and types - in-situ (Biosphere Reserves, National parks and sanctuaries) and ex-situ (gene bank, seed bank and botanical gardens).

Extra reading /Key words:*Convention on Biological Diversity(CBD), biopiracy.*

UNIT – IV Environment and Social issues 18hrs

Awareness and the role of individuals in conservation of the environment: Sustainable development – concepts and basic aspects of sustainability. Environmental, social and ethical issues of biotechnology. Environmental legislation: Global efforts in protecting the environment-Environmental Protection Act 1986, Role of IUCN, UNESCO, WWF, FAO, WHF, CITES,

WTO, NBPGR, IPR (patents, trade, secretes, copy rights and trade marks), PBR and TRIPS.NBA (National Biodiversity Authority).

Extra reading /Key words:*Green Peace Movement, eco- tourism*

UNIT – V – Remote Sensing and their Application: 18hrs

Remote Sensing – Definition, History, Elements of Remote Sensing, Principles, Sensors (Activeand Passive), Types of orbits – Geostationary and Sun synchronous orbit. Indian Remote sensingsatellite system –IRS, LISS. Role and applications of Remote sensing technology in the analysis of vegetation, management of environment and human health. Role of GIS and GPS (GlobalPosition System) and their applications.

Extra reading/ Key Words: *Oceanography, Climate research satellites.*

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	Classify the renewable and non-renewable resources	PSO 1 PSO 7	R, U
CO-2	Define the types of natural resources, their uses and impact of their degradation	PSO 1 PSO 7	R
CO-3	Enumerate environmental pollution, environmental monitoring and abatement	PSO 1 PSO 7	U
CO-4	Analyse the soil and water samples.	PSO 1 PSO 7	R, An
CO-5	Compare the ex-situ and in-situ conservation of biodiversity	PSO 1 PSO 7	U
CO-6	Outline the social issues of environment	PSO 1 PSO 7	U
CO-7	Summarize the application of remote sensing in environmental issues	PSO 1 PSO 7	R, U
CO-8	Describe the role of national and international agencies in environmental monitoring and conservation of natural resources.	PSO 1 PSO 7	U

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

Prescribed Text Books

1. Asthana, D. K. and Meera Asthana. 1999. Environment : Problems and solutions. S. Chandand Company, New Delhi.

2. Dubey, R. C. 1998. A text book of Biotechnology. S. Chand and Company, New Delhi.

3. Gupta, P. K. 1999. Elements of Biotechnology. Rastogi publications, Meerut.

Books for References

1. Kumar, U. and M. Asija. 2004. Biodiversity: Principles and Conservation. 2nd Edition,Agrobios, India.
2. Saxena, H.M. 2006. Environmental Studies. Rawat Publications, Jaipur, New Delhi.
3. Anubha Kaushik and C.P. Kaushik. Perspectives in Environmental Studies. 2nd Edition.New Age International (P) Limited, Publishers, New Delhi.
5 Bhattacharyya, B.C. and Rintu Banerjee. 2008. Environmental Biotechnology. OxfordUniversity Press.
7. Ranjit Daniels and Jagdish Krishnaswamy. 2009. Environmental Studies. Wiley IndiaPvt. Ltd., New Delhi.
8. K.V. Krishnamurthy, 2003 A Text Book on Biodiversity (Principles and Practice),Science Publishers,USA.
9. Mahua Bas, Xavier SavarimuthuS.J, , 2015. Fundamentals of Environmental studies.Cambridge University Press.
10. Jay H. Withgoot, Mathew Laposata, 2011. Essential environment. Pearson CollegeDivision.
11. B. C. Panda, 2008. Remote sensing Principles and Applications, VIVA Books, Pvt. Ltd.New Delhi.
12. George Joseph and C. Jaganathan. 2018. Fundamentals of Remote Sensing. UniversityPress 3rd Edition.

(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
First Year – Semester- II

Course Title	**MC 9 PRACTICAL – II- INHERITANCE BIOLOGY, MOLECULAR BIOLOGY, PLANT BIOTECHNOLOGY, ENVIRONMENTAL BIOTECHNOLOGY AND REMOTE SENSING**
Total Hours	**60**
Hours/Week	**4 hrs /wk**
Code	**P15BO2MCP09**
Course Type	**Practical**
Credits	**2**
Marks	**100**

GENERAL OBJECTIVE

To enable the students to understand, analyze the genetic problems, map distances, Molecular techniques, basic techniques of plant tissue culture – sterilization, micropropagation, callus induction from, direct organogenesis, Embryo culture, Protoplast isolation, somatic embryogenesis and preparation of synthetic seeds and analysis of water - dissolved O_2 and CO_2, BOD, soil, vegetation, remote sensing and determination of Important Value Index (IVI).

COURSE OBJECTIVES

The learner will be able to

CO. No.	Course Objectives
CO-1	Understand and analyze the genetic problems, gene sequence and map distances.
CO-2	Study of plant cell divisions using squash and smear techniques.

CO-3	Understand and apply the basic techniques of plant tissue culture – for the production of plants through micropropagation, and callus induction. direct organogenesis, Embryo culture, Protoplast isolation, somatic embryogenesis and preparation of synthetic seeds
CO-4	Understand and apply the techniques of direct organogenesis, Embryo culture, Protoplast isolation, somatic embryogenesis for large scale production of plant and preparation of synthetic seeds
CO-5	Understand and analysis the water, soil and vegetation and study the remote sensing.

Unit I: Inheritance Biology: 12hrs

Analysis of F2 and test cross progeny data (collected or supplied from standard works) toidentify segregation patterns, linkage (3 point), percentage of crossing over. Solving simple problems involving multiple gene inheritance. Determination of gene sequenceand map distances.

Unit II: Molecular Biology 12hrs

Study of plant cells and cell preparations. Staining methods using acetocarmine and acetoorcein,squash and smear techniques (root tips/anthers).

Unit III: Plant Biotechnology 12hrs

Basic techniques of tissue culture - Sterilization of glass wares & preparation of MS medium. Micropropagation. Callus induction from explants of leaf, stem & root; regeneration of shoots,rooting and hardening.

Unit IV: Plant Biotechnology 12hrs

Direct organogenesis. Embryo culture. Protoplast isolation by mechanical & enzymatic methods.Somatic embryogenesis. Preparation of synthetic seeds.

Unit V: Environmental Biotechnology and Remote Sensing 12hrs

Water Analysis : Estimation of dissolved O_2 and CO_2. BOD Determination,Soil Analysis : Soilnitrogen estimation, soil organic matter estimation and soil pH.Vegetation analysis :Determination of Important Value Index (I V I). Determination of Basal area and relativeDominance by count quadrat method.Visit to an industry and to an ecosystem.A visit to a biotechnology laboratory.

COURSE OUTCOMES (CO)

The Learner will be able to

CO No.	Course Outcomes	PSOs Addressed	Cognitive Level
CO-1	Analyse the F2 and test cross progeny data and percentage of crossing over	PSO 1,2,	An, U
CO-2	Describe and analyse simple problems involving multiple gene inheritance, gene sequence and map distances	PSO 1,2	An,U
CO-3	Analyse the mitotic and meiotic cell division	PSO1.,2	An, U
CO-4	Produce the clones through plant tissue culture techniques	PSO 5,6	R, U, An
CO-5	Explain and Produce the plants commercially through organogenesis and varients from somatic embryogenesis	PSO 5,6	R, U, An
CO-6	Explain and isolate and culture the protoplast and design the synthetic seeds from somatic embryos for conservation.	PSO 5, 6	R, U, An
CO-7	Analyse the soil and water samples	PSO 1 PSO 7	R, An
CO-8	Summarize the application of remote sensing in environmental issues	PSO 1 PSO 7	R, U
CO-9	Develop the practical skills by understand, analyze the genetic problems,molecular techniques, basic techniques of plant tissue culture and analysis of water quality	PSO-1	C

(For Candidates admitted from the academic year 2019 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
First Year – Semester- II

Course Title	**NON MAJOR ELECTIVE I** **PLANTS AND HUMAN WELFARE**
Total Hours	**75**
Hours/Week	**5 hrs /wk**
Code	**P19BO2NMT01**
Course Type	**Theory**
Credits	**3**
Marks	**100**

GENERAL OBJECTIVE

To enable the students to learn and understand the importnace of plants as food, medicine andalso in agriculture, industry and forest

COURSE OBJECTIVES

The learner will be able to

CO No.	Course Objectives
CO-1	Remember and understand the importance of lower and higher plants and their cultivation
CO-2	Understand the cultivation and processing of different crops and their uses.
CO-3	Understand the role of plants in medicine.
CO-4	Understand the role of plants in agriculture and their production.
CO-5	Remember and understand the importance of plants in industry and forest.

UNIT - IPlants as food: **15hrs**

Importance of plants and plant products to mankind. Use of lower plants as food. Mushrooms – introduction and cultivation of paddy straw mushroom. Higher plants as food – cereal – rice, pulses – pigeon pea.

Extra reading/Key words: *Vermicomposting, bio gas*

UNIT – II Plants as food **15hrs**

Sugar –sugarcane. Fruits – banana, Vegetables - lady's finger, Greens - Amaranthus, Nuts – cashew nut, Oil - Sesame, Spices – cardamom, Beverage – tea.

Extra reading/Key words: *Ethanol, vanaspathi*

UNIT – III P**lants as medicine**: **15hrs**

Lower plants- algae and fungi. Higher plants- Roots – licorice, Bark - cinchona, Stem – turmeric, Leaves – tulsi, Flower – clove, Seeds –pepper, Masticatory – betel vine.

Extra reading/Key words: *Traditional medicine, naturopathy*

UNIT - IV P**lants and agriculture**: **15hrs**

Organic farming (Sea weed liquid fertilizer), vermi composting. Leguminous plants in green manuring. Biofertilizer – *Nostoc, Azospirillum, Azolla*. Biopesticides – neem products.

Extra reading/Key words: *Bioremediation*

UNIT - V Plants in industry and forest: **15hrs**

Gums – gum arabic, fibres – cotton, dye – Henna, rubber – *Hevea*, essential oil – *Eucalyptus*. Wood – Teak, pulp wood – *Casuarina*, fuel –*Acacia*.

Extra reading/Key words:*Industry and green revolution, forest fire.*

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	List the importance of lower and higher plants.	PSO 2	R, U
CO-2	Discuss the cultivation methods of lower and higher plants.	PSO 2 PSO 3	R, U
CO-3	Explain the cultivation and processing of different crops and their uses	PSO 2 PSO 3	U
CO-4	Discuss the role of plants in medicine	PSO 3 PSO 4	R, U
CO-5	Explain the importance of biofertilizer and biopesticides.	PSO 2 PSO 3	U
CO-6	Lists the industrial products obtained from plants.	PSO 4 PSO 6	U

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

Prescribed Text Books

1. Albert F. Hill. 1952. Economic Botany. Tata Mc Graw-

   Hill Publishing CompanyLtd., New Delhi.

2. Pandey, B. P. 1983. A text book of Botany – The Fungi –

S. Chand & Co., NewDelhi.

3. Pandey, B. P. 1993. A Text book of Algae. S. Chand & Co., New Delhi.

4. Annie, R. & V. Kumaresan, 2002. Fungi & Plant pathology. Saras Pub. T. Nadu.

5. Kochhar, S.L.2016. Economic Botany, a Comprehensive Study, 5th edition. CambridgeUniversity Press, Cambridge, United Kingdom.

Books for References

1. Dubey, R. C. 2001. Text Book of Biotechnology. S. Chand & Co., New Delhi.

(For Candidates admitted from the academic year 2019 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- III

Course Title	**MC 10- ANGIOSPERM SYSTEMATICS**
Total Hours	**90**
Hours/Week	**6Hrs/week**
Code	**P15BO3 MC T10**
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 trends in 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 nomeclature 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 merits and 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.

Extra reading /Key words:*Biodiversity Informatics, Hierarchical and inverse modeling strategies*

UNIT-III Modern trends in taxonomy: **18 hrs**

Anatomy in relation to taxonomy, palynology, embryology, cytology, 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 – VMonochlamydeae & Monocotyledons 18 hrs

Study of the following families of flowering plants with reference to their vegetative, floralcharacters & economic importance:

Monochlamydeae:- Nyctaginaceae, Chenopodiaceae, Aristolochiaceae, Piperaceae, Loranthaceae,Amaranthaceae.

Monocotyledons:- Amaryllidaceae, Hydrocharitaceae, Typhaceae, Palmae, Cyperaceae.

Extra reading /Key words:*Rare medicinal plants in Monochlamydeae, endangered species inmonocot 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 nomeclature 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 of monochlamydeae	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. Rendle, A. B. 1979. Classification of flowering plants (Vol I & II). Vikas Publishing House Pvt Ltd, Ghaziabad.

2. Lawrence, G. H. M. 1967. Taxonomy of vascular plants. Oxford and IBH PublishingCo. Pvt. Ltd, New Delhi.
4. Sharma, O.P. 2017. Plant Taxonomy. 2nd edition. Tata Mc Graw Hill Education PrivateLimited. New Delhi.

4. Pandey, S.N. & S.P. Misra. 2008. Taxonomy of Angiosperms. .Ane Books India, New Delhi,Chennai, Mumbai.

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 Hodderand Stoughton, London Melbourne, Auckland.

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- 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 biophysicalmethods 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 & HighPerformance Liquid Chromatography. Principles & uses of Atomic AbsorptionSpectroscopy.Electrophoresis – principles, types – paper & gel electrophoresis (SDS- PAGE,2D-PAGE), operation and their applications. Radio isotopes—nature of radioactivity- type ofradiations. Tracer technique, detection and measurement of radio activity using GM counters &Scintillation counters. Autoradiography & its applications in biology.
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. Collection & processing of data. Presentation of data insuitable form (tables- graphs- bar diagram, line diagram & histogram & Photographs).Writing ofthe project report—organization of the report – title selection - abstract – interpretation results-literature citation – conclusion. Typing of the reports – proof reading and editing.
Extra Reading/Key Words*:Publication in Impact journal, H index*

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	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. Avinash Updhayay, Kakoli Updhayay and Nirmalendu Nath. 1998. Biophysical chemistry –Principles and techniques. Himalaya Publishing House, Mumbai.

Books for References

1. Van Norman R.W. 1971. Experimental biology. Iind Edition, Prentice Hall, Inc.,New Jersey.
2. Berlyn & Mische, 1976. Botanical microtechnique & cytochemistry. Iowa StateUniversity Press.
3. Gahan P.B.1984. Plant histochemistry & cytochemistry – An introduction. AcademicPress, London.
4. Wilson K. & Walker J. 1994. Practical biochemistry. 4th edition, Cambridge University,London.
3. Krishnamurthy, K.V. 1988. Methods in Plant Histochemistry.Viswanathan Publishers,Madras.

6. Saravanavel P. 1985 Research report writing. Emerald Publishers, Madras.
7. Shirish C. and Ashok T. 2009. An introduction to Research. Cambridge UniversityPress, India Pvt. Ltd. New Delhi.
8. Gurumani, N. 2011 Research Methodology : For Biological Sciences**,** MJP Publisher

(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- 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,prepare permanent 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 Monochlamydeaementioned in the syllabus
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 2 **18hrs**

Identification of local specimens
Study of the families and technical descriptions of plant specimens included in the syllabusSuch as Polypetalae:- Nymphaeaceae, Menispermaceae, Portulacaceae, Rosaceae, Vitaceae,Meliaceae, Myrtaceae, Sapindaceae.
Gamopetalae:- Sapotaceae, Apocynaceae, Boraginaceae, Convolvulaceae,Scrophulariaceae, Bignoniaceae, Pedaliaceae, Verbenaceae.

UNIT 3 **18hrs**

Identification of local specimens
Study of the families and technical descriptions of plant specimens included in the syllabusSuch as Monochlamydeae:- Nyctaginaceae, Chenopodiaceae, Aristolochiaceae, Piperaceae, Loranthaceae,Amaranthaceae.
Monocotyledons:- Amaryllidaceae, Hydrocharitaceae, Typhaceae, Palmae, Cyperaceae.

UNIT 4 **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 5 **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 Monochlamydeaementioned 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	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- III

Course Title	ME 1- RECOMBINANT DNA TECHNOLOGY
Total Hours	90
Hours/Week	6Hrs/Wk
Code	P15BO3MET02
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 medical forensics.

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 of DNA
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. 18hrs

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 and uses. Phage vectors (phage λ and M13 vectors), cosmid and phagemid vectors, Pi vectors, 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 andplaque hybridization. DNA sequencing - Maxam & Gilbert, Sanger's and automated genesequencing methods. DNA chips (micro arrays) and chemical synthesis of DNA.

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 chromosomejumping libraries.
Extra reading /Key words:*Loop mediated isothermal amplification (LAMP), nucleic acid sequence based amplification (NASBA)*

UNIT - IVPharmaceutical products of DNA: 18 hrs

Production of recombinant insulin and human growth hormones. Recombinant vaccines and DNA vaccines (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 and its applications. Human Genome project: approach, mile stones, achievements, applications andethical issues.
Extra reading /Key words:*West Nile Virus, forensic dentistry.*
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 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 blotting techniques	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. Gupta, P. K. 1999. Elements of Biotechnology – First Edition. Rastogi Publication,Meerut.
2. Dubey, R. C. 2001. A Text Book of Biotechnology. S. Chand and Co, New Delhi.
3. Satyanarayana U. 2015. Biotechnology. Books and Allied (P) Ltd. Kolkata.
4. Keya Chaudhuri. 2013. Recombinant DNA Technology. The Energy and ResourcesInstitute (TERI)Publishers. P. 298.
5. Monika JainRecombinant DNA Techniques: A Textbook Alpha Science InternationalPublishers, 2012. P. 288.

Books for References

1. Old, R. N. and Primrose, S. B. 1994. Principle of gene manipulation. Blackwell ScientificPublications.

2. Joshi, P. 2001. Genetic Engineering and its application. Student Edition, Jodhpur.

3. Ignacimuthu, S. 1996. Applied Plant

Biotechnology. Tata Mc Graw – Hill
Publishing Company Ltd., New Delhi.
4. Kumar, H. D. 1993. Molecular Biology and Biotechnology. Vikas Publishing House Pvt. Ltd,New Delhi.
5. John E. Smith. 1996. Biotechnology. Cambridge University Press, United Kingdom.
6. Sandhya Mitra. 1996. Genetic Engineering. MacMillan India Ltd., New Delhi.

(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- III

Course 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 anduses of microbes (beneficial and detrimental).

COURSE OBJECTIVES

The learner will be able to

CO. 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 through microorganisms – use of biofertilizers – algal (BGA)bacterial (*Azospirillum*), Fungal- (*Mycorrhiza*). Use of biopesticides in the control of microbialplant diseases (*Trichoderma*– Sheath blight of paddy, *Pseudomonas* – Citrus canker).

Extra reading/Key words: *Natural growth hormones, Insect based biopesticides*

UNIT III Role of microbes in environment: **15 hrs**

Treatment and recycling of liquid and solid waste. Production of organic compost and its uses.Biogas production. Use of microbes in septic tank. Microbial biodecomposition of cellulose(coconut fibre & paddy straw), visit to sewage treatment plant.

Extra reading/Key words: *Spirulina, mushroom*

UNIT IV Role of microbes in industry: **15 hrs**

Bioreactors, stock cultures of microorganisms, types of media for large scale production ofethanol, vinegar (acetic acid), antibiotic (penicillin) and vaccines. Microbes in biofuel generation(methane).

Extra reading/Key words: *Effect ofHydrocarbon, Streptomycin production*

UNIT V Role of microbes in human health: **15 hrs**

Microflora of intestine and stomach-Beneficial-probiotics (*Lactobacillus*&*Saccharomyces*),Harmful (*E.coli*&*Proteus*). Role of microbes in disease development – causes, symptoms andcontrol measures of typhoid, tuberculosis, measles, jaundice, amoebiosis, malaria, AIDS, Avianflu & SARS.

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	CO-7

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. Rangaswami, G. and Bagyaraj, D. J. 1993. Agricultural Microbiology. Prentice –Hall of India private Ltd, New Delhi.
3. Power, C. B. And Daginawala, H. F. 1993. General Microbiology Vol I & II.Himalaya Publishing House, New Delhi.
5. Tauro, P., Kapoor, K. K. and Yadav, K. S. 1997. An introduction to microbiology.Wiley Eastern Company Ltd., New Delhi.
6. Ronald M. Atlas & Richard Bartha. 1981. Microbiology – Fundamentals andapplications – Addition & Wiley Publication, London.

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	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	**U**nderstand 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	**S**ummarize, 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, C_3& C_4 cycles, types of C_4 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 ofenzyme 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 andDistributors, 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. JohnWiley and Sons, Inc. New York.
2. Noggle, G. R. and Fritz, G. J. 1992. Introductory Plant Physiology. Prentice – Hallof India Private Limited, New Delhi

3.Lincoln Teiz and Eduardo Zeiger. 2006. Plant Physiology. Benjamin/Cummings Publishingcompany, 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, NewYork.

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 absorptionSpectrum.
2. Hill reaction of isolated chloroplast.
3. Effect of GA_3 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 ofsecondary 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 & normaldistributions. Correlation : Types, me
Extra reaing/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 virtuallibrary. Searching biological informations using internet.
Biological data base – generalized and specialized data base. Premier institutions maintainingdata base - EMBL, NCBI, DDBJ.
Extra reading/Key words: *OMIM, Microarray databases*

UNIT - 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 Assignmentand 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. PalaniParamount, 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. DarbariPrakashan, 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. PearsonEducation, 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 againstinfection – laboratory garments (Apron, cloves, masks, caps) – sterilization, disinfectionantisepsis in clinical labs, hospitals and equipments. Infectious waste management in hospitalsand 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 Assignmentand 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, ElsevierIndia Publishers. P. 684.
4. Banerjee and Banerjee. 2008. Fundamentals of Microbiology and Immunology. NewCentral 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 – AHuman 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.

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 –2

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			Credits	Code
		IA	UE	Total		
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)	25	75	100	4	
	a. Appied Biotechnology/ b. Pharmacognosy/ c.Bioprospecting of medicinalplants/ d. Applied Molecular Biology/					**MPH16BO1E04/ MPH16BO1E05/ MPH16BO1E06/ MPH16BO1E**
	Dissertation and Viva-VoceViva 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 genomicand proteomic analysis.
4. Understand the principle and construction of microscopes and microtechniques inhistology.
5. Apply and analyze the important statistical methods and Understand, apply andanalyse 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 techniquesmentioned 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 molecularData

Books for References:

1. Avinash Updhayay, Kakoli Updhayay and Nirmalendu Nath. 1998. Biophysicalchemistry – 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., NewJersey.
7. Wilson, K. and Walker, J. 1997. Practical Biochemistry: Principles and Techniques.CambridgeUniversity Press, Cambridge.
8. Palanichamy, S. & Manoharan, M. 1990. Statistical methods forbiologists. 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 ofCarbohydrates, lipids and secondary metabolites
5. Understand and analyze Classification, structure and properties of amino acids proteins andenzymes

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 C_3, C_4, variations of C_4 cycle, C_3& C_4 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 (C_2 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 chemicalstress and their molecular mechanism of resistance in plants.

Unit IV. Carbohydrates, Lipids and Secondary metabolites

Carbohydrates - Monosaccharides, disaccharides and polysaccharides, structure, properties andtheir biological significance.
Lipids – Classification, properties, and biological importance. Triglycerides, phospholipids andderived 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 secondarymetabolites
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, NewDelhi.
4. Hopkins WG. 1995. Introduction to Plant Physiology. John Wiley and Sons Inc., NewYork.
5. Kramer PJ. 1969. Plant and soil water relationship – A modern synthesis.
6. Lehninger AL. Nelson DL. And Cox MM. 2002. Principles of biochemistry, MacmillanWorth publishers.

7. Moore TC.1989. Biochemistry and physiology of plant hormones. Springer-Verlag, NewYork.
8. Murray,R.K., Granner,D.K., Mayes, P.A. and Rod Well, V.W.1993. Harper'sBiochemistry. 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 DistributorsLtd, 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, NewYork.

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 anddevelop 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 toolsfor 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, NewDelhi.
7. Learning Management System :https://en.wikipedia.org/wiki/learning
8. managementsystem, retrieved on 05/01/2016.
9. Mangal,S.K (2002) Essential of Teaching Learning and Information Technology, TandonPublications, Ludhiana.
10. Michael, D and Willium (2000), Integrating Technology into Teaching and Learning:Concepts and Applications, Prentice Hall, New york
11. Pandey, S.K. (2005) Teaching Communication, Commonwealth Publishers, New Delhi.
12. Ram Babu, A abd Dandapani, S (2006), Microteaching (Vol. 1 & 2), NeelkamalPublications, 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 seedproduction
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 seedproduction.
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,Kolkat

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 technologyof 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. VallabhPrakashan. 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 PublishingHouse. 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 ofcarbohydrates, 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 bioactivecompounds

4.Remember, understand and evaluate the application of different types of instruments used incompound 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 researchinstitutes/ 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 Publishingcompany**.**
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.