HOLY CROSS COLLEGE (AUTONOMOUS) TIRUCHIRAPPALLI – 620002
SCHOOL OF LIFE SCIENCES
PG AND RESEARCH DEPARTMENT OF BOTANY
CHOICE BASED CREDIT SYSTEM
LEARNING OUTCOMES-BASED CURRICULUM FRAMEWORK (LOCF)

Program Outcomes(POs)

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

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

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

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

PO-5- Excel as empowered woman to empower women

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

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

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

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

Program Specific Outcomes (PSOs)

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

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

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

(For candidates admitted from the academic year 2023-24 onwards)

SCHOOL OF LIFE SCIENCES
PG AND RESEARCH DEPARTMENT OF BOTANY
CHOICE BASED CREDIT SYSTEM
LEARNING OUTCOMES-BASED CURRICULUM FRAMEWORK (LOCF)
I UG COURSE PATTERN(TANSCHE)

Sem	Part	Course	Subject	se Code	Hours	Credits
I	I	Language	**General Tamil/Hindi/French**	U23TL1GEN01/ U23HN1HIN01/ U23FR1FRE01	**6**	**3**
	II		**General English**	U23EL1GEN01	**6**	**3**
	III	Core Course-1	Plant Diversity-1- Algae	U23BO1CCT01	4	4
		Core Course - 2	Plant Diversity-1- Algae Practical	U23BO1CCP02	4	3
		Allied Course-1	Allied Zoology Paper I	U23ZO1ALT01	4	4
		Allied Course-2	Allied Zoology - Paper II Practical	U23ZO1ALP02	2	2
	IV	SEC I (NME I)	Organic farming	U23BO1SET01	**2**	**2**
		Foundation Course	Foundation Course- Basics of Botany	U23BO1FCT01	**2**	**2**
			Value Education		-	-
			Total		**30**	**23**
II	I	Language	**General Tamil/Hindi/French**	U23TL2GEN02/ U23HN2HIN02/ U23FR2FRE02	**5**	**3**
	II		**General English**	U23EL2GEN02	**5**	**3**
	III	Core Course- 3	Diversity- II- Fungi , Bacteria, Virus, Plant pathology and Lichens	U23BO2CCT03	5	4
		Core Course -4	Practical II- Diversity- II- Fungi , Bacteria, Virus, Plant pathology and Lichens	U23BO2CCP04	4	3
		Allied Course -3	Zoology II	U23ZO2ALT03	4	4
		Allied Course- 4	Zoology II Practical	U23ZO2ALP04	2	2
	IV	SEC 2 (NME II)-	Mushroom cultivation	U23BO2SET02	**2**	**2**
		SEC 3	Sustainable Rural Development and Student Social Responsibility	U23RE2SET03	**2**	**2**
			Massive Open Online Course (MOOC)	U23EX2ONC01		**2 Extra Credits**
			Value Education	U23VE2LVB01 U23VE2LVC01 U23VE2LVE01	1	-
			Internship	U23EX2INT01		**2EC**
			Total		**30**	**23 + 4**

(For Candidates admitted from the academic year 2023-24 onwards)

HOLY CROSS COLLEGE (AUTONOMOUS) TIRUCHIRAPPALLI –2

SCHOOL OF LIFE SCIENCES

PG AND RESEARCH DEPARTMENT OF BOTANY

CHOICE BASED CREDIT SYSTEM

LEARNING OUTCOMES-BASED CURRICULUM FRAME WORK(LOCF)

B.Sc BOTANY (TANSCHE)

First Year-Semester– I

Course Title	CORE COURSE I–PLANT DIVERSITY I-ALGAE
Total Hours	60
Hours/Week	4Hrs/Wk
Code	U23BO1CCT01
Course Type	Theory
Credits	4
Marks	100

CONSPECTUS

To enable the students to understand the classification, study of the genera belonging to various classes of algae, their habitat, thallus structure, reproduction, cultivation methods and economic importance.

COURSE OBJECTIVES

The learner will be able to

- To provide a comprehensive knowledge on the biology of algae.
- To provide a basis for better understanding of the evolution higher of plants.
- To understand reproductive biology, ecology of plants by studying the simpler systems in algae.
- To understand the role of algae in ecosystems as primary producers of nutrition.
- To understand the importance of algae to animals and humans.

UNIT–I **12hrs**

Classification (Fritsch-1935-1945), Salient features of important classes of algae. Criteria for classification- pigments, flagella, reserve food and reproduction, algal distribution- Freshwater algae, marine algae, soil algae, symbiotic algae and parasitic algae.

Extra reading/Keywords: *Seaweeds, fossil algae*

UNIT-II **12hrs**

Thallus organization (unicellular-*Chlorella*, Diatoms, colonial-*Volvox*, filamentous-*Anabaena*, *Oedogonium*, siphonous- *Caulerpa*, parenchymatous-*Sargassum*, *Gracilaria*).

Structure, reproduction and life cycle patterns of the following genera: Haplontic- *Chlamydomonas*, *Oedogonium*

and *Chara*

Extrareading/Keywords: *Haplodiplontic lifecycle, Haplo-diplobiontic life cycle*

UNIT-III **12hrs**

Structure, reproduction and life cycle patterns of the following genera: Diplontic- *Diatoms* and *Sargassum* Diplohaplontic-*Cladophora* and *Ulva* and Diplobiontic- *Gracilaria* and *Polysiphonia*.

Extrareading/Keywords: *biomineralization, biosilica pattern generation*

UNIT–IV **12hrs**

Algal cultivation methods-indoor and outdoor cultivation methods (algicides culture and cultivation of fresh water and marine algae (Knop's solution and Chu10 medium (1972)); large-scale cultivation and harvesting of algae-SCP-*Spirulina and Chlorella.* Algal production systems- Open raceway ponds (OPRs) and closed photobioreactors (PBRs).

Extrareading/Keywords: *semi-continuous alga lcultivation, aggregation-based sedimentation, aquaculture*

UNIT–V **12hrs**

Algae as food and feed: Agar-agar, Alginic acid and Carrageenan; Diatomite. Resource potential of algae: Application of algae as fuel, agriculture and pharmaceutical. Phyto - remediation. Role of algae in CO_2 sequestration, Algae as indicator of water pollution, Algal bio inoculants, Bioluminescence.

Extra reading/Keywords: *jet fuel, green diesel, food additives, cosmeceuticals, HAEDAT*

COURSE OUTCOMES(CO)

The learners will be able to

CO No.	Course Outcomes	PSOs Addressed	Cognitive Level
CO-1	Relate to the structural organization, reproduction and significance of algae.	PSO6,PSO7	K1
CO-2	Demonstrate knowledge in understanding the various life cycle patterns and the fundamental concepts in algal growth	PSO7,PSO8	K2
CO-3	Explain the benefits of various algal technologies on the ecosystem.	PSO8,PSO9	K3
CO-4	Compare and contrast the thallus organization and modes of reproduction in algae.	PSO9, PSO10	K4
CO-5	Determine the emerging areas of Algal Biotechnology for identifying commercial potentials of algal products and their uses.	PSO9, PSO10	K5

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

Prescribed Text Books:

1. Dehradun.Edwardlee,R.2018. Phycology, 5thEd.,Cambridge University Press, London.
2. Kumar,H.D. 1999 .Introductory Phycology. Affiliated East-West Press, Delhi.
3. Singh, Pandey and Jain.2020.A text book of Botany,5th Edition, Rastogi Publication, Meerut.
4. Vashishta,P.C.2014. A text book of Algae, S.Chand &Company Ltd, New Delhi.
5. IanMorris.1977. An introduction to the algae. Hutchinson &Co (Publishers)Ltd. London.

Books for References:

1. Aziz, F and Rasheed, R. 2019. A Course Book of Algae. Publisher: University of Sulaimani. ISBN: 978-9922-20-391-1.
2. MihirKumar,D.2010. Algal Biotechnology. Daya Publishing House, New Delhi.
3. ChapmanV.J.andChapmanD.J,2013. The Algae. Alpha Numera.
4. Fritsch,F.E.1945. Structure and reproduction of Algae. Cambridge University press.
5. Round,FE.1984. The Ecology of Algae. Cambridge University Press.
6. Lee, R.D.2008.Phycology 4th Edition, Cambridge University Press,NewYork.
7. Bold, H.C and Wynne,M.J.1978 .Introduction to the Algae: Structure and Function. Prantice Hall of India

New Delhi.

Web Resources:

1. https://www.crcpress.com/Therapeutic-and-Nutritional-Uses-of-Algae/Pereira/p/book/9781498755382
2. https://www.crcpress.com/Algae-Anatomy-Biochemistry-and-Biotechnology-Second-Edition/Barsanti-Gualtieri/p/book/9781439867327
3. https://www.crcpress.com/Marine-Algae-Biodiversity-Taxonomy-Environmental-Assessment-and-Biotechnology/Pereira-Neto/p/book/9781466581678
4. https://www.kopykitab.com/Botany-For-Degree-Students-ALGAE-by-B-R-Vashishta-Dr-A-K-Sinha-Dr-V-P-Singh
5. https://www.wileyindia.com/a-textbook-of-algae.html
6. https://www.kobo.com/in/en/ebook/algae-biotechnology
7. https://www.ikbooks.com/books/book/life-sciences/botany/a-textbook-algae/9788188237449/

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
CO5	H	H	H	M	H	M	H	H	H

PSO & CO Mapping

CO/PSO	**PSO1**	**PSO2**	**PSO3**
CO1	H	M	M
CO2	H	H	M
CO3	H	H	H
CO4	H	M	H
CO5	H	M	H

H-High M-Moderate L-Low

(For Candidates admitted from the academic year 2023-24 onwards)
HOLY CROSS COLLEGE (AUTONOMOUS), TIRUCHIRAPPALLI – 620 002
SCHOOL OF LIFE SCIENCES
PG & RESEARCH DEPARTMENT OF BOTANY
CHOICE BASED CREDIT SYSTEM
LEARNING OUTCOMES-BASED CURRICULUM FRAMEWORK (LOCF)B.Sc.
BOTANY
First Year - Semester – I

Course Title	**Core Course II- Plant Diversity–I Algae Practical**
Code	**U23BO1CCP02**
Course type	**Practical**
Hours/Week	**4Hrs/wk**
Credits	**3**
Marks	**100**

CONSPECTUS

To enable the students to understand thallus organization, internal and the reproductive structures, cultivation methods and uses of algae.

COURSE OBJECTIVES

- To develop skills to identify algae based on habitat, thallus structure and the internal organization.
- To identify microalgae in a mixture and to develop skills to prepare the microslides of algae
- To learn the cultivation practices of indoor and outdoor algae.
- To study the economic importance of few species of Algae.

UNIT – I **12 Hrs**

Algae: Observation and identification of the algal forms: Unicellular- *Chlamydomonas*, Colonial- *Volvox* and *Volvox* coenobium with daughter colony, Filamentous- *Ulva* thallus and *Oedogonium*, Siphonous- *Caulerpa* thallus and rhizome.

UNIT – II **12 Hrs**

Algae: Observation and identification of the algal forms: *Chlorella*, *Chara*- Filament with oogonium, *Diatoms* and *Sargassum*.

Sectioning: *Ulva* thallus and *Caulerpa* rhizome.

UNIT –III **12 Hrs**

Algae: Observation and identification of the algal forms: *Cladophora*, *Gracilaria*, *Polysiphonia* with carposporophyte.

UNIT – IV **12 Hrs**

Algal Cultivation: Sterilization and media preparation- Knop's solution and Chu 10 medium.

Algal cultivation methods- Indoor and outdoor methods.

- Field visit to study fresh/ marine algal habits.
- Visit to nearby Industry actively engaged in algal technology.
- Submission of field and Industrial visit reports.

UNIT – V **12 Hrs**

Algae: Economic importance of Algae as: (i) Food (ii) Feed (iii) Biofertilizers (iv) Seaweed liquid fertilizer (v) Hydrogen production by algae (vi) SCP (vii) Agar- Agar (viii) Alginate (ix) Diatomaceous earth.

COURSE OUTCOMES (CO)

CO No.	Course Outcomes	Cognitive Level
CO-1	Recall and identify algae using key identification characters.	K1
CO-2	Demonstrate practical skills in preparation of fresh mount and identification of algal forms from algal mixture.	K2
CO-3	Describe the internal structure of algae prescribed in the syllabus and algal diversity in fresh/marine water and their economic significance.	K3
CO-4	Demonstrate the cultivation methods of algae with their significance.	K4
CO-5	Determine the emerging areas of Algal Biotechnology for identifying commercial potentials of algal products and their uses.	K5

Recommended Texts

1. Kumar, H.D. 1999. Introductory Phycology. Affiliated East-West Press, Delhi.
2. Bendre, M. Ashok and Ashok Kumar, A. 2020. Text Book of Practical Botany-1 (10^{th} ed).Rastogi Publications, Meerut.
3. Round, FE. 1984.The Ecology of Algae. Cambridge University Press.
4. Aziz, F and Rasheed, R. 2019. A Course Book of Algae. Publisher: University of Sulaimani. ISBN: 978-9922-20-391-1.
5. Singh, Pandey and Jain. 2020. A text book of Botany, 5th Edition, Rastogi Publication, Meerut.
6. Balachandar. D. 2007. Introductory Microbiology, New India Publishing.
7. Prakash S. Bisen, Mousumi Debnath, G. B. Prasad. 2012. Microbes: Concepts and Applications. JohnWiley & Sons Publishers.

Reference Books

1. Nancy Serediak and M. Huynh. 2011. Algae identification lab Guide. Accompanying
2. manual to algae identification field guide, Ottawa Agriculture and Agri food Canada publisher.
3. Chapman, V.J and Chapaman, D.J. 1960.The Algae, ELBS & MacMillan, London.
4. Lee, R.D. 2008.Phycology 4th Edition, Cambridge University Press, New York.
5. Dehradun. Edwardlee, R. 2018. Phycology, 5^{th} Ed., Cambridge University Press, London.
6. Jacquelyn G. Black. 2008. Microbiology: Principles and Explorations. 7^{th} Edition John Wiley & Sons Publishers.P.422.
7. **Joanne Willey, Linda Sherwood and Christopher J. Woolverton. 2017. Prescotts Microbiology, 10^{th} Edition** Mcgraw-Hill Education.

Web References

1. https://www.amazon.in/Practical-Manual-Algae-Sundara-Rajan/dp/8126106492
2. https://books.google.co.in/books/about/Practical_Manual_of_Algae.html?id=8d5DAAAACAAJ&redir_esc=
3. https://freebookcentre.net/biology-books-download/Concepts-of-Botany-Algae-(PDF-21P).html
4. https://www.ebooks.com/en-in/book/210152662/algae/sachin-kumar-mandotra/
5. https://books.google.co.in/books/about/Algae.html?id=s1P855ZWc0kC&redir_esc=y
6. .https://www.idfa.org/pasteurization

PO – CO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO-1	H	M	M	H	H	M	M	M	H
CO-2	H	M	H	H	H	M	H	M	H
CO-3	H	H	M	M	H	M	H	M	H
CO-4	H	H	H	H	H	M	M	M	M
CO-5	H	H	M	M	H	M	H	M	H

PSO – CO MAPPING

CO/PSO	PSO1	PSO2	PSO3
CO-1	H	H	H
CO-2	M	H	H
CO-3	H	H	H
CO-4	H	H	H
CO-5	H	H	H

S-Strong (3) M-Medium (2) L-Low(1)

(For Candidates admitted from the academic year 2023 onwards)

HOLY CROSS COLLEGE (AUTONOMOUS) TIRUCHIRAPPALLI-620 002

SCHOOLOF LIFE SCIENCES

PG& RESEARCH DEPARTMENT OF BOTANY

CHOICE BASED CREDIT SYSTEM

LEARNING OUTCOMES-BASED CURRICULUM FRAMEWORK (LOCF)

B.Sc., BOTANY

First Year-Semester–I

Course Title	**ALLIED BOTANY-I**
Total Hours	**60**
Hours/Week	**4 Hrs/Wk**
Code	**U23BO1ALT01**
Course Type	**Theory**
Credits	**4**
Marks	**100**

CONSPECTUS

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

COURSE OBJECTIVES:

- To study morphological and anatomical adaptations of plants of various habitats.
- To demonstrate techniques of plant tissue culture.
- To familiarize with the structure of DNA,RNA.
- To carry out experiments related with plant physiology.
- To perform bio chemistry experiments.

UNIT–I Algae **12Hrs**

General characters of algae-Structure, reproduction and life cycle of the following genera-*Anabaena* and *Sargassum* and economic importance of algae.

Extra reading (KeyWords): SCP production, Mushroom cultivation.

UNIT–II Fungi, Bacteria and Virus **12Hrs**

General characters of fungi, structure, reproduction and life cycle of the following genera -*Penicillium* and *Agaricus* and economic importance of fungi.Bacteria - general characters,structure and reproduction of *Escherichia coli* and economic importance of bacteria. Virus –general characters, structure of TMV, structure of bacteriophage.

Extra reading (Key Words): *Pathogenic fungi, Fungal Sinusitis.*

UNIT–III Bryophytes, Pteridophytes and Gymnosperms: **12Hrs**

General characters of Bryophytes, Structure and life cycle of *Funaria*. General characters of Pteridophytes, Structure and life cycle of *Lycopodium*. General characters of Gymnosperms,Structure and life cycle of *Cycas*.

Extra reading (KeyWords): *Medicinal bryophytes,Geological timescale.*

UNIT–IV Cell Biology: **12Hrs**

Prokaryotic and Eukaryotic cell ,Cell wall- structure /organization. Cell organelles – ultra structure and function ofchloroplast,mitochondriaand nucleus.Cell division-mitosis and meiosis.

Extra reading (KeyWords):*Polymorphicgene,Pleiotropy*

UNIT-V Genetics and Plant Biotechnology: 12Hrs

Mendelism-Law of dominance,Law of segregation,Incomplete dominance.Law of independent assortment. Monohybrid and di hybrid cross - Test cross - Back cross. Plant tissue culture-*Invitro* culture methods.Plant tissue culture and its application in biotechnology.

Extra reading (KeyWords): *Karyotype, Duplicate gene*

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

COURSE OUTCOMES (CO)

The learner will be able to

CO No.	Course Outcomes	Cognitive Level
CO-1	Increase the awareness and appreciation of human friendly algae and their economic importance.	K1
CO-2	Develop an understanding of microbes and fungi and appreciate their adaptive strategies	K2
CO-3	Develop critical understanding on morphology,anatomy and reproduction of Bryophytes, Pteridophytes and Gymnosperms.	K3
CO-4	Compare the structure and function of cells and explain the development of cells.	K4
CO-5	Understand the core concepts and fundamentals of plant biotechnology and genetic engineering.	K5

Text Books

1. Singh,V.,Pande,P.CandJain,D.K.2021.ATextBookofBotany.RastogiPublications,Meerut.
2. Bhatnagar,S.PandAlokMoitra.2020.Gymnosperms,New AgeInternational(P)Ltd.,Publishers,Bengaluru.
3. Sharma,O.P.2017.Bryophyta,MacMillan India Ltd.Delhi.
4. Lee,R.E.2008.Phycology,IVEdition,CambridgeUniversityPress, New Delhi.
5. Rao, K., Krishnamurthy, K.V and Rao, G.S. 1979. Ancillary Botany,S. Viswanathan Pvt.Ltd.,Madras.

Reference Books:

1. Parihar, N.S. 2012. An introduction to Embryophyta –Pteridophytes - Surjeet Publications,Delhi.
2. Alexopoulos, C.J. 2013.IntroductiontoMycology. WilleyEasternPvt. Ltd.
3. Vashishta,P.C.2014. Botany for Degree Students Gymnosperms. Chand&Company Ltd,Delhi. Coulter,M.Jhon,2014.MorphologyofGymnosperms.SurjeetPublications,Delhi.
4. Vashishta, P.C. 2014. Botany for Degree Students Algae. 2014.Chand & Company Ltd,Delhi.
5. Parihar, N.S. 2013. An introduction to Embryophyta –Bryophytes surjeetPublications,Delhi.

Web Resources:

1. https://www.kobo.com/us/en/ebook/the-algae-world
2. http://www.freebookcentre.net/biology-books-download/Fungi-(PDF-15P).html
3. http://scitec.uwichill.edu.bb/bcs/bl14apl/bryo1.htm
4. https://www.toppr.com/guides/biology/plant-kingdom/pteridophytes/
5. https://arboretum.harvard.edu/wp-content/uploads/2013-70-4-beyond-pine-cones-an-introduction-to-gymnosperms.pdf
6. https://www.us.elsevierhealth.com/medicine/cell-biology
7. https://www.us.elsevierhealth.com/medicine/genetics

Mapping with Programme Outcomes:

PO – CO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO-1	H	M	M	H	H	M	M	M	H
CO-2	H	M	H	H	M	M	H	M	M
CO-3	H	H	M	M	H	M	H	M	H
CO-4	H	H	H	H	H	M	M	M	M
CO-5	H	H	M	M	H	M	H	M	H

PSO – CO MAPPING

CO/PSO	PSO1	PSO2	PSO3
CO-1	H	H	H
CO-2	M	H	H
CO-3	H	H	H
CO-4	H	H	H
CO-5	M	H	H

(For Candidates admitted from the academic year 2023 onwards)
HOLY CROSS COLLEGE (AUTONOMOUS) TIRUCHIRAPPALLI-620002
SCHOOL OF LIFE SCIENCES
PG & RESEARCH DEPARTMENT OF BOTANY
CHOICE BASED CREDIT SYSTEM
LEARNING OUTCOMES-BASED CURRICULUM FRAMEWORK(LOCF)
B.Sc. BOTANY
First Year - Semester – I

Course Title	**PRACTICAL ALLIED BOTANY –I**
Code	**U23BO1ALP02**
Course type	**Practical**
Hours/Week	**2 Hrs /Wk**
Credit	**2**
Marks	**100**

CONSPECTUS:

To enable the students to give the practical exposure on the basic structure and life cycle pattern of primitive forms such as Algae, Fungi, Bryophytes, Pteridophytes and Gymnosperms. It also provides knowledge on Cell organelles-cell division mitosis and meiosis.Plant tissue culture and its application in biotechnology.

COURSE OBJECTIVES

- To enhance information on the identification of each taxonomical group by developing the skill-based detection of the morphology and microstructure of microorganisms, algae, and fungi.
- To comprehend the fundamental concepts and methods used to identify Bryophytes, Pteridophytes and Gymnosperms through morphological changes and evolution, anatomy and reproduction.
- To be familiar with the basic concepts and principles of plant systematics.
- Understanding of laws of inheritance, genetic basis of loci and alleles.

UNIT – I Algae : **6 hrs**

Observation and identification of the algal forms: Make suitable micro preparation of the types prescribed in Algae- *Anabaena* and *Sargassum*

UNIT – II Fungi, Bacteria and Virus **6 hrs**

Observation and identification of the fungal forms: *Penicillium* and *Agaricus.* Structure of *E.coli*.Virus- Structure of TMV .

UNIT- III Bryophytes, Pteridophytes and Gymnosperms: **6 hrs**

Observation and identification of morphological structure of *Bryophytes- Funaria*. Pteridophytes- *Lycopodium.* Gymnosperm- *Cycus leaflet.*

UNIT – IV Cell Biology : **6 hrs**

Micro photographs of the cell organelles ultra structure. Cell division –Preparation of squash (Mitosis -Onion root tip)

UNIT – V Genetics and Plant Biotechnology : **6 hrs**

Simple problems in monohybrid and dihybrid ratios. In vitro culture methods- Sterilization and Micropropagation.

COURSE OUTCOMES (CO)

CO No.	Course Outcomes	Cognitive Level
CO-1	To study the internal organization of algae and fungi.	K1
CO-2	To study the internal organization of Bryophytes, Pteridophytes and Gymnosperm	K2
CO-3	Develop critical understanding on morphology, anatomy and reproduction of Bryophytes, Pteridophytes and Gymnosperms..	K3
CO-4	Describe the stages of mitosis and its role in plant growth	K4
CO-5	Construct the checker board for Mono and dihybrid cross.	K5

Text Books:

1. Sharma, O.P. 2017. Bryophyta, MacMillan India Ltd, New Delhi.
2. Sharma, O.P. 2012. Pteridophyta, Tata McGraw-Hills Ltd, New Delhi.
3. Subramaniam, N.S. 1996. Laboratory Manual of Plant Taxonomy. Vikas Publishing House Pvt. Ltd., New Delhi..
4. Benjamin, A. Pierce. 2012. Genetics- A conceptual Approach. W.H. Freeman and Company, New York, England.
5. Noggle G.R and G.J. Fritz. 2002. Introductory Plant Physiology. Prentice Hall of India, New Delhi.

Suggested Reading:

1. Strickberger, M.W. 2005. Genetics (III Ed). Prentice Hall, New Delhi, India.
2. Nancy Serediak and M. Huynh. 2011. Algae identification lab Guide. Accompanying manual to algae identification field guide, Ottawa Agriculture and Agri food Canada publisher.
3. Mohammed Gufran Khan, Shite Gatew and Bedilu Bekele. 2012. Practical manual for Bryophytes and Pteridophytes. Lambert Academic Publishing.
4. Aler Gingauz. 2001. Medicinal Chemistry. Oxford University Press & WileyPublications.

Steward, F.C. 2012. Plant Physiology Academic Press, US

Mapping with Programme Outcomes:

PO – CO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO-1	H	M	M	H	H	M	M	M	H
CO-2	H	M	M	H	M	M	H	M	M
CO-3	H	H	H	M	H	M	H	M	H
CO-4	H	H	H	H	H	M	M	M	M
CO-5	H	H	H	H	H	M	M	M	M

PSO – CO MAPPING

CO/PSO	PSO1	PSO2	PSO3
CO-1	H	H	H
CO-2	M	H	H
CO-3	H	H	H
CO-4	H	H	H
CO-5	H	H	H

H-High M-Medium L-Low

(For Candidates admitted from the academic year 2023-24 onwards)
HOLY CROSS COLLEGE (AUTONOMOUS) TIRUCHIRAPPALLI-620 002
SCHOOL OF LIFE SCIENCES
PG & RESEARCH DEPARTMENT OF BOTANY
CHOICE BASED CREDIT SYSTEM
LEARNING OUTCOMES-BASED CURRICULUM FRAMEWORK (LOCF)
B.Sc. BOTANY
First Year - Semester – I

Course Title	**SKILL ENHANCEMENT COURSE –I** **NME – 1 - ORGANIC FARMING**
Total Hours	**30**
Hours/Week	**2 Hrs /Wk**
Code	**U23BO1NMT01**
Course Type	**Theory**
Credits	**2**
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 biology.

UNIT – I Principles of Organic Farming 6hrs.

The Basis of Farming- Aim,Principle and objectives. Soil types:- Alluvial, Laterite, Clay, and Loam. , Agriculture and Climate change

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

UNIT – II Models and mixed Organic farming 6hrs.

Organic Farming Models - Natural Farming - Australian Organic Farming, Ecological Farming Palekar Model. Mixed organic farming system, its definition concept and benefits. Advantages and disadvantages.

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

UNIT – III Soil preparation and Nutrients for Organic farming 6 hrs.

Soil preparation, soil and water conservation strategies. Sources of nutrients - Organic Manure –FYM/Rural compost, Green Manure – Leguminous crops in crop rotation, Bio fertilizers and their use as nutrients.

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

UNIT – IV Crops for organic farming and marketing. 6hrs.
Indigenous Crops – Selection & Processing, Food Crops , Cash Crops, Mono crops, Mixed Crops, Herbs and Spices. Terrace farming. Vertical gardens. Marketing, Imports and exports, .

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

UNIT – V – Maintenance of Standards and Agencies of Organic farming 6hrs.
Farm inspection and certification, National and International level Agencies and institutions related to organic farming. Indian National Standards for organic products.

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..	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
CO-5	Assess the different models and types of organic farming practice	K5

Text Books:

1.Bavec, F. and Bavec, M. (2007). Organic Production and Use of Alternative Crops.CRC ress, 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
CO5	H	H	H	M	H	M	H	H	H

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
CO5	H	M	H

H-High M-Moderate L-Low

(For Candidates admitted from the academic year 2023-24 onwards)

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

CourseTitle	**FOUNDATION COURSE–BASICS OF BOTANY**
TotalHours	**30**
Hours/Week	**2 Hrs/Wk**
Code	**U23BO1FCT01**
CourseType	**Theory**
Credits	**2**
Marks	**100**

CONSPECTUS

To recall the students about the basic aspects of Botany.

COURSEOBJECTIVES

The learner will be able to

To learn about the classification, distinguishing traits, geographic distribution, and reproductive cycle of Algae, Fungi, Bryophytes, Viruses -Bacteria.

- To investigate the classification, distinctive traits, distribution and reproduction and life history of the various classes and major types of Pteridophytes and Gymnosperms.
- Enable to learn various cell structures and functions of prokaryotes and eukaryotes and understand the salient features and functions of cellular organelles
- Understand the laws of inheritance, genetic basis of loci and alleles.
- Learn the significance of plant morphology and physiology.

UNIT–I **6hrs**

Biodiversity - Systematics : Two Kingdom and Five Kingdom systems - Salient features ofvarious Plant Groups : Algae, Fungi, Bryophytes, Pteridophytes and Gymnosperms- Viruses -Bacteria.

Extra reading/Keywords: *Molecular systematics, Plant nomenclature*

UNIT-II **6hrs**

Cell Biology – Cell as a basic unit of life – Prokaryotic and Eukaryotic cell (Plant cell) – Light Microscope and Electron Microscope Ultra structure of Prokaryotic and Eukaryotic Cells- Cell wall–Cell Membrane.

Extra reading/Keywords: *cellular and genomic DNA, cytoplasmic inheritance*

UNIT-III **6hrs**

Plant Morphology – Structure and modification of root, stem and leaf – Structure and types of Inflorescences–structure and types of flowers, fruits and seeds.

Extra reading/Keywords: *Nodal anatomy, Vasculature*

UNIT–IV **6hrs**

Genetics–Concept of Heredity and Variation–Mendel's laws of inheritance

Extra reading/Key words: *Demorgan's experiments, Linkage*

UNIT–V **6hrs**

Plant Physiology – Cell as a physiological unit : Water relations – Absorption and movement: Diffusion, Osmosis, Plasmolysis, Imbibition – Permeability, Water Potential- Transpiration –Movement–Mineral Nutrition**.**

Extra reading/Keywords: *Aquaporin, apoplast symplast concept*

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

COURSE OUTCOMES (CO)

The learners will be able to

CO No.	Course Outcomes	Cognitive Level
CO-1	Increase the awareness and appreciation of human friendly Algae and their economic importance.	K1
CO-2	Develop an understanding of microbes and fungi and Appreciate their adaptive strategies	K2
CO-3	Develop critical understanding on morphology, anatomy And reproduction of Bryophytes, Pteridophytes and Gymnosperms.	K3
CO-4	Compare the structure and function of cells and explain the development of cells.	K4
CO-5	Understand the core concepts and fundamentals of plant biotechnology and genetic engineering.	K5

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

Recommended Texts:

1. Singh, V., Pande, P.C and Jain, D.K. 2021. A Text Book of Botany. Rastogi Publications,Meerut.
2. Bhatnagar, S.P and Alok Moitra. 2020. Gymnosperms, New Age International (P) Ltd., Publishers, Bengaluru.
3. Sharma, O.P. 2017. Bryophyta, MacMillan India Ltd. Delhi.
4. Lee, R.E. 2008. Phycology, IV Edition, Cambridge University Press, New Delhi.
5. Pandey B.P. 1986, Text Book of Botany (College Botany) Vol I and II, S.Chand and Co. New Delhi.
6. Rao, K., Krishnamurthy, K.V and Rao, G.S. 1979. Ancillary Botany,S. Viswanathan Pvt. Ltd., Madras.

Reference books:

1. Parihar, N.S. 2012. An introduction to Embryophyta –Pteridophytes - Surjeet Publications, Delhi.
2. Alexopoulos, C.J. 2013. Introduction to Mycology. Willey Eastern Pvt. Ltd.
3. Vashishta, P.C. 2014. Botany for Degree Students Gymnosperms. Chand & Company Ltd, Delhi.
4. Coulter, M. Jhon, 2014. Morphology of Gymnosperms. Surjeet Publications, Delhi.

Web Resources:

1. https://www.kobo.com/us/en/ebook/the-algae-world
2. http://www.freebookcentre.net/biology-books-download/Fungi-(PDF-15P).html
3. http://scitec.uwichill.edu.bb/bcs/bl14apl/bryo1.htm
4. https://www.toppr.com/guides/biology/plant-kingdom/pteridophytes/
5. https://arboretum.harvard.edu/wp-content/uploads/2013-70-4-beyond-pine-cones-an-introduction-to-gymnosperms.pdf
6. https://www.us.elsevierhealth.com/medicine/cell-biology
7. https://www.us.elsevierhealth.com/medicine/genetics
8. https://www.kobo.com/us/en/ebook/plant-biotechnology-1

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
CO5	H	H	H	M	H	M	H	H	H

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
CO5	H	M	H

H-High M-Moderate L-Low

(For Candidates admitted from the academic year 2023-24 onwards)

I B.Sc. BOTANY - Semester – II

Course Title	**CORE COURSE 3- DIVERSITY – II- FUNGI, BACTERIA, VIRUS, PLANT PATHOLOGY AND LICHENS**
Total Hours	**75**
Hours/Week	**5 Hrs. /Wk**
Code	**U23BO2CCT03**
Course Type	**Theory**
Credits	**4**
Marks	**100**

CONSPECTUS

To enable the students to understand the classification, study of the genera belonging to various classes of fungi, bacteria, virus & lichens and their structure, reproduction and economic importance and also to understand the plant diseases.

COURSE OBJECTIVES

The learner will be able to

- To remember and understand the morphology and reproduction of the various genera of fungi.
- To describe the morphology, reproduction and lifecycle of fungi.
- To analyze the structure and types of bacteria and virus.
- To understand the types of plant diseases.
- To remember and understand the classification and different types of lichens and analyze the economic importance of lichens.

UNIT– I Fungi **15 Hrs.**

Outline of classification of fungi (Ainsworth, 1971). Salient features of the different classes of fungi. Occurrence, Characteristic features, thallus organization, mode of nutrition and reproduction of the following genera: *Rhizopus*, *Albugo, Saccharomyces* and *Penicillium.*

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

UNIT – II Fungi **15 Hrs.**

Morphology and reproduction of the following genera: *Peziza, Puccinia, Polyporus* and *Agaricus*. Importance of fungi in human life- medicine, agriculture and food industry. Mushroom cultivation. Structure and importance of AM (Arbuscular Mycorrhiza) fungi, Harmful effects of Fungi.

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

UNIT – III Bacteria and Virus **15 Hrs.**

Bacteria: Morphology, ultra-structure, types and reproduction of Bacteria. **Staining:** Simple and differential staining (Gram staining).

Virus: Structure, types, reproduction and life cycle of bacteriophages and plant viruses (CaMV). Phycoviruses and Mycoviruses.

Extra reading/Key words: *Arboviruses, FMDV*

UNIT – IV Plant Pathology **15 Hrs.**

Plant diseases: Concept and pathogenesis. Koch's Postulates. Host parasite interaction-pathogenesis- entry of pathogen-development inside the host.

Etiology, causative organism, symptoms and control measures of the following diseases:

Bacterial diseases – Citrus canker and Bacterial Wilt of Banana

Fungal diseases – Blast disease in Rice and Tikka disease of groundnut
Viral diseases – Tobacco Mosaic Virus and Vein clearing of Papaya

Extra reading/Key words: *Phytoalexin, Integrated disease Management.*

UNIT – V Lichens **15 Hrs.**

Classification of lichens (Hale, 1969). Lichens- distribution, structure and types. Nature of association of algal and fungal partners. *Usnea*- distribution, thallus organization and reproduction. Economic importance of lichens.

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

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

COURSE OUTCOMES (CO)

The learner will be able to

CO No.	Course Outcomes	Cognitive Level
CO-1	List the salient features of the main classes of fungi.	K1
CO-2	Describe the morphology and reproduction of the various genera of fungi.	K2
CO-3	Explain the structure and different types of microbial species and classify the various plant diseases.	K3
CO-4	Analyze the Nature of association of algal and fungal partners and economic importance of lichens.	K4

(K1-Remember; K2-Understand; K3-Apply; K4–Analyze)

Prescribed Text Books:

1. Pandey, B.P. 1997. College Botany. Vol. I Fungi & Pathology.
2. Mehrotra, R.S and Aneja, K.R. 2003. An introduction to mycology. New age International (P) Ltd, Publishers, New Delhi.
3. Sharma, P.D. 2011. Plant Pathology, Rastogi Publication, Meerut, India.
4. Mahendra Rai. 2009. Advances in Fungal Biotechnology. I.K. International Publishing House, New Delhi.Vashishta, B. R. 2010. Botany for degree students Algae. S. Chand and Company Ltd, New Delhi.
5. Vashista, B. R. and Sinha, A. K. 2016. Botany for degree students Fungi. S. Chand and Company Ltd, New Delhi.

Books for Reference:

1. Alexopoulos, C.J., Mims, C.W., Blackwell, M. 1996. Introductory Mycology. 4th edition. John Wiley & Sons (Asia) Singapore.
2. Sharma, O.P. 2011. Fungi and allied microbes The McGraw –Hill companies, New Delhi.
3. Dharani Dhar Awasthi. 2000. A Handbook of Lichens Vedams eBooks (P) Ltd. New Delhi.
4. Pelzer, M.J., Chan, E.C.S and Krieg, N.R. 1983. Microbiology, Tata MaGraw Hill Publishing House, New Delhi.
5. Pandey, P.B. 2014. College Botany- 1: Including Algae, Fungi, Lichens, Bacteria, Viruses, Plant Pathology, Industrial Microbiology and Bryophyta. Chand Publishing, New Delhi.
6. Mishra, A. and Agarwal, R.P. 1978. Lichens – A Preliminary Text. Oxford and IBH.
7. Pandey, B.P. 2005. College Botany I: Including Algae, Fungi, Lichens, Bacteria, Viruses, Plant Pathology, Industrial Microbiology and Bryophyta. S Chand & Company

Web References:

1. https://www.amazon.in/Fungi-Sarah-C-Watkinson-ebook/dp/B0199YFDFE
2. http://www.freebookcentre.net/biology-books-download/A-text-book-of-mycology-and-plant-pathology.html
3. http://www.freebookcentre.net/Biology/Mycology-Books.html
4. https://www.kobo.com/us/en/ebook/introduction-to-fungi
5. http://www.freebookcentre.net/biology-books-download/Introductory-Mycology.html
6. http://www.freebookcentre.net/biology-books-download/Fungi-(PDF-15P).html

Mapping :

PO & CO Mapping

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	3	1	3	2	1	2	2	2	2
CO 2	3	2	2	3	3	2	1	2	1
CO 3	2	3	3	1	2	2	3	2	3
CO 4	3	3	3	3	2	3	3	3	3

PSO & CO Mapping

CO/PSO	PSO1	PSO2	PSO3	PSO4
CO1	2	2	2	2
CO 2	2	1	2	1
CO 3	1	3	1	3
CO 4	3	3	3	3

S-Strong (3) M-Medium (2) L-Low(1)

(For Candidates admitted from the academic year 2023-2024 onwards)

I B.Sc. BOTANY - Semester – II

Course Title	**CORE COURSE 4- PRACTICAL II -DIVERSITY – II- FUNGI, BACTERIA, VIRUS, PLANT PATHOLOGY AND LICHENS**
Total Hours	**60**
Hours/Week	**4 Hrs. /Wk**
Code	**U23BO2CCP04**
Course Type	**Practical**
Credits	**3**
Marks	**100**

CONSPECTUS

To enable the students to understand thallus organization, internal and the reproductive structures of fungi, bacteria, virus, plant pathology and lichens.

COURSE OBJECTIVES

The learner will be able to

- To remember and understand the internal structure and reproduction of fungi.
- To understand the economic importance of fungi
- To analyze the staining technique and understand the structure of bacteria and virus.
- To classify the different types of plant diseases.
- To understand the morphology of thallus & apothecium of *Usnea*

UNIT – I Fungi: **12 Hrs.**

Observation and identification of the fungal forms: *Rhizopus*, *Albugo*, *Saccharomyces, Penicillium* - conidia. *Peziza* - apothecium, *Polyporus* - basidiocarp. Sectioning: *Albugo* infected leaves.

UNIT – II Fungi: **12 Hrs.**

Observation and identification of the fungal forms: *Puccinia*- infected leaves showing uredia, telia, pycnidia and aecidia. *Agaricus*- structure of Gill. Mushroom cultivation. *Mycorrhiza*: Ecto-mycorrhiza and endo-mycorrhiza.**Economic Importance of Fungi:** Biopesticides, edible fungi/yeast, organic acids (citric acid), enzymes (protease), antibiotics and vitamins.

UNIT – III Bacteria & Virus: **12 Hrs.**

Ultra structure of Bacteria, structure of bacteriophage, Structure of plant virus(CaMV), Staining Techniques: Simple Staining, Gram staining- Gram positive/ Gram negative.

UNIT – IV Plant Pathology: **12 Hrs.**

Etiology, Causative organism, symptoms and control measures of the following diseases: Bacterial disease – Citrus canker and Bacterial wilt of Banana, Fungal disease –Blast disease in Rice and Tikka disease of ground nut, Viral disease – Tobacco mosaic virus and Vein clearing of Papaya.

UNIT – V Lichens: **12 Hrs.**

Observation & identification of lichen form **:** *Usnea***–** Morphology of thallus & apothecium. Economic importance of Lichens- Dyes and perfume.

COURSE OUTCOMES (CO)

The learner will be able to

CO No.	Course Outcomes	Cognitive Level
CO-1	Describe the morphology and reproduction of the various genera of fungi.	K1
CO-2	Develop the practical skills by observing the morphological and anatomical and structures of Fungi	K2
CO-3	Analyze and identify the bacteria using staining technique.	K3
CO-4	Categorize, identify, draw and explain the plant disease. Analyze the economic importance of the Lichens and application in the various field.	K4

(K1-Remember; K2-Understand; K3-Apply; K4–Analyze)

Prescribed Text Books:

1. Chmielewski, J.G and Krayesky, D. 2013. General Botany Laboratory Manual. Author House, Bloomington, USA.
2. Das, S and Saha, R. 2020. Microbiology Practical Manual. CBS Publishers and Distributors (P) Ltd., New Delhi, India.
3. Webster, J and Weber, R. 2007. Introduction to Fungi, 3rd Ed. Cambridge University Press, Cambridge.
4. Nair, L.N. 2007. Topics in Mycology and Pathology, New Central Book agency, Kolkata.

Suggested Reference Books:

1. Alexopoulos, J and Mims, W. 1985 . Introductory Mycology, Wiley Eastern Limited New Delhi.
2. Bendre, M. Ashok and Ashok Kumar, A. 2020. Text Book of Practical Botany 1 (10th ed).Rastogi Publications, Meerut.
3. Singh, R and U.C. Singh 2020. Modern mushroom cultivation, 3d Edition Agrobios (India), Jodhpur.
4. Poonam Singh and Ashok Pandey. 2009. Biotechnology for agro-Industrial residues utilization. Springer.
5. Satyanarayana T and Johri B.N. 2005. Microbial diversity, Current Perspectives and Potential Applications, IK International.

Website References:

1. https://www.amazon.in/Practical-Manual-Fungi-Fungicides/dp/B0025AEFP4
2. https://books.google.co.in/books/about/Practical_Mycology.html?id=5ycJAQAAMAAJ&redir_esc=y
3. https://www.flipkart.com/colour-handbook-practical-plant-pathology/p/itmefsn6dyhfhs9b
4. https://books.google.co.in/books/about/Practical_Botany.html?id=T5narQEACAAJ&redir_e
5. https://www.kobo.com/us/en/ebook/introduction-to-fungi

Mapping: PO & CO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	3	1	3	2	1	1	2	2	3
CO 2	3	2	2	3	3	2	3	2	3
CO 3	2	3	3	1	2	3	3	3	3
CO 4	3	3	3	3	2	2	2	3	3

PSO/CO Mapping

CO/PSO	PSO1	PSO2	PSO3	PSO4
CO1	2	2	2	2
CO 2	2	1	2	1
CO 3	1	3	1	3
CO 4	3	3	3	3

(For Candidates admitted from the academic year 2023-2024 onwards)

I B.Sc., BOTANY –Semester –II

Course Title	**ALLIED COURSE 3- BOTANY-II**
Total Hours	**60**
Hours/Week	**4 Hrs./Wk**
Code	**U23BO2ALT03**
Course Type	**Theory**
Credits	**4**
Marks	**100**

CONSPECTUS

To enable the students to understand the basic concepts and fundamentals of various branches of botany like plant systematics, plant anatomy, embryology and plant physiology.

COURSE OBJECTIVES:

- To be familiar with the basic concepts and principles of plant systematics.
- To understand plant anatomical systems.
- To identify the mechanisms underlying the shift from vegetative to reproductive phase.
- To learn about the physiological processes that underlie plant metabolism.
- To know the energy production and its utilization in plants.

UNIT–I Morphology of flowering plants: 12Hrs.

Plant and its parts. Structure and function of root and stem. Leaf and its parts. Leaf types- simple and compound. Phyllotaxy. Inflorescence - Racemose, Cymose and Special types. Terminology with reference to flower description.

Extra reading (KeyWords): *Ectogenesis and Xerophytes.*

UNIT–II Taxonomy: 12Hrs.

Natural system of Classification (Bentham and Hooker). Study of the range of characters and plants of economic importance in the following families: Annonaceae, Rutaceae, Rubiaceae, Amaranthaceae and Poaceae.

Extra reading (Key Words): *Cladogram and ICBN*.

UNIT–III Anatomy 12Hrs.

Tissue and tissue systems: Simple and complex tissues. Anatomy- Primary and secondary structure of dicot root and stem, Monocot stem and dicot leaf. Nodal types of dicot plants - Uni, tri and multi lacunar.

Extra reading (KeyWords): *Anomalous Secondary growth in plants and dendrochronology.*

UNIT–IV Embryology 12Hrs.

Embryology – structure of anther, microsporogenesis and male gametophyte. Structure of dicot embryo, structure of embryo sac. Structure of ovule, megasporogenesis and female gametophyte.

Extra reading (KeyWords): *Pollinators and specific plants.*

UNIT-V Plant Physiology 12Hrs.

Absorption of water – active & passive absorption. 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). Photoperiodism.

Extra reading (KeyWords): *Gibberellins and Ethylene*

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

Prescribed Text Books:

1. Sharma, O.P. 2017. Plant Taxonomy. (II Edition).The McGraw Hill Companies.
2. Bhojwani, S.S. Bhatnagar, S.P and Dantu, P.K. 2015. The Embryology of Angiosperms (6th revised and enlarged edition). Vikas Publishing House, New Delhi.
3. Maheshwari, P. 1963. Recent Advances in Embryology of Angiosperms. Intl. Soc. Plant Morphologists, New Delhi.

Suggested Reference Books

1. Bhojwani, S.S and Bhatnagar, S.P. 2000. The Embryology of Angiosperms (4th revised and enlarged edition). Vikas Publishing House, New Delhi.
2. Pandey, B.P. 2012. Plant Anatomy. S Chand Publishing.
3. Jain, VK. 2006. Fundamentals of Plant Physiology, S. Chand and Company Ltd.
4. Rajni Gupta. 2012. Plant Taxonomy: Past, Present and Future. Vedams (P) Ltd. New Delhi.

Website References

1. https://books.google.co.in/books/about/plant_taxonomy.html?Id=0bys8f0mb9gc&redir
2. https://books.google.co.in/books/about/plant_taxonomy_2e.html?Id=roi0lwsxfnuc&redi
3. https://archive.org/experiments/plantanatomy031773mbp
4. https://www.amazon.in/embryology-angiosperms-6th-s-p-bhatnagar-ebook/dp/b00un5kpqg

COURSE OUTCOMES(CO)

The learner will be able to

CO No.	Course Outcomes	Cognitive Level
CO-1	Increase the awareness and identification of flowering plants based on the morphology.	K1
CO-2	Develop an understanding of the plant systematic characters and economic importance of plants and appreciate their adaptive strategies.	K2
CO-3	Develop critical understanding on anatomy of plant parts	K3
CO-4	Compare the structure and function of embryo and explain the development of seeds.	K4

(K1-Remember; K2 Understand; K3-Apply; K4–Analyze)

Mapping with Programme outcomes:

PO– CO MAPPING

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

PSO –CO MAPPING

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

S-Strong(3) M-Medium(2) L-Low(1)

(For Candidates admitted from the academic year 2023-2024 onwards)

I B.Sc. BOTANY –Semester –II

Course Title	**ALLIED COURSE 4- BOTANY –II PRACTICAL**
Total Hours	**30**
Code	**U23BO2ALP04**
Course type	**Practical**
Hours/Week	**2 Hrs./Wk**
Credit	**2**
Marks	**100**

CONSPECTUS

To enable the students to give the practical exposure on the morphological structure of flowering plants, plant systematics, plant anatomy, and embryology and plant physiology. It also provides knowledge on growth hormones.

COURSE OBJECTIVES

- To enhance information on the identification of each taxonomical group by developing the skill-based detection of the morphology.
- To be familiar with the basic concepts and principles of plant systematics.
- To comprehend the fundamental concepts and methods used to identify through morphological changes and, anatomy.
- To study the Structure of mature anther and ovule.
- To learn about the physiological processes that underlie plant metabolism.

UNIT – I Morphology of flowering plants **6Hrs.**

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

UNIT – II Taxonomy: **6 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- III Anatomy **6 Hrs.**

Primary and secondary structure of dicot stems and root (Vernonia), Monocot stem (Bamboo) and dicot leaf. Nodal types of dicot plants – uni, tri and multi lacunar.

UNIT – IV : Embryology **6Hrs.**

Structure of mature anther and ovule - Types of ovules, structure of dicotyledonous and monocotyledonous embryo, structure of embryo sac.

UNIT – V Plant Physiology : **6Hrs.**

Experiments on absorption (Osmosis), Photosynthesis (test tube funnel), transpiration (Ganong's potometer) respiration (Ganong's respiroscope).

Prescribed Text Books:

1. Sharma,O.P.2017. Bryophyta, Mac Millan India Ltd, New Delhi.
2. Sharma,O.P.2012. Pteridophyta,Tata McGraw-Hills Ltd,New Delhi.
3. Subramaniam, N.S. 1996. Laboratory Manual of Plant Taxonomy. Vikas Publishing House Pvt. Ltd., New Delhi..
4. Benjamin, A. Pierce. 2012. Genetics- A conceptual Approach. W.H. Freeman and

Company, NewYork, England.
5. Noggle G.R and G.J. Fritz. 2002. Introductory Plant Physiology. Prentice Hall of India, New Delhi.

Suggested Reference Books

1. Lawrence.G.H.M. 1985. An Introduction to Plant Taxonomy, Central Book Depot, Allahabad.
2. Bhojwani, S.S and Bhatnagar, S.P. 2000. The Embryology of Angiosperms (4th revised and enlarged edition). Vikas Publishing House, New Delhi.
3. Pandey, B.P. 2012. Plant Anatomy. S Chand Publishing.
4. Jain, VK. 2006. Fundamentals of Plant Physiology, S. Chand and Company Ltd.
5. Steward, F.C. 2012. Plant Physiology Academic Press, US.

COURSE OUTCOMES(CO)

CO No.	Course Outcomes	Cognitive Level
CO-1	To study the morphological features of flowering plants.	K1
CO-2	To study the internal organization of flowers and floral parts.	K2
CO-3	Develop critical understanding on anatomy of stem, root and leaves.	K3
CO-4	Describe Structure of mature anther, ovule and structure of dicotyledonous and monocotyledonous seeds.	K4

(K1-Remember; K2Understand; K3-Apply; K4–Analyze)

Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	3	3	3	3	3	3	3	3	3
CO2	3	3	3	3	3	3	3	3	3
CO3	2	3	3	3	3	1	3	3	1
CO4	3	3	2	3	3	3	3	2	3

PSO –CO MAPPING

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

(For Candidates admitted from the academic year 2023-2024 onwards)

I B.Sc., BOTANY - Semester – II

Course Title	**SEC II (NME II) MUSHROOM CULTIVATION**
Total Hours	**30**
Hours/Week	**2 Hrs. /Wk**
Code	**U23BO2SET02**
Course Type	**Theory**
Credits	**2**
Marks	**100**

CONSPECTUS

To enable the students to understand Basic knowledge on structure and function of various groups of mushrooms.

COURSE OBJECTIVES

The learner will be able to

- To remember, learn and develop skills in mushroom cultivation.
- To understand and appreciate the role of mushrooms in Nutrition, Medicine and health.
- To cultivate mushroom cultivation in small scale industry.
- To learn about diseases of mushrooms and post-harvest technology.
- To understand and study new methods and strategies to contribute to mushroom production

UNIT – I **6 Hrs.**

Mushroom cultivation, prospects and scope of Mushroom cultivation in small scale Industry. International demand and marketing of mushrooms. Mushroom cultivation in India.

Extra reading /Key Words: *Shittake mushroom, morels*

UNIT – II **6 Hrs.**

Introduction: Morphology, Types of Mushroom, identification of edible and poisonous mushroom, Nutritive and medicinal importance of common edible mushrooms. Nutraceuticals and additives from mushroom and its products.

Extra reading /Key Words: *Veganism, Agribusiness*

UNIT – III **6 Hrs.**

Mushroom cultivation sheds and its types. Life cycle of *Pleurotus spp* (Oyster mushroom) and *Agaricus Spp* (Button mushroom). Substrates and medium of growth for oyster and button mushroom.

Extra reading /Key Words: M*ilky mushroom, Ganoderma*

UNIT – IV **6 Hrs.**

Production of pure culture,mother culture and bed culture.Spawn production, growth media, spawn running and harvesting of mushrooms.

Extra reading /Key Words: *Pure cultures, grain spawn.*

UNIT – V **6 Hrs.**

Post harvest technology, Packing, marketing and transporation. Diseases-Insect pests, viruses, fungal competitors ,symptoms and its control measures.

Extra reading /Key Words: *grading and canning, steeping preservation.*

COURSE OUTCOMES (CO)

The learner will be able to

CO No.	Course Outcomes	Cognitive Level
CO-1	Describe various types and categories of mushroom.	K1
CO-2	Develop various types of food technologies associated with mushroom industry.	K2
CO-3	Apply techniques studied for cultivation of various types of mushroom.	K3

(K1-Remember; K2Understand; K3-Apply)

Prescribed Text Books:

1. Handbook of Mushroom Cultivation. 1999. TNAU publication.
2. Marimuthu, T., Krishnamoorthy, A.S., Sivaprakasam, K. and Jayarajan. R. 1991. Oyster Mushrooms, Department of Plant Pathology, Tamil Nadu Agricultural University, Coimbatore.
3. Swaminathan, M. 1990. Food and Nutrition. Bappco, The Bangalore Printing and Publishing Co. Ltd., No. 88, Mysore Road, Bangalore - 560018.
4. Sing. 2005. Modern Mushroom Cultivation, International Book Distributors, Dehradun.
5. Verma,2013. Mushroom:edible and medicinal:cultivation conservation,strain improvement with their marketing. Daya Publishing House.

Suggested Reference Books:

1. Nita Bahl. 2002. Handbook on Mushroom 4th edition Vijayprimlani for oxford & IBH publishing co., Pvt., Ltd., New Delhi.
2. Suman. 2005. Mushroom Cultivation Processing and Uses, M/s. IBD Publishers and Distributors, New Delhi.

Website References:

1. https://www.amazon.in/Practical-Manual-Fungi-Fungicides/dp/B0025AEFP4
2. https://books.google.co.in/books/about/Practical_Mycology.html?id=5ycJAQAAMAAJ&red ir_esc=y
3. https://www.flipkart.com/colour-handbook-practical-plant-pathology/p/itmefsn6dyhfhs9b

Mapping:

PO & CO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	3	3	1	3	2	1	2	2	2
CO 2	2	3	2	2	3	3	2	3	3
CO 3	2	2	3	3	1	2	1	3	1

PSO & CO Mapping

CO/PSO	PSO1	PSO2	PSO3
CO1	3	1	3
CO 2	3	2	2
CO 3	2	3	3

(For Candidates admitted from the academic year 2022 onwards)

II B.SC.,BOTANY

SEMESTER (III and IV)

Sem.	Part	Course	Title of the paper	Course Code	Hrs. / Week	Credits	Marks
III	I	Language	Tamil paper III/ Hindi paper III / French paper III	U22TL3GEN03/ U22HN3HIN03/ U22FR3FRE03	3	3	100
	II	English	General English III	U22EL3GEN03	3	3	100
	III	Major Core -7	MC- Cell Biology and Biostatistics	U22BO3MCT07	5	4	100
		Major Core -8	MC-7 Horticulture and Plant Breeding	U22BO3MCT08	5	4	100
		Major Elective	ourse within the school- Organic Farming	U22BO3MET01	4	3	100
		MSBE –II (Star College paper)	MSBE - 2 - Botanical Techniques for Chemistry/ Botanical Techniques for Physics	U22BO3SBP03/ U22BO3SBP04	2	1	100
		Allied-4	Paper I -Plant Diversity, Taxonomy, Anatomy, Embryology, Ecology and Physiology	U22BO3ALT04	4	2	100
	IV	NME	NME – 1 Food Science & Technology	U22BO3NMT01	2	2	100
		Gender	Gender Studies	U22WS3GST01	1	1	100
		Value Education	Bible/Catechism/Ethics	U22VE3LVE02/ U22VE3LVB02/ U22VE3LVC02	1		-
		Extra Credit	Online Course	U22EX3ONC02	-	1	100
	VI	Extension Activities	Service Oriented Course (Any one activity based on the student's choice – 15 activities)				-
		Extra Credit	Internship / Field Work / Field Project 30Hours - Extra Credit	U22E3INT03		2 (Extra Credit)	100
			Total		**30**	**23+3**	**900+100**

Sem.	Part	Course	Title of the paper	Course Code	Hrs./ Week	Credits	Marks
IV	I	Language	Tamil paper IV/ Hindi paper IV / French paperIV	U22TL4GEN04/ U22HN4HIN04/ U22FR4FRE04	3	3	100
	II	English	General English IV	U22EL4GEN04	3	3	100
	III	Major Core – 9	Bioprospecting and utilization of Plant resources.	U22BO4MCT09	5	4	100
		Major Core – 10	Phytogeography & Forestry	U22BO4MCT10	4	4	100
		Major Elective-2	Course within School – Horticulture and Plant tissue culture .	U22BO4MET02	4	3	100
		Allied – 5	Paper-II Bioprospecting and Plant Biotechnology	U22BO4ALT05	4	2	100
		Allied – 6	Paper III Practical-1	U22BO4ALP06	4	2	100
	IV	NME- 2	Value added products and their recipes	U22BO4NMT02	2	2	100
		Value Education	Bible/Catechism/Ethics	U22VE4LVB02/ U22VE4LVC02/ U22VE4LVE02	1	1	100
	VI	Extension Activities	Service Oriented Course (Any one activity based on the student's choice – 15 activities)	-	-	2	100
			RESCAPES	U22EX4RES02		1	
		Extra Credit	Internship / Field Work / Field Project 30Hours - Extra Credit	U22EX4INT04		2 (Extra Credit)	100
			Total		**30**	**24+5**	**900+200**

(For Candidates admitted from the academic year 2022 onwards)
HOLY CROSS COLLEGE (AUTONOMOUS) TIRUCHIRAPPALLI –2
SCHOOL OF LIFE SCIENCES
PG AND RESEARCH DEPARTMENT OF BOTANY
CHOICE BASED CREDIT SYSTEM
LEARNING OUTCOMES-BASED CURRICULUM FRAMEWORK (LOCF)
B.Sc. BOTANY

Second Year - Semester – III

Course Title	**MAJOR CORE – 7- CELL BIOLOGY AND BIOSTATISTICS**
Total Hours	**75**
Hours/Week	**5 Hrs /Wk**
Code	**U22BO3MCT07**
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

The learner will be able to

- Remember and understand the cell biology through the knowledge of cell theory,ultra structureof plant cell and its organelles.
- Understand and apply the knowledge of cell cycle and cell division, evaluate thechanges inthe chromosome
- Understand and analyse the structure of genetic material and the mechanism of DNAreplication.
- Remember, understand the collection, classification and presentation of data
- 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). Chromosomal mutation causes, mechanism and types

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 of chromosomes. 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) and RNA as genetic material (Fraenkel Conrat and Stanley in TMV). Nucleosome concept and Central Dogma of Biology

Extra reading /Key Words: *Structure of RNA, Types of RNA*

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 throughAssignment and Seminars.

COURSE OUTCOMES (CO)

The learner will be able to

CO No.	Course Outcomes	Cognitive Level
CO-1	Describethe 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 analyze its functions, changes in chromosome structure and number, investigate DNA and RNA as genetic material, categorize data and plot various types of graphs, analyze the measures of dispersion.	K4
CO-5	Evaluate the data using measures of central tendencies, dispersion	K5

Prescribed Text Books:

1. Sundarajan,S.2000.Cytogenetics.Anmolpublicationspvt.Ltd.,New Delhi.
2. Arumugam, N. 2016. Cell biology and Molecular Biology. Saras publications, Tamil Nadu, India.
3. Gupta,P.K.2016.Cytology,GeneticsandEvolution.Rastogi publications,Meerut.
4. Ramakrishnan, P. Biostatistics. 2006. Saras publications, Tamil Nadu, India.

Suggested Readings:

1. SatguruPrasad. 1992.FundamentalsofBiostatistics.Emkay publications,New Delhi.
2. DeRobertis.2017.CellAndMolecularBiology.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

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	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

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 2020-21 onwards)
HOLY CROSS COLLEGE (AUTONOMOUS) TIRUCHIRAPPALLI –2
SCHOOL OF LIFE SCIENCES
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CHOICE BASED CREDIT SYSTEM
LEARNING OUTCOMES-BASED CURRICULUM FRAMEWORK (LOCF)

B.Sc. BOTANY

Second Year - Semester – III

Course Title	MAJOR CORE – 8 - HORTICULTURE AND PLANT BREEDING
Total Hours	75
Hours/Week	5 Hrs /Wk
Code	U22BO3MCT08
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 analyze the objectives, selection methods and techniques in plantbreeding

UNIT – I Basics of Horticulture: 15 hrs

Horticulture - Definition, scope and importance, division and classification of horticultural crops. Horticultural zones in India and Tamil Nadu. Propagation and its methods. Weed management - nutrient application methods in horticultural crops. Crop regulation - physical and chemical regulation.

Extra reading/Key words: *Pomology, olericulture*

UNIT – II Plant Propagation practices: **15 hrs**

Propagation - tools and implements, propagation media, containers, preparation of nursery bed, seed treatment, sowing. Seedling production – potting, depotting and repotting of plants. Methods ofasexual propagation through cuttings, layering, grafting and budding - types of cutting, layering and grafting. Culture of bonsai

Extra reading/Key words: *Dappled shade, slow release fertilizers.*

UNIT –III Growth and Development: **15 hrs**

Growth and development - definitions, components, photosynthetic production of horticultural crops. Factors affecting flowering. 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: 15 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: 15 hrs

Methods of Polyploidy breeding and its 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	Analyze application of the nutrients, preparation of nursery bed, seed treatment, postharvest in horticulture crops	K4
CO-5	Evaluate the different types of selection methods and polyploidy	K5

TextBooks:

1. ManiBhusahan Rao,K.1991.TextbookofHorticulture-MacMillan IndiaLtd., Madras.
2. Arumugam,N.andKumaresan, V.2010.FundamentalsofhorticultureandPlantbreeding.SarasPublications .
3. Manibhushan Rao, K. 2002. Textbook of Horticulture, Laxmipublications: Second edition.
4. John E. Preece, Paul E. Read, 2004. The Biology of Horticulture: An Introductory Textbook, 2nd Edition

Books for Reference:

1. EdmondJ.B., Senn,T.L. andAndrews,F.S.1964Fundamentals ofHorticulture-TataMcGraw–HillPublishingCompanyLtd.,New Delhi.
2. PeterM.andTessaEve.2007.GardenplanningandGardendesign.SouthwaterPublishing . London.
3. Prasad and Kumar, 2014. Principles of Horticulture 2nd Edn. Agrobios (India).
4. Neeraj Pratap Singh, 2005. Basic concepts of Fruit Science 1st Edn. IBDC Publishers.
5. Kausal Kumar Misra and Rajesh Kumar, 2014. Fundamentals of Horticulture Biotech Books.

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-ps/

PO & CO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	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

PSO & CO Mapping

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

H-High M-Moderate L-Low

(For Candidates admitted from the academic year 2021-22 onwards) HOLY CROSS COLLEGE (AUTONOMOUS) TIRUCHIRAPPALLI-620 002
SCHOOL OF LIFE SCIENCES
PG & RESEARCH DEPARTMENT OF BOTANYCHOICE
BASED CREDIT SYSTEM
LEARNING OUTCOMES-BASED CURRICULUM FRAMEWORK (LOCF)

B.Sc. BOTANY
Second Year - Semester – III

Course Title	**ME –1- ORGANIC FARMING**
Total Hours	**60**
Hours/Week	**4 Hrs /Wk**
Code	**U22BO3MET01**
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 practicesand need ofthe 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 theavailable resources.
- To understand the standards and agencies meant for organic farming and the health benefitsof food products
- To understand and apply the organic certification process and its application in biology.

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 (APEDA- NPOP), IFOAM. 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 throughAssignment 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
CO-5	Assess the different models and types of organic farming practice	K5

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
CO5	H	H	H	H	H	M	H	H	H

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
CO5	H	M	H

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

SCHOOL OF LIFE SCIENCES
CHOICE BASED CREDIT SYSTEM
LEARNING OUTCOMES-BASED CURRICULUMFRAMEWORK (LOCF)
B.Sc. BOTANY
Second Year - Semester – III

Course Title	**MSBE- 2 BOTANICAL TECHNIQUES FOR CHEMISTRY**
Total Hours	**30**
Hours/Week	**2 Hrs /Wk**
Code	**U22BO3SBP03**
Course Type	**Theory cum Lab**
Credit	**1**
Marks	**100**

CONSPECTUS

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

COURSE OBJECTIVES

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

UNIT I- Biological System: 6hrs

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

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

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

UNIT II– Cytology 6hrs

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

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

Extra reading/Key words: *Meiosis, Karyogamy*

UNIT III– Physiology: **6hrs**

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

Lab exercise: Ascent of sap, Thistle Funnel Experiment.

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

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

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

Lab exercise: Spirulina & mushroom cultivation.

Extra reading/Key words: *Chlorella, Mycoprotein*

UNIT V- Plant Tissue Culture: 6hrs

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

Lab exercise: Callus induction, Synthetic seed preparation.

Extra reading/Key words: *Hybrids, Cybrids*

COURSE OUTCOMES (CO)

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

Text Books:

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

Suggested Reading:

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

Web references:

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

PO – CO MAPPING

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

PSO – CO MAPPING

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

(For Candidates admitted from the academic year 2021-22 onwards)
HOLY CROSS COLLEGE (AUTONOMOUS) TIRUCHIRAPPALLI-620002
SCHOOL OF LIFE SCIENCES
PG & RESEARCH DEPARTMENT OF BOTANY
CHOICE BASED CREDIT SYSTEM

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

CourseTitle	**MSBE- 2 BOTANICAL TECHNIQUES FOR PHYSICS**
Code	**U22BO3SBP04**
Course type	**Theory cum Lab**
Hours/Week	**2 Hrs /Wk**
Credit	**1**
Marks	**100**

CONSPECTUS

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

COURSE OBJECTIVES

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

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

Organization of Plant system- structure ofa plant cell and cell organelles–tissues -types and functions –Interna l structure of dicot stem and root.

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

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

UNIT II– Cytology **6hrs**

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

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

Extra reading/Key words: *Meiosis, Karyogamy*

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

Absorption of water and minerals. phytochemical compounds – Carotenoids, saponins, alkaloids, polyphenols and their antioxidant property.

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

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

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

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

Lab exercise: Spirulina & mushroom cultivation

Extra reading/Key words: *Chlorella, Mycoprotein*

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

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

Lab exercise: Meristem culture, Synthetic seed preparation.

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

COURSE OUTCOMES (CO)

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

Text Books:

1. Jain, V. K. 1990. Fundamentals of Plant Physiology. S. Chand and Company Ltd., New Delhi.
2. Dubey. R. C. 2006. Text book of biotechnology. S. Chand and Company Ltd., New Delhi.
3,Kumaresan, V. 2005. Text book of Biotechnology,
4.Annie Ragland, V. Kumaresan, N. Arumugam, 2019. Cell Biology, Saras Publication,Nagercoil, Tamilnadu.
5. Pandey B. P. 2012. Plant Anatomy (Revised Edition). S. Chand andCompany Ltd. New Delhi.
6. Satyanarayana U. 2015. Biotechnology. Books and Allied (P) Ltd. Kolkata.

Suggested Reading:

- 1. De Robertis,E.D.P. and De Robertis,E.M.F.(1995). Cell and MolecularBiology, Saunders College, PA.
- 2.Powar, C.B. 2002. Cell Biology, Himalaya Publishing House, Mumbai,India.
- 3.Bishun Deo Prasad, Sangita Sahni, Prasant Kumar, Mohammed Wasim Siddiqui.2021. Plant Biotechnology, Principles, Techniques and Applications. Apple AcademicPress.

Web References:

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

PO – CO MAPPING

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

H-High M-Moderate L-Low

PSO – CO MAPPING

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

(For Candidates admitted from the academic year 2022-23 onwards)
HOLY CROSS COLLEGE (AUTONOMOUS) TIRUCHIRAPPALLI-620 002
SCHOOL OF LIFE SCIENCES
PG & RESEARCH DEPARTMENT OF BOTANY
CHOICE BASED CREDIT SYSTEM

LEARNING OUTCOMES-BASED CURRICULUM FRAMEWORK (LOCF)
B.Sc. BOTANY
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	**U22BO3ALT04**
Course Type	**Theory**
Credits	**2**
Marks	**100**

CONSPECTUS

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

COURSE OBJECTIVES:

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

UNIT – I Algae and Fungi: 12 Hrs

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

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

UNIT –II Bryophyte, Pteridophyte and Gymnosperm: **12 Hrs**

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

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

UNIT – III Anatomy and Embryology: **12 Hrs**

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

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

UNIT – 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, Amaranthaceaeand Poaceae.

Extra reading (Key Words): Euphorbiaceae, Meliaceae

UNIT - V Physiology and Ecology: **12 Hrs**

Absorption of water – mechanism. Transpiration – mechanism of stomatal transpiration. Photosynthesis – light reaction (cyclic and non-cyclic). Dark reaction (Calvin cycle). Respiration- Aerobic (Glycolysis, Kreb's cycle and Electron transportchain). C_2 and C_4 plants. Photoperiodism. Morphological and anatomical adaptations of hydrophytes, halophytes and xerophytes.

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

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

COURSE OUTCOMES (CO)

The learner will be able to

CO No.	Course Outcomes	Cognitive Level
CO-1	Recall and relate the general characters of algae and fungi. Explain the photosynthetic system of plants	K1
CO-2	Explain the life cycle patterns of bryophyte and Pteridophytes	K2
CO-3	Compare the reproductive patterns of cryptogamic plants	K3
CO-4	Analyze and contrast the floral characters of different families. Outline the internal structure of dicot plants,	K4
CO-5	Analyze and contrast the floral characters of different families. Outline the internal structure of dicot plants,	K5

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.
7. Jain.V.K.2017.Fundamentals of plant physiology. S Chand Publishing House.New Delhi.
8. Bishun Deo Prasad, Sangita Sahni, Prasant Kumar, Mohammed Wasim Siddiqui.2021. Plant Biotechnology, Principles, Techniques and Applications. Apple Academic Press.

Web Reference

- https://www.keaipublishing.com/en/journals/plant-diversity/
- https://towson.libguides.com/biol208/websites
- https://www.sciencedirect.com/science/article/pii/S2468265916300300
- http://www.bsienvis.nic.in/Database/Status_of_Plant_Diversity_in_India_17 566. aspx

PO – CO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO-1	H	M	M	H	H	M	M	M	H
CO-2	H	M	H	H	H	M	H	M	H
CO-3	H	H	M	M	H	M	H	M	H
CO-4	H	H	H	H	H	M	M	M	M
CO-5	H	H	H	H	H	M	M	M	M

CO/PSO	PSO1	PSO2	PSO3
CO-1	H	H	H
CO-2	M	H	H
CO-3	H	M	H
CO-4	H	H	H
CO-5	H	H	M

(For Candidates admitted from the academic year 2022- 2023 onwards)

HOLY CROSS COLLEGE (AUTONOMOUS) TIRUCHIRAPPALLI-620 002

SCHOOL OF LIFE SCIENCES

PG & RESEARCH DEPARTMENT OF BOTANY

CHOICE BASED CREDIT SYSTEM

LEARNING OUTCOMES-BASED CURRICULUM FRAMEWORK (LOCF)

B.SC. BOTANY

Second Year - Semester – III

Course Title	**NON MAJOR ELECTIVE 1 – FOOD SCIENCE AND TECHNOLOGY**
Total Hours	**30**
Hours/Week	**2 Hrs /Wk**
Code	**U22BO3NMT01**
Course Type	**Theory**
Credits	**2**
Marks	**100**

CONSPECTUS

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

COURSE OBJECTIVES

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

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

Cereals and products (Rice- carbohydrates), Pulse (red gram - protein), fats and oils (vanaspathi and sunflower oil), fruits and vegetables (vitamins A and minerals). Economic importance of cereals and pulses.

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

UNIT – II Types of cooking: **6hrs**

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. .

Extra reading/Key words: Seasoning, Shrivelling

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

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

Extra reading/Key words: Fermentation, Radiation

UNIT – IV Food preservation technology: **6 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.

Extra reading/Key words: Ultrasonics, Cold plasma

UNIT - V Food additives and Food standards: **6hrs**

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.

Extra reading/Key words: Role of IFAD, WF

COURSE OUTCOMES (CO)

The learner will be able to

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

Prescribed Text Books:

1. Sumathi, R., Madambi and Rajagopal, M. V. 1997. Fundamentals of foods 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 Reference:

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

Web Reference

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

PO-CO Mapping

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

H-High M-Moderate L-Low

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

(For Candidates admitted from the academic year 2022-23 onwards)
HOLY CROSS COLLEGE (AUTONOMOUS) TIRUCHIRAPPALLI –2
SCHOOL OF LIFE SCIENCES
PG AND RESEARCH DEPARTMENT OF BOTANY CHOICE
BASED CREDIT SYSTEM
LEARNING OUTCOMES-BASED CURRICULUM FRAMEWORK (LOCF)

II B.Sc., BOTANY- Semester- IV

Course Title	**MAJOR CORE 9– BIOPROSPECTING AND UTILIZATION OF PLANT RESOURCES**
Total Hours	75
Hours/Week	5 Hrs/Wk
Code	**U22BO4MCT09**
Course Type	Theory
Credits	4
Marks	100

CONSPECTUS

The students will be able to understand the utilization of plants as food, medicine and economically important products and also emphasizes the marine and microbial bioprospecting and their applications in industries.

COURSE OBJECTIVES

- To understand the cultivation practices, economic products and uses of cereals, pulses, vegetables, fruits, oils and beverages.
- To remember the sources, extraction and uses of certain medicinal plants.
- To classify the sources, production of economically important bio products.
- To apply and analyze the marine and microbial bio resources.
- To analyze the bioprospecting concepts and methods, biopiracy and Traditional Knowledge Digital Library(TKDL).

Unit I Bioprospecting **15hrs**

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

Extra reading (Key Words): dry drupes, ragi.

Unit II: Bioprospecting of medicinal plants: **15hrs**

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

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

Unit-III: Bioprospecting of economically important plants: **15hrs**

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

Extra reading (Key Words): Sago, natural dyes

Unit-IV Bioprospecting of micro organisms: **15hrs**

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

Extra reading (Key Words): Kelp forest, penicillin

Unit-V Bioprospecting **methods:** 15hrs

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

Extra reading (Key Words): Drug designing, Biopiracy of African super-sweet berries

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

COURSE OUTCOMES (CO)

The learner will be able to

CO. No.	Course Outcomes	Cognitive Level
CO-1	Explain the bioprospecting concepts and methods, cultivation practices, uses of cereals, pulses, vegetables, fruits, oils and beverages	K1
CO-2	Discuss the sources, Production of economically important bio products, bioprospecting aspects related to marine and microbial Bioresources	K2
CO-3	Classify the sources and production of economically important bio products.	K3

CO-4	Apply and analyze the extraction and uses of alkaloid, morphine, glycosides and methods of extraction of plant samples	K4
CO-5	Evaluate the processing, grading and packing of rubber, processing of coir, industrial production and uses antibiotics	K5

(K1-Remember; K2Understand; K3-Apply; K4–Analyze; K5-Evaluate, K6-Create, PO–Programme Outcomes;CO–Course Outcomes)

Prescribed Text Books:

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

Suggested Reference Books:

1. Hill.A. F,1996. Economic Botany–Tata Mc Grew–Hill publishing company Limited, New Delhi.
2. Kochhar,S. L, 2016. Economic Botany. 5th Edition – Cambridge University Press.
3. Tanveer Bilal Pirzadah, Bisma Malik, Rouf Ahmad Bhat, Khalid RehmanHakeem.2022. Bioresource Technology: Concept, Tools and Experiences. John Wiley & Sons Ltd.
4. Joanna Mossop, 2015. Marine Bioprospecting, The Oxford Handbook of the Law of the Sea. Oxford University Press.

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1. https://www.sciencedirect.com/topics/medicine-and-
2. https://link.springer.com/chapter/10.1007/978-981-19-5779-6_3
3. https://onlinelibrary.wiley.com/doi/full/10.1002/jobm.202100504
4. https://link.springer.com/chapter/10.1007/978-981-10-8291-
5. https://pubmed.ncbi.nlm.nih.gov/32529587/

PO– CO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	3	2	2	3	3	2	2	2	3
CO2	3	2	3	3	3	2	3	2	3
CO3	3	3	2	2	3	3	3	2	3
CO4	3	3	3	3	3	2	2	2	2
CO5	3	3	3	3	3	2	3	2	3

PSO–CO MAPPING

CO/PSO	PSO1	PSO2	PSO3
CO1	3	3	3
CO2	3	2	2
CO3	2	3	3
CO4	3	2	3
CO5	3	3	3

3-High 2-Moderate 1-Low

(For Candidates admitted from the academic year 2022-23 onwards)
HOLY CROSS COLLEGE (AUTONOMOUS) TIRUCHIRAPPALLI –2
SCHOOL OF LIFE SCIENCES

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

Course Title	**MAJOR CORE 10- PHYTOGEOGRAPHY AND FORESTRY**
Total Hours	**60**
Hours/Week	**4 Hrs /Wk**
Code	**U22BO4MCT10**
Course Type	**Theory**
Credits	**4**
Marks	**100**

CONSPECTUS:

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

COURSE OBJECTIVES:

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

UNIT– I Phytogeography **12hrs**

Definition, concepts - Descriptive and dynamic - Continental drift, age and area theory, Endemism and Barriers to plant distribution, Centre of origin, Methods of dispersal, migrations and isolation; Theory of tolerance. Factors influencing plant distribution; Migration of floras, and Evolution of floras. Topographic factors- Altitude and latitude. GPS – Eco geographic survey. 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 Scrub jungle, phytogeographical regions of India. Sundarbans and its characteristics, Eastern and Western Himalayan regions. GIS and its application. Floristic regions of the world: Vegetation Zones in relation to latitudes and altitudes.

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

UNIT- III Plant Biodiversity and its Conservation **12hrs**

Definition, levels of biodiversity-genetic, species and ecosystem. Biodiversity hotspots - Criteria, hotspots of India. IUCN criteria (Near threatened, vulnerable, Endangered, critically endangered) Loss of biodiversity – causes and conservation (In-situ and ex-situ methods). Seed banks - conservation of genetic resources and their importance.

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

UNIT – IV Forest ecology **12hrs**

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

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

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

Forest policies - Necessity - Formulation of National Forest Policy. History of forest development in India - Indian Forest Policy of 1988 and 2017. Forest Organizations and Institutes - National - FRI, IGNFA, - International - ICRAF, ITTO. Forest laws - necessity - general principles - Indian Forest Act 1927, Forest Conservation Act 1980. National Biodiversity Authority 2003 – Salient features.

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

Course Outcomes (CO):

The learner will be able to

CO No.	Course Outcomes	Cognitive Level
CO-1	List the Methods of dispersal, factors influencing plant distribution, and explain the different types of phyto geographical distribution and theories of phytogeography.	K1
CO-2	Discuss the policies and laws related to forestry, Describe the Role of forest protection in Indian Forestry and agencies that cause damage to forest and protective measures.	K2
CO-3	Classify types of soils, biodiversity hotspots in India, conservation of biodiversity and seed banks.	K3
CO-4	Analyze the floristic regions of the world: Vegetation Zones in relation to latitudes and altitudes.	K4
CO-5	Evaluate the protective measures and benefits due to chemical and biological control. ozone layer depletion - acid rain.	K5

(K1-Remember; K2Understand; K3-Apply; K4–Analyze; K5-Evaluate, K6- Create PO–Programme Outcomes;CO–Course Outcomes)

Prescribed Text Books:

1. Mc Manus B. Collins and Fred M White, 1981. Elementary Forestry. Reston Publishing Company, Inc., Reston, Virginia.
2. Mac Donald, 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.

Suggested Reference Books:

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.

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

Mapping

PO– CO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	3	2	2	3	3	2	2	2	3
CO2	3	2	3	3	3	2	3	2	3
CO3	3	3	2	2	3	3	3	2	3
CO4	3	3	3	3	3	2	2	2	2
CO5	3	3	3	3	3	2	3	2	3

PSO–CO MAPPING

CO/PSO	PSO1	PSO2	PSO3
CO1	3	3	3
CO2	3	2	2
CO3	2	3	3
CO4	3	2	3
CO5	3	3	3

3-High 2-Moderate 1-low

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

II B.Sc., BOTANY- Semester – IV

Course Title	**MAJOR ELECTIVE 2 - HORTICULTURE AND PLANT TISSUE CULTURE**
Total Hours	**60**
Hours/Week	**4 Hrs. /Wk**
Code	**U22BO4MET02**
Course Type	**Theory**
Credits	**3**
Marks	**100**

CONSPECTUS

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

COURSE OBJECTIVES

The learner will be able to

- To remember and understand the types of horticultural crops and propagation
- To apply the plant propagation practices of horticultural crops
- To remember and understand the growth and development of horticultural crops
- To analyze the micro propagation of rare and medicinal plants through tissue culture technique.
- To apply the alternative techniques of plant tissue culture for mass propagation.

UNIT–I Basics of Horticulture: 12 Hrs.

Horticulture-Definition, scope, purpose and classification of horticultural crops.- Crop regulation –physical and chemical regulation. Horticultural zones in India and Tamil Nadu.

Extra reading/Key words: *Pomology, olericulture*

UNIT–II Gardening: 12Hrs.

Gardening -Establishment and maintenance of garden- Types of gardens – kitchen garden, terrace garden and vertical garden-principles, planning and layout, management of orchards, water management, weed management, fertility management in horticultural crops.

Extra reading/Key words: *Dappled shade, slow release fertilizers.*

UNIT–III Nursery Techniques 12Hrs.

Nursery preparation - preparation of nursery bed, seed treatment, sowing. Seedling production– potting, depotting and repotting of plants. Nursery techniques and their management-cutting-Root, stem and leaf bud. Layering- Air, tip, simple, compound, trench and mount. Grafting-Approach, whip and cleft. Budding-T-budding, Patch, chip and ring. Culture of bonsai.

Extra reading/ Keywords: *Microclimate, mulching*

UNIT – IV: Plant tissue culture: 12 Hrs.

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

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

UNIT–V: Plant tissue culture: **12 Hrs.**

Organogenesis – direct and indirect methods and their significance. Somatic embryogenesis- Principle, types, protocol and importance. Synthetic seed preparation and its application. Plant protoplast culture: principle, isolation, fusion & culture of protoplasts and its importance.

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

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

COURSE OUTCOMES (CO)

The learner will be able to

CO No.	Course Outcomes	Cognitive Level
CO-1	Describe the horticultural zones in India, tools and implements, growth and development of horticultural crops.	K1
CO 2	Discuss the scope and importance of horticulture and compare the physiological disorders of fruits and vegetables. Explain the role of alternative techniques in plant tissue culture.	K2
CO 3	Classify the types of horticultural techniques and gardens, Analyze application of the nutrients, preparation of nursery bed, seed treatment, postharvest in horticulture crops	K3
CO-4	Categorize the different types of isolation of protoplast and regeneration of plantlets.	K4
CO-5	Apply the knowledge in the production of synthetic seed preparation. apply the culture of bonsai	K5

(K1-Remember; K2-Understand; K3-Apply; K4–Analyze; K5-Evaluate)

Prescribed Text Books:

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

Suggested Reference Books:

1. Peter, M. and Tessa Eve.2007. Garden planning and Garden design. South water Publishing. London.
2. Prasad and Kumar, 2014. Principles of Horticulture 2nd Edn. Agrobios (India).
3. Gupta, P. K.1999. Elements of biotechnology. Rastogi Publications, Meerut.
4. John E. Smith. 1988. Biotechnology – II Edition. Cambridge University Press, London.
5. Ignacimuthu, S. 1996. Applied Plant Biotechnology. Tata Mc Graw–Hill Publishing Company Ltd., New Delhi.

Web References:

1. https://www.kopykitab.com/Precision-Horticulture-by-Archarya-SK
2. https://www.ebooks.com/en-us/subjects/science-horticulture-ebooks/423/
3. http://www.agrimoon.com/horticulture-icar-ecourse-pdf-books/

4. https://www.worldcat.org/title/handbook-of-horticulture/oclc/688653648
5. https://cbseportal.com/ebook/vocational-books-horticulture

Mapping:

PO & CO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	3	3	1	1	2	1	2	2	2
CO2	3	3	2	1	1	3	1	3	1
CO3	2	2	3	3	1	2	2	3	1
CO4	3	3	2	2	3	2	3	1	3
CO5	3	3	2	3	1	3	2	3	1

PSO & CO Mapping

CO/PSO	PSO1	PSO2	PSO3
CO1	3	1	3
CO2	3	2	2
CO3	2	3	3
CO4	3	3	3
CO5	3	2	3

S-Strong (3) M-Medium (2) L-Low(1)

(For Candidates admitted from the academic year 2022-23 onwards)
HOLY CROSS COLLEGE (AUTONOMOUS) TIRUCHIRAPPALLI –2
SCHOOL OF LIFE SCIENCES
PG AND RESEARCH DEPARTMENT OF BOTANY
CHOICE BASED CREDIT SYSTEM
LEARNING OUTCOMES-BASED CURRICULUM FRAMEWORK (LOCF)
B.Sc. BOTANY
Second Year - Semester – IV

Course Title	**ALLIED CORE 5 – PAPER II – BIOPROSPECTING AND PLANT BIOTECHNOLOGY**
Total Hours	**60**
Hours/Week	**4 Hrs /Wk**
Code	**U22BO4ALT05**
Course Type	**Theory**
Credits	**2**
Marks	**100**

CONSPECTUS:

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

COURSE OBJECTIVES:

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

UNIT – I Bioprospecting: 12 Hrs

Cultivation practices, economic products and uses of the following plants. Main economic products and their uses: cereals (*Oryza*, *Maize*), Pulses (*Cajanus*, *Black gram*), Sunflower oil, Sesame oil (*Helianthus*, *Sesamum*), Sugarcane, (*Saccharum*), Beverage (*Coffea*).

Extra reading (Key Words): Sugarcane industries in Tamilnadu

UNIT – II Bioprospecting: 12 Hrs

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

Extra reading (Key Words): Jute and silk

UNIT – III Bioprospecting: 12 Hrs

Source and extraction and use of the following: Medicine – Alkaloid (*Cinchona*) and antioxidants (Green tea). Essential oil – extraction and uses of Eucalyptus and Lemon grass oil. Paper and pulp – Source, manufacture and use of papers (Bamboo and bagasse). Coir – Source, process and use of coconut.

Extra reading (Key Words): Lycopene, quinolizidine alkaloid

UNIT – IV Bioprospecting: 12 Hrs

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

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

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

Tissue culture techniques –Sterilization, medium preparation, inoculation, Regeneration of plants through micropropagation. Production of transgenic plant- insect pest resistance, 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 words must be tested only through Assignment and Seminar

COURSE OUTCOMES (CO)

The Leaners will be able to

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

(K1-Remember; K2Understand; K3-Apply; K4–Analyze; K5-Evaluate, K6-Create, PO–Programme Outcomes; CO–Course Outcomes)

Prescribed Text Books:

1. Pandey, B.P. 2007. Economic Botany. 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 – Iand II. New Central Book Agency, Calcutta.
5. Verma, V. 1985. A text book of Plant Physiology. Emkay Publications, New Delhi.

Suggested Reference Books:

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

Web References

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

Mapping

PO– CO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	3	2	2	3	3	2	2	2	3
CO2	3	2	3	3	3	2	3	2	3
CO3	3	3	2	2	3	3	3	2	3
CO4	3	3	3	3	3	2	2	2	2
CO5	3	3	3	3	3	2	3	2	3

PSO–CO MAPPING

CO/PSO	PSO1	PSO2	PSO3
CO1	3	3	3
CO2	3	2	2
CO3	2	3	3
CO4	3	2	3
CO5	3	3	3

3-High 2-Moderate 1-low

(For Candidates admitted from the academic year 2022-23 onwards)
HOLY CROSS COLLEGE (AUTONOMOUS) TIRUCHIRAPPALLI –2
SCHOOL OF LIFE SCIENCES
PG AND RESEARCH DEPARTMENT OF BOTANY
CHOICE BASED CREDIT SYSTEM
LEARNING OUTCOMES-BASED CURRICULUM FRAMEWORK (LOCF)
B.Sc. BOTANY
Second Year - Semester – IV

Course Title	**ALLIED 6 -PAPER III– PRACTICAL – I**
Total Hours	**60**
Hours/Week	**4 Hrs /Wk**
Code	**U22BO4ALP06**
Course Type	**Practical**
Credits	**2**
Marks	**100**

CONSPECTUS:

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

COURSE OBJECTIVES:

The learner will be able to

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

UNIT – I Algae and Fungi: **12 hrs**

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

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

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

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

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

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

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

UNIT – V Bioprospecting and Plant Biotechnology: **12 hrs**

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

Course Outcomes (CO):

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

(K1-Remember; K2Understand; K3-Apply; K4–Analyze; K5-Evaluate, K6-Create, PO– Programme Outcomes; CO–Course Outcomes)

PO – CO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO-1	3	2	2	3	3	2	2	2	3
CO-2	3	2	3	3	3	2	3	2	3
CO-3	3	3	2	2	3	2	3	2	3
CO-4	3	3	3	3	3	2	2	2	2
CO-5	3	3	3	3	3	2	3	2	3

CO/PSO	PSO 1	PSO2	PSO3
CO 1	3	3	3
CO2	2	3	3
CO3	3	2	3
CO4	3	3	2
CO4	3	2	3

3-High 2-Moderate 1-Low

(For Candidates admitted from the academic year 2022-23 onwards)
II B.Sc., BOTANY - Semester – IV

Course Title	**NON MAJOR ELECTIVE 2 – VALUE ADDED PRODUCTS AND THEIR RECIPES**
Total Hours	**30**
Hours/Week	**2 Hrs. / Wk**
Code	**U22BO4NMT02**
Course Type	**Theory**
Credits	**2**
Marks	**100**

CONSPECTUS

To enable the students to learn the basic principles of value added products from various sources, involving its processing, storage and marketing with practical experience.

COURSE OBJECTIVES

- To remember the importance of value added products from plant sources.
- To understand the method of processing, storage and marketing of value added products.
- To apply the practical experience on the preparation of value added products from millets, milk, fruits and vegetables.
- To analyze the knowledge of preparation of value added products from various plant sources.
- To evaluate the herbal preparations of value added products practically.

UNIT I Introduction to Value added products: **6 Hrs.**

Introduction, objectives and importance of value added products. Concept of value addition. Sources for the production and manufacture of value added products. Commercial production and marketing of value added products. Quality standardization of value added products.

Extra reading/Key words: *Grading of value added products, standardizing of value added product*

UNIT – II Nutritional benefits of Value added products from herbal plants*:* ***6 Hrs.***

Introduction to medicinal plants and their role in nutraceuticals. Herbal products –Herbal foods and its preparation of locally available herbal plants; Herbal confectionary (Honey amla), Herbal beverage (pudina lemonade); Herbal candy (Ginger candy); Herbal soup powder (Moringa, thoothuvalai); Herbal food (Methi, Moringa Chapati); Herbal snack (Omavalli baji); Herbal tea.

Extra reading/Key words: *Importance of therapeutic plants, Preparation of herbal foods*

UNIT – III Nutritional benefits of value added products from millets, vegetables and fruits:*6 Hrs.*

Introduction to nutritional benefits of millets, fruits and vegetables. Millets and its products – Health mix, bajra laddu. Bakery products – Bread, biscuits. Pasta products – Vermicilli, noodles, macroni. Vegetable and its products - pickle, sauce, ketch-up, puree. Fruits and its products - Intermediate moisture food – Jam, Jelly, Candy, Marmalade. Beverages – Juices, smoothies.

Extra reading/Key words: *Nourishment of value added products, balanced food*

UNIT –IV Preparation and recipes of Value added products from herbal plants: ***6 Hrs.***

Herbal confectionary - Honey amla. Herbal beverage - Pudina lemonade. Herbal candy - Ginger candy. Herbal soup powder - Moringa soup powder. Herbal food – Methi/Moringa Chapati. Herbal snack – Omavalli baji. Herbal tea

Extra reading/Key words: *Preparation of savories; Importance of natural products*

UNIT – V Preparation and recipes of Value added products: ***6 Hrs.***

Millets, Vegetables and Fruits. Traditional products – Health mix powder and bajra laddu. Bakery products – Millet Cookies. Pasta products – Millet noodles. Fruits – Mixed fruit Jam, Beverage – Mixed fruit Smoothie. Vegetables –Tomato Sauce.

Extra reading/Key words: *Methods of pastry making, Natural flavoring agents*

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

COURSE OUTCOMES(CO)

The learner will be able to

CO No.	Course Outcomes	Cognitive Level
CO-1	List the scope and importance of value added products from plant sources.	K1
CO-2	Describe the significance of nutritional benefits of millets, milk, fruits, vegetables.	K2
CO 3	Summarize the benefits of herbals as nutraceuticals.	K3

(K1-Remember; K2-Understand; K3-Apply)

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.
3. Girija Khanna.1986. Herbal Remedies –Vikas Publishing House Ltd, New Delhi.
4. Joseph E. Pizzarno and Michael T Murray, 2013. Text book of Natural Medicine. Churchill Livingstone Publisher.
5. Anne Kennedy, 2017. Herbal Medicine Natural Remedies.
6. Rahana Hammed and Lateef Ahmed Rather, 2019.Herbal Medicine- A Text Book for Under Graduate Students. Akinik Publications.

Suggested Reference Books:

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 in Food 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. Wood head publishers.
5. Wolfert, Paula. 2009. Mediterranean clay pot cooking. Traditional and modern recipes to savor and share. Hoboken, N.J: John Wiley & Sons Publishers.
6. Norman N. Potter and Joseph H. Hotchkiss.2021. Food science. Fifth edition. S. K.Jainfor CBS publishers and distributors. New Delhi

Web References:

1. https://ifst.onlinelibrary.wiley.com/journal/26891816 https://www.frontiersin.org/journals/food-science-and-technology
2. https://www.sciencedirect.com/journal/trends-in-food-science-and-technology
3. https://www.karger.com/fst
4. https://www.academia.edu/40614191/Handbook_of_Food_Science_and_Technology_2 _ Food_Process_Engineering_and_Packaging
5. https://www.sciencedirect.com/book/9780323523424/textbook-of-natural-medicine
6. https://www.thegoodtrade.com/features/natural-remedies-books
7. https://www.booktopia.com.au/books-online/non-fiction/mind-body-spirit/complementary- therapies/traditional-medicine-herbal-remedies/cVXHT-p1.html

PO-CO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	3	2	2	3	2	2	2	2	3
CO2	3	2	3	3	3	2	3	2	3
CO3	3	3	2	2	3	3	3	2	3

3-High 2-Moderate 1-Low

PSO-CO Mapping

CO/PSO	PSO 1	PSO2	PSO3
CO1	3	3	3
CO2	2	3	2
CO3	2	3	3

3-High 2-Moderate 1-Low

III B.SC.,BOTANY(V AND VI SEMESTER)

Sem.	Part	Course	Title of the paper	Course Code	Hrs./ Week	Credits	Marks
V	III	Major Core -11	MC-11 Genetics and Molecular Biology	U21BO5MCT11	5	4	100
		Major Core -12	MC-12 Morphology, Taxonomy ofAngiosperms and Ethnobotany	U21BO5MCT12	6	5	100
		Major Core – 13	MC- 13 Bioprospecting and utilization of plant resources	U21BO5MCT13	5	4	100
		Major Core – 14	MC-14 Practical – III	U21BO5MCP14	5	4	100
		Major Elective – 3	Course within school Phytomedicine/	U21BO5MET05/ U21BO5MET06	4	3	100
	IV	NME-3	NME – 3 Floriculture	U21BO5NMT03	3	3	100
		Industrial Relation	Herbal Entrepreneurship	U21BO5IRT01	1	1	100
		Extra Credit	Online Course	U21OC5ECT01	-	2	100
		Value Education	Bible/Catechism/Ethics	U21VE5LVE03/ U21VE5LVB03/ U21VE5LVC03	1		-
		Extra Credit	Internship / Field Work / Field Project 30Hours - Extra Credit	U21SP5ECC05		EC)	100
			Total		**30**	**24+4**	**700+200**
Sem.	**Part**	**Course**	**Title of the paper**	**Course Code**	**Hr/ W**	**Credits**	**Marks**
VI	III	Major Core – 15	Plant Physiology and Biochemistry	U21BO6MCT15	6	5	100
		Major Core – 16	Plant tissue culture, genetic engineering and nanotechnology	U21BO6MCT16	5	4	100
		Major Core – 17	Instrumentation and botanical techniques	U21BO6MCT17	4	4	100
		Major Core – 18	Practical IV	U21BO6MCP18	5	4	100
		lajor Elective – 4	Course within School – Principles in horticulture and plant tissue culture/Spirulina cultivation and post harvest technology	U21BO6MET07/ U21BO6MET08	4	3	100
	IV	NME- 4	Natural remedies and Cosmetics	U21BO6NMT04	3	3	100
		SBC-3	Research Methodology (Theory Cum Project)	U21DS6SBC03	2	1	100
		Value Education	Bible/Catechism/Ethics	U21VE6LVB03/ U21VE6LVC03/ U21VE6LVE03	1		100
	V	Extension Activities	RESCAPES - Impact Study Projects	U21RE6ETF01		4	100
		Extra Credit	Internship / Field Work / Field Project 30Hours - Extra Credit	U21SP6ECC06		2 (Extra Credit)	100
			Total		**30**	**24+6**	**700+200**
			Grand Total		**180**	**140 + 20 Extra Credits = 160**	**5000 + 900 (EC)**

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

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

LEARNING OUTCOMES-BASED CURRICULUM FRAME WORK(LOCF)
B.Sc.BOTANY
ThirdYear-Semester–V

CourseTitle	**MAJORCORE-11 GENETICS AND MOLECULAR BIOLOGY**
TotalHours	**75**
Hours/Week	**5 Hrs/Wk**
Code	**U21BO5MCT11**
CourseType	**Theory**
Credits	**4**
Marks	**100**

CONSPECTUS

The students will be able to understand Mendel's ratios and deviation, blood groups, linkage and crossing over, central dogma of molecular biology, DNA replication, mutation and translation

COURSE OBJECTIVES

- To understand, apply and evaluate the laws of Mendel in classical genetics and deviations from Mendelian ratios.
- To remember and understand the different types of Gene interaction.
- To classify and analyse the concept of linkage and crossingover.
- To remember and understand sex determination and apply the concepts of cytoplasmic inheritance, the mechanism of replication.
- To remember and understand the mechanism of translation and mutation.

UNIT–I Classical genetics: 15hrs

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

Extra reading/ Keywords: *Aneuploidy, chromosomal rearrangement*

UNIT–II Gene interaction: 15hrs

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

Extra reading/Keywords*:* *Karyotype, Duplicategene*

UNIT–III Gene interaction: **15hrs**

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

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

Extra reading/Keywords:*Male sterility ,recombination frequency*

UNIT–IVCyto plasmic inheritance **15hrs**

Cytoplasmic inheritance in diploid organisms (plastid transmission in plants, kappa particles transmission in *Paramecium*), Cytoplasmic inheritance in haploid organisms (yeast), Significance. **Molecular Biology:** History of Molecular Biology. Organization and Structure of DNA, Alternative forms of chromosomal DNA–A,B, C and Z forms.DNA polymerases. DNA replication: semi-conservative mode of replication - Initiation, Elongation & Termination.

Extra reading/Keywords:*Male sterility ,recombination frequency*

UNIT–V Molecular Biology: **15hrs**

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

Extra reading/Keywords: *Polymorphicgene, Pleiotropy*

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

COURSEOUTCOMES (CO)

The learner will be able to

CO No.	Course Outcomes	Cognitive Level
CO-1	Explain the laws of Mendel in classicalgenetics,complementary factor and the mechanism of replication& mutation	K1
CO-2	Discuss deviations from Mendelian ratios,sex determination, epistasis, duplicate factor and the mechanism of mutation.	K2
CO-3	Classify the lethal genes, linkages, crossing over and the types of DNA&RNA	K3
CO-4	Apply and analyze the incomplete &co-dominance, sex linked inheritance, replication, translation and DNA &RNA polymerases.	K4
CO-5	Evaluate the sex linkage, cytoplasmic inheritance, Intergeneric and Intra generic mutation.	K5
CO-6	Construct the checker board for tri hybrid cross, back crosses and polygenic inheritance.	K6

Text Books:

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

Suggested Reading:

1. Gardner,F.J.1972.PrinciplesofGenetics.Wiley EasternPvt.Company Ltd.,New Delhi.
2. Singh,B.D.2018.Fundamentalsof Genetics.Kalyani Publications.New Delhi.
3. ShaneSimpson.2019.Plant Genetics and Genomics.
Larsen and Keller Education.New Delhi.
4. Miguel A.Andrade.2020. Bioinformatics and Genomes- Current
5. Perspectives.Horizon Scientific Press Ltd. India.
6. Nancy Craig,Rachel Green,CarolGreide,GiselaStorz. 2021. Molecular Biology:
7. Principles of Genome Function. OUP Oxford Publishers.

Web Reference:

1.https://www.toppr.com/guides/biology/Genetics/classicalgenetic
2/ 2.https://www.peoi.org/Courses/Coursesen/bot/bot16.html
3.https://bio.libretexts.org/Bookshelves/Introductory_and_General_ Biology/
4. https://www.sciencedirect.com/topics/CellBiology/MolecularBiology
5. https://www.peoi.org/Courses/Coursesen/MolecularGenetics/Mechanis

PO– CO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	H	M	M	H	H	M	M	M	H
CO2	H	M	H	H	H	M	H	M	H
CO3	H	H	M	M	H	H	H	M	H
CO4	H	H	H	H	H	M	M	M	M
CO5	H	H	H	H	H	M	H	M	H
CO6	H	H	H	H	H	M	H	M	H

H-High M-Moderate L-Low

PSO –CO MAPPING

CO/PSO	PSO1	PSO2	PSO3
CO1	H	H	H
CO2	H	M	M
CO3	M	H	H
CO4	H	M	H
CO5	H	H	H
CO6	H	M	H

H-High M-Moderate L-Low

(For Candidates admitted from the academic year 2021-22 onwards)
HOLY CROSSCOLLEGE(AUTONOMOUS)TIRUCHIRAPPALLI–2
SCHOOL OF LIFE SCIENCES
PG AND RESEARCH DEPARTMENT OF BOTANY
CHOICE BASED CREDIT SYSTEM

LEARNING OUTCOMES-BASED CURRICULUM FRAME WORK(LOCF)
B.Sc.BOTANY
ThirdYear-Semester–V

CourseTitle	**MAJORCORE–12 MORPHOLOGY, TAXONOMYOF ANGIOSPERMS AND ETHNOBOTANY**
TotalHours	**90**
Hours/Week	**6Hrs/Wk**
Code	**U21BO5MCT12**
CourseType	**Theory**
Credits	**5**
Marks	**100**

CONSPECTUS

The students will be able 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, ethno botanical applications and traditional medicine.

COURSE OBJECTIVES

- To remember the morphological variation and modifications of the plant parts
- To understand the importance of botanical nomenclature and herbarium and its importance
- To classify the types of root, stem, inflorescence and fruits.
- To apply the knowledge gained in the classification of Bentham and Hooker and plants belonging to the families Annonaceae to Apiaceae and Rubiaceae to Poaceae
- To analyse the relationship between human and plants, and evaluate the origin and application of traditional medicine system

UNIT–I Morphology: 18hrs

Root types and modifications: Adventitious–*Ruellia*, Taproot–*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/ Keywords: ***Stolon, Cladode***

UNIT-II Taxonomy of Angiosperms: 18hrs

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

Extrareading/Keywords: *Digital herbaria,Kew botanical garden,*

UNIT-III Taxonomy: **18hrs**

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

Extra reading/Keywords: *Mimosaceae* ,field notebook

UNIT–IVTaxonomy: **18hrs**

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

Extrareading/Keywords:*Musaceae,* National tropical botanical garden,

UNIT–V Ethnobotany **18hrs**

Definition and Scope of Ethno botany. Interdisciplinary approaches in Ethno botany. Ethnic groups of India and their knowledge wealth. 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 ethno botany. Role of ethno botany in the conservation - Sacred groves. (religious belief, social custom and Taboos) and domestication of native plant genetic resources. Role of Herbaria in ethnobotany.

Extrareading / Keywords: *Ecotourism, validation of ethnomedicine*

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

COURSE OUT COMES (CO)

The learners will be able to

CONo.	Course Outcomes	Cognitive Level
CO-1	Explain the morphological variation of the plant parts, role of ethnobotany in conservation of medicinal plants.	K1
CO-2	Discuss the botanical nomenclature, importance of herbarium, And the salient features of plants belonging to the families Annonaceae to Apiaceae and Rubiaceae to Poaceae	K2

CO-3	Classify the monocot and dicot families based on Bentham and Hooker's classification.	K3
CO-4	Apply and analyze the relationship between the human and plants and domestication of native plant genetic resources	K4
CO-5	Evaluate the economic importance of the families, origin and application of traditional medicine system	K5
CO-6	Assemble the floral parts of the families Brassicaceae, Rutaceae, Euphorbiaceae, Orchidaceae and Poaceae.	K6

TextBooks:

1SinghandJain.1987.TaxonomyofAngiosperms.RastogiPublications,Meerut,India.

2Jain,S.K.1987.A Manual of Ethnobotany-Scientific publishers,Jodhpur.

3. Pandey,S.N.andMisra,S.P.2008.TaxonomyofAngiosperms.AneBooks,India,New Delhi.

4.Sharma,O.P.2017.PlantTaxonomy.2nd Edition.Mc Graw Hill Education.

5.AnnieRagland,V.Kumaresan.2019.TaxonomyofAngiosperms –Taxonomy, Systematic Botany, Economic Botany, Ethnobotany. Saras Publication.India.

Suggested Reading:

1.Lawrence.1955.An introduction to PlantTaxonomy.Central Book Depot.Allahabad.

2.PaulandJain1998.Tribal Medicine–Oxford and IBH PublishingCo.,New Delhi.

3. Sambamoorthy,A.V.S.S.2019. Taxonomy of Angiosperms. Dream tech Press. NewDelhi, India.

4. MicahelG.Simpson.2019.PlantSystematics,3rd Edition.AcademicPress.India.

WebReference:

1. https://www.toppr.com/guides/biology/Taxonomy/MorphologyofAngiosperms/
2. https://www.peoi.org/Courses/Coursesen/Ethnobotany16.html
3. https://bio.libretexts.org/Bookshelves/EconomicBotany/PlantSystematics
4. https://www.sciencedirect.com/topics/TribalMedicine
5. https://www.peoi.org/Courses/Coursesen/Ethnobotany/TaxonomyofAngios perm PO–COMAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	H	M	M	H	H	M	M	M	H
CO2	H	M	H	H	H	M	H	M	H
CO3	H	H	M	M	H	H	H	M	H
CO4	H	H	H	H	H	M	M	M	M
CO5	H	H	H	H	H	M	H	M	H
CO6	H	H	H	H	H	M	H	M	H

H-High M-Moderate L-Low

PSO– CO MAPPING

CO/PSO	PSO1	PSO2	PSO3
CO1	H	H	H
CO2	H	M	M
CO3	M	H	H
CO4	H	M	H
CO5	H	H	H
CO6	H	M	H

H-High M-Moderate L-Low

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

Course Title	**MAJOR CORE 13–BIOPROSPECTING AND UTILIZATION OF PLANT RESOURCES**
TotalHours	**75**
Hours/Week	**5 Hrs/Wk**
Code	**U21BO5MCT13**
CourseType	**Theory**
Credits	**4**
Marks	**100**

CONSPECTUS

The students will be able to understand the utilization of plants as food,medicine and economically important products and also emphasizes the marine and microbial bioprospecting and their applications in industries.

COURSE OBJECTIVES

- To understand the cultivation practices, economic products and uses of cereals, pulses,vegetables,fruits,oils and beverages.
- To remember the sources, extraction and uses of certain medicinal plants.
- To classify the sources, production of economically important bioproducts.
- To apply and analyze the marine and microbialbioresources.
- To analyze the bioprospecting concepts and methods, biopiracy and Traditional Knowledge Digital Library(TKDL).

UnitI **15hrs**

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

Extra reading(KeyWords): *dry drupes, ragi.*

Unit II **15hrs**

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

Extra reading (KeyWords):*Phenolic compounds,volatile oils*

Unit-III **15hrs**

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

Extrareading(KeyWords):*Sago,naturaldyes*

Unit-IV **15hrs**

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

Extrareading(KeyWords):*Kelpforest, penicillin*

Unit-V **15hrs**

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

Extrareading(KeyWords):*Drug designing,****Biopiracy of African super-sweet berries***

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

COURSE OUTCOMES (CO)

The learner will be able to

CO. No.	Course Outcomes	Cognitive Level
CO-1	Explain the bioprospecting concepts and methods,cultivation practices, uses of cereals, pulses, vegetables,fruits,oils and beverages	K1
CO-2	Discuss the sources, Production of economically important bio products, bioprospecting aspects related to marine and microbial bioresources	K2
CO-3	Classify the sources and production of economically important bioproducts.	K3
CO-4	Apply and analyze the extraction and uses of alkaloid, morphine, glycosides and methods of extraction of plant samples	K4

CO-5	Evaluate the processing, grading and packing of rubber, processing of coir, industrial production and uses antibiotics	K5
CO-6	Formulate the economic products from cereals, pulses and vegetables	K6

TextBooks:

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

SuggestedReading:

1. Hill.A.F,1996.Economic Botany–Tata Mc Grew–Hill publishing company Limited, New Delhi.
2. Kochhar,S.L,2016. Economic Botany.5thEdition-CambridgeUniversityPress.
3. Tanveer Bilal Pirzadah,Bisma Malik,Rouf Ahmad Bhat, Khalid Rehman Hakeem.2022. Bioresource Technology:Concept,Tools and Experiences.John Wiley&SonsLtd.
4. Joanna Mossop, 2015**.** Marine Bioprospecting**,** The Oxford Handbook of the Law of the Sea.OxfordUniversityPress.

WebReference:

1. https://www.sciencedirect.com/topics/medicine-and-dentistry/bioprospecting#:~:text=Bioprospecting%20is%20defined%20as%20a,overall%20benefits%20of%20the%20society.
2. https://link.springer.com/chapter/10.1007/978-981-19-5779-6_3
3. https://onlinelibrary.wiley.com/doi/full/10.1002/jobm.202100504
4. 4.https://link.springer.com/chapter/10.1007/978-981-10-8291-7_11#:~:text=Bioprospecting%20of%20medicinal%20plants%20is,plants%20that%20are%20commercially%20valuable.
5. 5.https://pubmed.ncbi.nlm.nih.gov/32529587/

PO– CO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	H	M	M	H	H	M	M	M	H
CO2	H	M	H	H	H	M	H	M	H
CO3	H	H	M	M	H	H	H	M	H
CO4	H	H	H	H	H	M	M	M	M
CO5	H	H	H	H	H	M	H	M	H
CO6	H	H	H	H	H	M	M	M	M

H-High M-Moderate L-Low

PSO–CO MAPPING

(For Candidates admitted from the academic year 2021-22 onwards)
HOLY CROSS COLLEGE (AUTONOMOUS) TIRUCHIRAPPALLI–2
SCHOOL OF LIFE SCIENCES
PG AND RESEARCH DEPARTMENT OF BOTANY
CHOICE BASED CREDIT SYSTEM
LEARNING OUTCOMES-BASED CURRICULUM FRAMEWORK(LOCF)

B.Sc. BOTANY
Third Year-Semester–V

Course Title	**MAJOR CORE 14–PRACTICAL III**
Total Hours	**75**
Hours/Week	**5Hrs/Wk**
Code	**U21BO5MCP 14**
Course Type	**Practical**
Credits	**4**
Marks	**100**

CONSPECTUS

The students will be able to learn problems in genetics with examples, practical knowledge on technical description of vegetative and floral parts of the families, Basic aspects of bioprospecting and utilization of plant resources.

COURSEOBJECTIVES

- To remember laws of Mendel in classical genetics and deviations from Mendelian ratios.
- To understand the morphologicalvariation and modifications of the plant parts.
- To apply the knowledge gained by studying the plants belonging to Polypetalae.
- To apply the knowledge gained by studying the plants belonging to Gamopetalae and Monocotyledons.
- To apply and analyse the bioprospecting and utilization of plant resourses.

UNIT–I Genetics and MolecularBiology **15hrs**

Simple problems in monohybrid and dihybrid cross, backcross dominant and recessive, incomplete dominance, lethal gene, gene interaction, multiple allele, codominant allele. Alternative forms of chromosomal DNA. Mutation- Intergeneric and Intra generic. Structure and functions of RNA. Isolation of DNA.

UNIT–II Plant Morphology **15hrs**

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

UNIT–III Taxonomy **15hrs**

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

UNIT–IV Taxonomy **15hrs**

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

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

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

COURSE OUTCOMES(CO)

The learners will be able to

CONo.	Course Outcomes	Cognitive Level
CO-1	Explain the laws of Mendel in classical genetics and deviations from Mendelian ratios.	K1
CO-2	Illustrate the morphological variation of the plant parts and salient features of plants belonging to Polypetalae and Gamopetalae.	K2
CO-3	Examine the floral parts of the families belonging to Monocotyledons.	K3
CO-4	Apply and analyze the relationship between the human and plants, traditional usage of medicinal plants by tribal people	K4
CO-5	Evaluate the origin and application of traditional medicine system	K5
CO-6	Construct the checker board for dihybrid cross, genetic inheritance and assemble the floral parts of Leguminosae –Fabaceae and Caesalpiniaceae	K6

PO– COMAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	H	M	M	H	H	M	M	M	H
CO2	H	M	H	H	H	M	H	M	H
CO3	H	H	M	M	H	H	H	M	H
CO4	H	H	H	H	H	M	M	M	M
CO5	H	H	H	H	H	M	H	M	H
CO6	H	H	H	H	H	M	M	M	M

H-High M-ModerateL-Low

PSO –COMAPPING

CO/PSO	PSO1	PSO2	PSO3
CO1	H	H	H
CO2	H	M	M
CO3	M	H	H
CO4	H	M	H
CO5	H	H	H
CO6	H	M	H

H-High M-ModerateL-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
Third Year - Semester – V

Course Title	**MAJOR ELECTIVE-3 PHYTOMEDICINE**
Total Hours	**60**
Hours/Week	**4 Hrs /Wk**
Code	**U21BO5MET03**
Course Type	**Theory**
Credits	**3**
Marks	**100**

CONSPECTCONSPECTUS

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 phyto constituents.

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

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

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

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

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

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

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

COURSE OUTCOMES (CO)
The learner will be able to

CO No.	Course Outcomes	Cognitive Level
CO-1	Define the types of Indian system of medicine	K1
CO-2	Classify the crude drugs	K2
CO-3	Summarize and analyse the phytoconstituents of therapeutic values of plant drugs	K3
CO-4	Analyse the drug adulteration	K4
CO-5	Lists the indegenous traditional drugs	K5
CO-6	Explain the collection and processing of plant drugs	K6

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, NewDelhi.
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 andPhytochemistry. CBS Publishers and Distributors Pvt. Ltd.
5. Biren N. Shah and Seth, A. K. 2010.Text book of Pharmacognosy and Phytochemistry. ElsevierPublishers.
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.

PO – COMAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO-1	H	M	M	H	M	M	M	M	H
CO-2	H	M	M	H	M	M	H	M	M
CO-3	H	H	M	M	H	L	H	M	H
CO-4	H	M	H	H	H	M	M	M	M
CO-5	H	H	M	M	H	L	H	M	H
CO-6	H	M	H	H	H	M	M	M	M

HighM-ModerateL-Low

PSO/COMapping

CO/PSO	PSO1	PSO2	PSO3
CO-1	H	H	H
CO-2	H	H	H
CO-3	M	H	H
CO-4	H	M	H
CO-5	M	H	H
CO-6	H	M	H

HighM-ModerateL-Low

(For Candidates admitted from the academic year -2021 onwards)
HOLY CROSS COLLEGE (AUTONOMOUS) TIRUCHIRAPPALLI–2
SCHOOL OF LIFE SCIENCES
PG AND RESEARCH DEPARTMENT OF BOTANY
CHOICE BASED CREDIT SYSTEM
LEARNING OUTCOMES-BASED CURRICULUM FRAMEWORK(LOCF)
B.Sc.BOTANY
ThirdYear-Semester–V

Course Title	**NON MAJOR ELECTIVE 3– FLORICULTURE**
Total Hours	**45**
Hours/Week	**3Hrs/Wk**
Code	**U21BO5NMT03**
Course Type	**The ory**
Credits	**3**
Marks	**100**

CONSPECTUS:

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

Course Objectives:

- To Understand,apply and analyze the Commercial Floriculture.
- Understand and apply the different kinds of gardens
- Relate the mind relaxation by through Aromatherapy
- Apply and evaluate the knowledge on Ornamental floriculture.
- Understand, apply and analyze the fresh and dry flower arrangements.

Unit–I.Floriculture **9hrs**

Introduction, Definition, Scope and Importance of floriculture. Nursery management and special practices on floriculture. Present status of floriculture in India, Prospects of floriculture in India.

Extra reading/Key words: *Olericulture, Pomology.*

Unit-II Cultivation and Management **9hrs**

Soil requirements and artificial growing media for floriculture plants, planting methods,influence of environmental parameters. Water and nutrient management, fertigation, weed management, use of growth regulators, IPM

.

Extra reading/Keywords:*ABA,Florigen*

Unit–III Commercial Floriculture **9hrs**

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

Extra reading/Key words:*Verticalgarden,Xeriscaping.*

Unit-IV Commercial Floriculture **9hrs**

Production techniques of plants(Carnation,Anthurium and orchids). Essential oil production . Production for exhibition purposes.

Extrareading/Keywords:*Pottedplants,Loose flowers*

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

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

Extra reading/Key words:*Floating garden.*

Course Outcomes:The learner will able to

CO No.	Course Outcomes	Cognitive Level
CO-1	Describe the post harvesting techniques in floriculture and Write the scope and importance of Floriculture.	K1
CO-2	Discuss the post harvesting techniques in floriculture and Write the scope and importance of Floriculture.	K2
CO-3	Demonstrate the fresh and dry bouquet preparations. packing,Storage & transportation,marketing,	K3
CO-4	Develop the practical skills by learning Plantation, cultivation,postharvesting techniques,indoor and outdoor gardening, IPM, Trade ofFloriculture -Domestic and Global scenario	K4
CO-5	Relate the Production techniques of Carnation,Anthurium And orchids.Explain and relate the extraction of alkaloids, antioxidants,essential oils and dyes	K5
CO-6	Create an idea for an arrangement of different varieties of Dry flower.	**K6**

Text Books:

1. Introductionto Floricuture Roya. Larson1980,San Diego, CA, U.S.A.: Academic Press, 1980;2nd edition.
2. Text book of floriculture Anil K.Singh2020,New India Publishing Agency-Nipa 3.BhattacharjeeSK.2006.AdvancesinOrnamentalHorticulture.Vols.I-VI.PointerPubl.
4. BoseTK, MaitiRG,DhuaRS&DasP.1999.FloricultureandLandscaping. Naya Prokash. Published by Naya Prokash, 1999.
5. ReddyS, JanakiramB, BalajiT, KulkarniS, &MisraRL. 2007. Hightech Floriculture.Indian Societyof Ornamental Horticulture, New Delhi.
6. KurianA&Asha Sankar M.2007.MedicinalPlants. HorticultureScienceSeries New India Publ. Agency.

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

Suggested Reading:

1. Floriculture in india-G.S.RandhawaandA.Mukhopadhyay-AlliedPublishers Pvt.Limited-2017
2. FloriculturePrinciplesandSpecies(SecondEdition)JohnM.Dole (Author),HaroldF.Wilkins Professor Emeritus (Author) 2019
3. AHandbookofFloriculture–S.PrasadandU.Kumar2022
4. CommercialFloriculture-MM.Syamal-NarendrapublishingHouse.
5. FloricultureataglancebookDeshRaj2008
6. FloricultureHandbookbyBoardEiri2012,Publisher·EngineersIndiaResearch Institute; Genre Business & Economics
7. AHandbookofFloricultureBookS.Prasad2020,Publisher Bio-Greenbooks.

Web references:

1. http://ecoursesonline.iasri.res.in/mod/page/view.php?id=103233
2. https://k8449r.weebly.com/uploads/3/0/7/3/30731055/landscape_gardening.pdf
3.https://www.purdue.edu/hla/sites/cea/wp-content /uploads /sites /15/2016/12/Introduction-to-floriculture.pdf
4.https://dgt.gov.in/sites/default/files/Floriculture%20_%20Landscaping_CTS2.0_NSQF- pdf
5.https://www.studocu.com/in/document/anand-agricultural-university/agriculture-sciences/floriculture-notes/8974249

PO – CO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO-1	H	M	M	H	M	M	M	M	H
CO-2	H	M	M	H	M	M	H	M	M
CO-3	H	H	M	M	H	L	H	M	H
CO-4	H	M	H	H	H	M	M	M	M
CO-5	H	M	M	H	M	M	M	M	H
CO-6	H	M	M	H	M	M	H	M	M

HighM-ModerateL-Low PSO/CO Mapping

CO/PSO	PSO1	PSO2	PSO3
CO-1	H	H	H
CO-2	H	H	H
CO-3	M	H	H
CO-4	H	M	H
CO-5	H	H	H
CO-6	H	H	H

High M-Moderate L-Low

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

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

Course Title	**HERBAL ENTREPRENEURSHIP**
Total Hours	**15**
Hours/Week	**1Hr**
Code	**U21BO5BIR01**
Course Type	**Theory**
Credits	**1**
Marks	**100**

CONSPECTUS

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

COURSE OBJECTIVES

- To Understand the herbal products demand in the market and apply the knowledgein the formulation of raw material
- To Understand the identification of raw material at species level and assuringthe quality and authencity of material.
- To Apply the standard operating procedure for the manufacture of the product.
- To Apply the knowledge in setting quality standard of the product withspecific parameter.
- To Understand packaging, pricing and marketing.

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

Finding out production demand and marketing potential . Survey in local area about the products. Conceptualisation and formulation of raw materials.

Extra Reading/Keywords: *topical medications, pharmaceutics*

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

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

Extra Reading/Keywords:*Digital herbaria,SCAR*

Unit-III Processing **3hrs**

Drawing standard operating procedure for the manufacture of the product.

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

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

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

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

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

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

Extra Reading/Keywords:*DPCO(DrugPricingControlOrganization),Pharma marketingchannels*

TextBooks

- Roseline,A.2011.Phamacognosy. MJP Publishers,Chennai.
- Kokate,C.K.,Purohit,A.P.&Gokhale,S.B.1998. Pharmacognosy.NiraliPrakashan, Pune.
- Pandey,S.N.andMisra,S.P.2008.Taxonomy of Angiosperms.AneBooks,InNewDelhi.

SuggestedReadings

1. MichaelHeinrich,JoanneBarnes,JoseM.PrietoGarcia,SimonGibbonsandElizabeth
2. M.Williamson.2018.Fundamentals of Pharmacognosy and Phytotherapy.ElsevierPublishers.
3. EdwinJerald,EandSheejaEdwinJerald,2007. Text book of Pharmacognosy and Phytochemistry.CBS Publishers and Distributors Pvt.Ltd.
4. NigelC.Veitch,MichaelSmith,2013.Herbal Medicines Fourth edition. Pharmaceutical Press.
5. Lawrence.1955. An introduction to PlantTaxonomy. Central Book Depot.Allahabad.

COURSE OUTCOMES(CO)

The learners will be able to

CO No.	Course Outcomes	Cognitive Level
CO-1	Find the need assessment of herbal products demand in The market, Explain the methods for the formulation of raw materials	K1
CO-2	Discuss the raw material at species level	K2
CO-3	Compile the standard operating procedure for the manufacture Of the product.	K3

CO-4	Examine the quality and authenticity of the raw materialand Analyse the quality standard for the product with specific parameters	K4
CO-5	Evaluate the guidelines on packaging, pricing, labeling and marketing of herbal products	K5
CO- 6	Create an idea for the formulation of raw materials	K6

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

PO – CO MAPPING

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

H-HighM-ModerateL-LowPSO – CO MAPPING

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

HighM-ModerateL-Low

(For Candidates admitted from the academic year 2021-22 onwards)
III B.Sc. BOTANY – Semester – VI

Course Title	**MAJOR CORE 15 – PLANT PHYSIOLOGY AND BIOCHEMISTRY**
Total Hours	**90**
Hours/Week	**6 Hrs. /Wk**
Code	**U21BO6MCT15**
Course Type	**Theory**
Credits	**5**
Marks	**100**

CONSPECTUS

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

COURSE OBJECTIVES

- To remember the concept of absorption in plant system and structure of molecules.
- To understand the pathways involved in respiration, photosynthesis and the significance of amino acids, proteins and enzymes.
- To classify the types of stomatal movement, carbohydrates, proteins, enzymes and vitamins.
- To apply the knowledge gained in apoplast and symplast concept, plant growth regulators, carbohydrates and lipids.
- To analyze the factors affecting photosynthesis, photoperiodism and enzyme activity.
- To evaluate the mineral nutrition, biological nitrogen fixation, nitrogen cycle and the sources of vitamins.

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 – II Physiology: 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- C3, C4 fixations and CAM plants. Factors affecting photosynthesis.

Extra reading/Key words: *chemiosmosis, carbon sequestration*

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 – Auxins, gibberellins, cytokinins, ethylene, abscissic

acid. Photoperiodism. Plant rhythms and Biological clock. Vernalization, Seed dormancy and senescence.
Extra reading/Key words: *Circadian rhythm, remobilization of nitrogen*

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

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

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

COURSE OUTCOMES (CO)
The learner will be able to

CO No.	Course Outcomes	Cognitive Level
CO-1	Explain the concept of water and mineral absorption in plant system, structure of carbohydrates and proteins	K1
CO-2	Discuss the various pathways involved in respiration, photosynthesis and the importance of enzymes, vitamins and alkaloids	K2
CO-3	Classify the dark reactions of plants,carbohydrates, proteins, enzymes and vitamins	K3
CO-4	Apply the functions and deficiency symptoms of essential elements, plant growth regulators, carbohydrates and lipids	K4
CO-5	Evaluate the factors affecting photosynthesis, photoperiodism, enzyme activity, importance of enzymes, vitamins and alkaloids	K5
CO-6	Combine the mineral nutrition, importance of enzymes, vitamins and alkaloids	K6

(K1-Remember; K2Understand; K3-Apply; K4–Analyze; K5-Evaluate, K6-Create)
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. 2018. Fundamentals of Plant Physiology. Nineteenth Edition. S. Chand and Company Ltd., New Delhi
4. Srivastava. 1987. Introduction to biochemistry. Rastogi publications, Meerut, India.

5. Jain, J. L. and Sunjay Jain 2016. Fundamentals of Biochemistry. S. Chand and Company Ltd., New Delhi.

Suggested Reference Books:

1. Noggle, G. R. and Fritz, G. J. 1992.. Introductory Plant Physiology. Prentice – Hall of India Pvt. Ltd., New Delhi.
2. Kochhar S. L. and Gujral S. K. 2021.Plant Physiology: Theory and Applications, 2nd Edition. Cambridge University Press. Cambridge. U.K.
3. Conn, E. E. and Stumpf, P. K. 1976. Outlines of Biochemistry. Wiley Eastern Ltd., New Delhi.
4. Hans-Walter Heldt Professor Em and Birgit Piechulla. 2019. Plant Biochemistry, Kindle edition.

Web Reference:

1. https://www.toppr.com/guides/biology/mineral-nutrition/metabolism-of-nitrogen/
2. https://www.britannica.com/science/photosynthesis
3. https://byjus.com/biology/plant-growth-regulators/
4. https://unacademy.com/content/csir-ugc/study-material/life-sciences/structure-of-atomsmoleculesand-chemical-bonds-in-biology/
5. https://soe.unipune.ac.in/studymaterial/swapnaGaikwadOnline/aminoacids-171113130407.pdf

PO – CO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO 1	3	2	2	3	3	2	2	2	3
CO2	3	2	3	3	3	2	3	2	3
CO3	3	3	2	2	3	3	3	2	3
CO4	3	3	3	3	3	2	2	2	2
CO5	3	3	3	3	3	2	3	2	3
CO 6	3	3	3	3	3	2	3	2	3

H-High M-Moderate L-Low

PSO – CO MAPPING

CO/PSO	PSO 1	PSO2	PSO3
CO 1	3	3	3
CO2	3	2	2
CO3	2	3	3
CO4	3	2	3
CO5	3	3	3
CO 6	3	2	3

(For candidates admitted from the academic year 2021-22 onwards)
III B.Sc. BOTANY - Semester – VI

Course Title	**MAJOR CORE 16 - PLANT TISSUE CULTURE, GENETIC ENGINEERING AND NANOTECHNOLOGY**
Total Hours	**75**
Hours/Week	**5 Hrs./Wk**
Code	**U21BO6MCT16**
Course Type	**Theory**
Credits	**4**
Marks	**100**

CONSPECTUS

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

- To understand the tissue culture techniques in micro propagation of rare and medicinal plants
- To remember and understand the alternative techniques for mass propagation
- To understand and apply the tools and techniques adopted in production of transgenic plants
- To analyze the concept of GMOs in the field of medicine, agriculture and bioremediation.
- To apply the basics of nanotechnology and its role in agriculture, medicine and environment

UNIT – I: Plant tissue culture: **15 Hrs.**

Introduction, Cellular totipotency, basic principles, infrastructure for 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: **15 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: **15 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): **15Hrs.**

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: 15 Hrs.
Introduction, history, bio-nano tools, types of nano materials, Characterization of nanoparticles, applications of nanotechnology – environment, agriculture, food, industry, medicine. Safety and limitations of nanotechnology.
Extra Readings/Key words:*RFID, Kuppfer cells, Nano farming*

Note: Texts given in the Extra reading /Key words must be tested only through Assignment and Seminars. Course Outcomes:
The learner will be able to

CO No.	Course Outcomes	Cognitive Level
CO-1	Discuss the tissue culture techniques in micro propagation of rare and medicinal plants	K1
CO-2	Describe the alternative techniques for mass propagation	K2
CO-3	Distinguish the tools and techniques adopted in production of transgenic plants, Explain the production of recombinant hormone, vaccine	K3
CO-4	Enumerate the role of GMOs in the field of medicine, agriculture and bioremediation.	K4
CO-5	Summarize the basics of nanotechnology and its role in agriculture, medicine and environment	K5
CO-6	Develop the employability skills by understanding the basic and recent trends of plant tissue culture, recombinant DNA technology and nanotechnology	K6

(K1-Remember; K2-Understand; K3-Apply; K4–Analyze; K5-Evaluate, K6-Create)

Prescribed Text Books:

1. Dubey. R. C. 2006. Text book of biotechnology. S. Chand and Company Ltd. New Delhi.
2. Kumaresan, V. Text book of biotechnology. Saras Publications.
3. Satyanarayana U.2015.Biotechnology. Books and Allied(P) Ltd. Kolkata.
4. Kalyan Kumar de, 2020. An Introduction to Plant Tissue Culture. New Central book Agency, Pvt. Ltd.
5. Ignacimuthu, S.J. 2003. Plant Biotechnology. Oxford & IBH Publishing, New Delhi.
6. Bhojwani, S.S and Razdan, M.K. 2004. Plant Tissue Culture, Read Elsevier India Pvt. Ltd.

Suggested Reference Books:

1. Gupta, P. K.1999. Elements of biotechnology. Rastogi Publications, Meerut.
2. John E. Smith. 1988. Biotechnology – II Edition. Cambridge University Press, London.
3. Joy Deep Dutta and Anil K.Rao, 2008. Introduction to Nanoscience. CRC Press, London.
4. Bernard R Glick and Jack J Pasternak. 2001. Molecular biotechnology-principles and applications of recombinant DNA, (2nd Edition), ASM Press, Washington, D.C.
5. James, D Watson et al., 1992. Recombinant DNA (2nd Edition), WH Freeman and Co., New York.

Web References:

1. http://www.freebookcentre.net/Biology/BioTechnology-Books.html
2. https://books.google.co.in/books/about/Introduction_to_Plant_Biotechnology.html?id=RgQLISN8zT8C
3. https://www.kobo.com/us/en/ebook/plant-biotechnology-1
4. https://www.kobo.com/us/en/ebook/plant-biotechnology-1
5. https://www.worldcat.org/title/molecular-biology/oclc/1062496183

Mapping :

PO & CO Mapping

CO/PO	COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	3	3	1	3	2	1	2	2	2	2
CO 2	3	3	2	2	3	3	2	1	2	1
CO 3	2	2	3	3	1	2	1	3	1	3
CO 4	3	3	3	3	3	2	3	3	3	3
CO 5	3	3	2	3	2	3	3	3	3	3
CO 6	3	2	3	2	3	3	3	3	3	3

PSO & CO Mapping

CO/PSO	PSO1	PSO2	PSO3
CO1	3	1	3
CO 2	3	2	2
CO 3	2	3	3
CO 4	3	3	3
CO 5	3	2	3
CO 6	3	2	3

(For Candidates admitted from the academic year 2021 onwards)
III B.Sc. BOTANY - Semester – VI

Course Title	MAJOR CORE 17 – INSTRUMENTATION AND BOTANICAL TECHNIQUES
Total Hours	**60**
Hours/Week	**4Hrs. /Wk**
Code	**U21BO6MCT17**
Course Type	**Theory**
Credits	**4**
Marks	**100**

Conspectus

The student will be able to understand the botanical techniques, working principles and applications of biological instruments.

Course Objectives:

- To remember, understand and apply the instrumentation of microscopy and micrometry.
- To understand and apply the working principles and applications of Colorimeter and pH meter
- To understand and apply the instrumentation of centrifuge, Dialysis and chromatography
- To understand and apply the botanical techniques, microtomy, and staining for preparing permanent slides
- To understand and apply the basic techniques of DNA and protein studies and also localization of carbohydrates, proteins and lipids

UNIT – I Instrumentation: **12 Hrs.**

Microscopy– magnification, resolution, numerical aperture and refractive index. Instrumentation, Working principle and applications: light microscope, Phase contrast microscope, Electron Microscope: Transmission Electron Microscope. Basic principles and significance of Micrometry – types and applications.

Extra Reading /Keywords: *Working principle* of *Dark field microscope, fluorescence microscope*

UNIT – II Instrumentation: **12 Hrs.**

Instrumentation, working principle of Colorimeter, spectrophotometer – types: UV- Visible spectrophotometer and FTIR & their applications. pH meter – working principle and application. Buffers – Types and its applications in biological research.

Extra Reading/Keywords*:* *Atomic Absorption Spectrophotometer, flame photometer*

UNIT – III Instrumentation: **12 Hrs.**

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

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

UNIT – IV Botanical techniques: **12 Hrs.**

Collection, fixation (fixative FAA) and processing (dehydration, clearing, infiltration and embedding) of plant materials. Microtomy: working principles, construction and applications of Rotary and ultra-microtome, Stains: Acidic and Basics. Staining - Double staining with safranin

and fast green.

Extra Reading/Keywords: *Microsection, negative staining*

UNIT – V Histochemistry and Electrophoresis **12 Hrs.**

Histochemical localization and identification of carbohydrates (starch), proteins and lipids. Electrophoresis: Basic principles, techniques and its types; Separation of DNA – Agarose gel, Protein separation – SDS PAGE.

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

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

COURSE OUTCOMES(CO)

CO No.	Course Outcomes	Cognitive Level
CO-1	Describe the principle and working mechanism of light microscope, transmission of electron microscope	K1
CO 2	Describe the basic techniques of Centrifuges, Colorimeter and pH meter	K2
CO-3	Illustrate the botanical techniques, working principles and applications of biological instruments	K3
CO-4	Analyze the DNA and protein in plant samples and also localization of carbohydrates, proteins and lipids .	K4
CO-5	Evaluate the basics techniques of DNA and protein studies and also localization of carbohydrates, proteins and lipids	K5
CO-6	Develop the employability skills by understanding the botanical techniques, working principles and applications of biological Instruments	K6

(K1-Remember; K2-Understand; K3-Apply; K4–Analyze; K5-Evaluate, K6-Create)

Prescribed Text Books:

1. Veerakumari L. 2015. Bioinstrumentation. MJP Publishers, Chennai.
2. Machve K. K. 2007. A text book of Bio – Instrumentation. Manglam Publishers & Distributors, Delhi.
3. Wilson, K. and Walker, J. 2000. Principles and Techniques of Practical Biochemistry (5th Edition), Cambridge University Press, Cambridge.
4. Plummer D. (1988). Practical Biochemistry. McGraw Hill Publication.
5. Krishnamurthy, K.V. 1988. Methods in Plant Histochemistry. S. Viswanthan (Printers & Publishers) Pvt.Ltd., Chennai.

Suggested Reference Books:

1. Palanivelu P (2013). Analytical biochemistry and separation techniques, 20th century Publication, Palkalai Nagar, Madurai
2. Avinash U., Kakoli U. and Nirmalendu N.1998.Biophysical Chemistry. Himalaya Publishing House,
3. Jayaraman, J. (1985). Laboratory Manual in Biochemistry Wiley Eastern Ltd., New Delhi.
4. Ninfa, A. J. and D. P. Ballou, 1998. Fundamental Laboratory Approaches for Biochemistry and Biotechnology, 2nd Edition Wiley.
5. Meenakshi Chakraborty. 2012. Histology & Histochemistry, Wisdom Press, New Delhi.

Web References:

1. https://www.britannica.com/science/chromatography/Elution-chromatography

2. https://chem.libretexts.org/Bookshelves/Analytical_Chemistry/Analytical_Chemistry_2.1_(Harvey)
3. https://www.britannica.com/science/molecular-biology
4. https://beckassets.blob.core.windows.net/product/readingsample/574278/9780896038097_excerpt_001.pdf

PO – CO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO-1	3	2	2	3	2	2	2	2	3
CO-2	3	2	2	3	2	2	3	2	2
CO-3	3	3	2	2	3	1	3	2	3
CO-4	3	2	3	3	3	2	2	2	2
CO-5	3	2	2	3	2	2	2	2	3
CO-6	3	2	2	3	2	2	3	2	2

PSO – CO MAPPING

CO/PSO	PSO1	PSO2	PSO3
CO-1	3	3	3
CO-2	3	3	3
CO-3	2	3	3
CO-4	3	2	3
CO-5	2	3	3
CO-6	3	2	3

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

III B.Sc. BOTANY – Semester – VI

Course Title	MAJOR CORE -18 PRACTICAL IV
Total Hours	75
Hours/Week	5 Hrs. /Wk
Code	U21BO6MCP18
Course Type	Practical
Credits	4
Marks	100

CONSPECTUS

The students will be able to prepare the solutions, carry out the experiments on plant physiology, biochemistry and plant tissue culture.

COURSE OBJECTIVES:

- To remember the mechanism of osmosis, plasmolysis, and transpiration.
- To understand the mechanism of respiration and photosynthesis.
- To apply the mechanism of ascent of sap, root pressure and remember the separation of plant pigments.
- To analyse the estimation of starch, reducing sugar, total lipids, total soluble protein, ascorbic acid and enzyme activity.
- To evaluate the preparation of medium, sterilization and inoculation of explants and incubation.

UNIT – I Physiology: 15 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: 15 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: 15 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 – IV Biochemistry: 15 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: 15 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	Cognitive Level
CO-1	Describe the mechanism of water absorption, plasmolysis, and transpiration.	K1
CO-2	Determine the respiration rate by Ganong's respiroscope and the quality of light on photosynthesis.	K2
CO-3	Identify the plant pigments by various separation techniques.	K3
CO-4	Calculate the quantity of primary and secondary metabolites of plant by standard procedures.	K4
CO-5	Demonstrate the working principle of dialysis, centrifuge and colorimeter.	K5
CO-6	Combine the preparation of medium, sterilization and inoculation of explants and incubation.	K6

(K1-Remember; K2-Understand; K3-Apply; K4–Analyze; K5-Evaluate, K6-Create)

PO – CO MAPPING & PSO – CO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO 1	3	2	2	3	3	2	2	2	3
CO2	3	2	3	3	3	2	3	2	3
CO3	3	3	2	2	3	3	3	2	3
CO4	3	3	3	3	3	2	2	2	2
CO5	3	3	2	3	3	2	3	2	3
CO 6	3	3	3	3	3	2	3	2	3

CO/PSO	PSO 1	PSO2	PSO3
CO 1	3	3	3
CO2	3	2	2
CO3	2	3	3
CO4	3	2	3
CO5	3	3	3
CO6	3	2	3

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

III B.Sc. BOTANY - Semester – VI

Course Title	**MAJOR ELECTIVE-4 PRINCIPLES IN HORTICULTURE AND PLANT TISSUE CULTURE**
Total Hours	**60**
Hours/Week	**4 Hrs. /Wk**
Code	**U21BO6MET07**
Course Type	**Theory**
Credits	**3**
Marks	**100**

Conspectus

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

Course Objectives

- To understand and apply the types of horticultural crops and propagation
- To understand and apply the plant propagation practices of horticultural crops
- To remember the growth and development of horticultural crops, understand, apply the tissue culture techniques in micro propagation of rare and medicinal plants
- To remember, understand and apply the alternative techniques of plant tissue culture for mass propagation
- To understand, apply the tissue culture techniques in micro propagation of rare and medicinal plants

UNIT – I Horticulture: **12 Hrs.**

Horticulture - Definition, scope, purpose and classification of horticultural crops. - Crop regulation physical and chemical regulation. Horticultural zones in India and Tamil Nadu.

Extra reading/Key words: *Pomology, olericulture*

UNIT – II Gardening: **12 Hrs.**

Gardening -Establishment and maintenance of garden- Types of gardens – kitchen garden, terrace Garden and vertical garden-principles, planning and layout, management of orchards, water management, weed management, fertility management in horticultural crops.

Extra reading/Key words: *Dappled shade, slow release fertilizers.*

UNIT –III Nursery Techniques **12 Hrs.**

Nursery preparation-preparation of nursery bed, seed treatment, sowing. Seedling production– potting, depotting and repotting of plants. Nursery techniques and their management-Cutting-Root, stem and leaf bud. Layering-Air, tip, simple, compound, trench and mount. Grafting- Approach, whip and cleft. Budding-T-budding, Patch, chip and ring. Culture of bonsai.

Extra reading/Key words: *Microclimate, mulching*

UNIT – IV: Plant tissue culture Techniques: **12 Hrs.**

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

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

UNIT–V: Plant tissue culture: **12 Hrs.**

Organogenesis – direct and indirect methods and their significance. Somatic embryogenesis- Principle,

types, protocol and importance. Synthetic seed preparation and its application. Plant protoplast culture: principle, isolation, fusion & culture of protoplasts and its importance. Somatic hybridization and Cybridization.

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

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 tissue culture.	K1
CO-2	Discuss the scope and importance of horticulture and compare the physiological disorders of fruits and vegetables.	K2
CO 3	Classify the types of crop regulation, propagation, asexual propagation and types of hybridization	K3
CO-4	Analyze application of the nutrients, preparation of nursery bed, seed treatment, postharvest in horticulture crops,	K4
CO-5	Apply the knowledge in the production of synthetic seed preparation. apply the culture of bonsai	K5
CO-6	Categorize the different types of isolation of protoplast and regeneration of plantlets and Compile the post harvesting technology in horticulture	K6

(K1- Remember; K2- Understand; K3- Apply; K4- Analyse; K5- Evaluate; K6 – Create)

Prescribed Text Books:

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

Books for Reference:

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

Web references:

1. https://ncert.nic.in/textbook/pdf/ievs101.pdf
2. https://agritech.tnau.ac.in/pdf/HORTICULTURE.pdf
3. https://www.agrimoon.com/wp-content/uploads/Fundamentals-of-Horticulture.pdf

4. https://gurunanakcollege.edu.in/files/science/tissue-culture.pdf
5. https://igntu.ac.in/eContent/IGNTU-eContent-320700680443-M.Sc-EnvironmentalScience-2- ManojkumarRai- Environmental microbiology and biotechnology-5.pdf

PO – CO MAPPING & PSO – CO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO-1	3	2	2	3	3	2	2	2	3
CO-2	3	2	3	3	3	2	3	2	3
CO-3	3	3	2	2	3	2	3	2	3
CO-4	3	3	3	3	3	2	2	2	2
CO-5	3	3	3	3	3	2	2	2	2
CO-6	3	3	3	3	3	2	2	2	2

CO/PSO	PSO1	PSO2	PSO3
CO-1	3	3	3
CO-2	2	3	2
CO-3	3	2	3
CO-4	3	3	2
CO-5	2	2	3
CO-6	3	3	3

(For Candidates admitted from the academic year 2021-2022 onwards)

III B.Sc. BOTANY - Semester – VI

Course Title	**MAJOR ELECTIVE 4- SPIRULINA CULTIVATION AND POST HARVEST TECHNOLOGY**
Total Hours	**30**
Hours/Week	**4 Hrs. /Wk**
Code	**U21BO6MET08**
Course Type	**Theory**
Credits	**3**
Marks	**100**

CONSPECTUS

To enable the students to understand Basic knowledge on structure and function of various groups of spirulina.

COURSE OBJECTIVES

The learner will be able to

- To remember, learn and develop skills in spirulina cultivation.
- To understand and appreciate the role of spirulina in Nutrition, Medicine and health.
- To cultivate spirulina cultivation in small scale industry.
- To introduce fundamental concepts and methods of spirulina cultivation.
- To train the students in comprehensive spirulina production and post-production.
- To make the students become an entrepreneur

UNIT – I Introduction to SCP production **6 Hrs.**

Introduction to SCP production – historical use and rediscovery of *Spirulina,importance, morphology*, taxonomy and habitat of *Spirulina*

Extra reading /Key Words*: Closed Photobioreactor Systems, morels*

UNIT – II B**iochemical composition of SCP** **6 Hrs.**

Biochemical composition - amino acids, unsaturated fatty acids and lipids, Minerals vitamins, pigments, carotenoids and phycobili proteins. Chelating of toxicminerals.

Extra reading /Key Words: *Selenium, Agribusiness*

UNIT – III Cultivation and production of spirulina **6 Hrs.**

Natural production –Nutritional media small scale commercial production – commercial and mass cultivation (tank construction, culture medium, strain selection, scaling up of the process) – importance of light and pH in *Spirulina* cultivation –Harvesting and processing drying and packing , Production of spirulina in organic nutrients including waste effluents post-harvest technology and single cell protein formulation.

Extra reading /Key Words: *Arthrospira platensis,*

UNIT – IV Products, uses and benefits **6 Hrs.**

Spirulina and its use by humans-Immune system enhancement,nutritional supplements, Food source, Food safety aspects related to human consumption of spirulina, Spirulina and Agriculture-Use as fertilizer, Use as aprotein supplement in poultry and livestock feeds, Use as a colourant in poultry, livestock and food products, Spirulina and Aquaculture-Spirulina as a nutritional supplement,

Spirulina as a colourant.

Extra reading /Key Words: *Pure cultures, Spirulina maxima.*

UNIT – V Post harvest technology of spirulina **6 Hrs.**

Post harvest technology, Packing, marketing and transporation. Diseases-Insect pests, viruses, fungal competitors ,symptoms and its control measures.

Extra reading /Key Words: *grading and canning, steeping preservation.*

COURSE OUTCOMES (CO)

The learner will be able to

CO No.	Course Outcomes	Cognitive Level
CO-1	Describe various types and categories of spirulina.	K1
CO-2	Develop various types of food technologies associated with spirulina industry.	K2
CO-3	Apply techniques studied for cultivation of various types of spirulina.	K3
CO-4	Analyze and explore the growth medium and post-harvest techniques and marketing of spirulina	K4
CO-5	Evaluate the economic importance, new methods and strategies to contribute to spirulina production.	K5
CO-6	Create the new methods and strategies to cultivate to spirulina production.	K6

(K1- Remember; K2- Understand; K3- Apply; K4- Analyze; K5- Evaluate; K6 – Create)

Prescribed Text Books:

1. Avigad Vonshak. *Spirulina platensis* (Arthrospira) Physiology, cell-biology and biotechnology, Taylor & Francis Ltd.
2. Selvendran D. 2015. Large Scale Algal Biomass (Spirulina) Production in India. In: D. Das (Ed.) Algal An Integrated Approach, Springer
3. Habib M.A.B., Parvin M., Huntington T.C. and Hasan M.R. 2008. A review on culture, production and use of Spirulina as food for humans and feeds for domestic animals and fish. FAO Fishers and Aquaculture Circular No. 1034, FAO, Rome, Italy.

Suggested Reference Books:

1.Spirulina in Human Nutrition and Health" by M. E. Gershwin and Amha Belay.

2.Spirulina World Food: How This Micro-Algae Can Transform Your Health and Our Planet" by Robert Henrikson published by Ronore Enterprises,2022.

Website References:

1. https://www.techno-preneur.net/technology/project-profiles/food/Spirulina.htm
2. https://www.fao.org/3/i0424e/i0424e00.pdf
3. http://www.sp100.com/spirulina/spirulina_3.html
4. https://www.asiafarming.com/spirulina-farming-cultivation-practices

Mapping:

PO & CO Mapping & PSO & CO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	3	3	1	3	2	1	2	2	2
CO 2	2	3	2	2	3	3	2	3	3
CO 3	2	2	3	3	1	2	1	3	1
CO 4	3	3	3	3	3	2	3	3	3
CO 5	3	3	2	3	2	3	3	3	2

CO/PSO	PSO1	PSO2	PSO3
CO1	3	1	3
CO 2	3	2	2
CO 3	2	3	3
CO 4	3	3	3
CO 5	3	2	3

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

III B.Sc. BOTANY - Semester – VI

Course Title	**NON MAJOR ELECTIVE 4 - NATURAL REMEDIES AND COSMETICS**
Total Hours	**45**
Hours/Week	**3 Hrs. /Wk**
Code	**U21BO6NMT04**
Course Type	**Theory**
Credits	**3**
Marks	**100**

CONSPECTUS

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

COURSE OBJECTIVES

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

UNIT I Indian system of medicine: **9Hrs.**

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 natural remedies for the common ailments: **9Hrs.** 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: **9Hrs.**

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: **9Hrs.**

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 and cosmetics **9Hrs.**

Herbal preparations – decoctions, tea, infusions, oils, sanitizer, cosmetics (herbal scrub, face pack, face wash, soap, sunscreen 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.

COURSEOUTCOMES(CO)

The learner will be able to

CO No.	Course Out comes	Cognitive Level
CO-1	Write the scope and importance of herbal medicine, Discuss the importance of Indian system of medicine.	K1
CO-2	Explain the alternate herbal remedies for common ailments.	K2
CO 3	Relate the skin, hair care; kidney and uterus problems by natural ways. Apply the cultivation and processing of herbs.	K3

(K1-Remebering, K2-Understand,, K3-Apply, K4-Analyze, K5-Evaluate K6-Create))

Prescribed Text Books:

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

Books for Reference:

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

Web Reference

1. https://www.sciencedirect.com/book/9780323523424/
2. https://www.akinik.com/products/273/herbal-medicine

PO-CO Mapping and PSO-CO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	3	2	2	3	2	2	2	2	3
CO2	3	2	3	3	3	2	3	2	2
CO3	3	3	2	2	3	3	3	2	3

H-High M-Moderate L-Low

CO/PSO	PSO1	PSO2	PSO3
CO1	3	1	3
CO2	3	2	2
CO3	2	3	3

(For Candidates admitted from the academic year 2023-24 onwards)
I PG - COURSE PATTERN (2023-2024 ONWARDS) – TANSCHE

Sem.	Subject	Title of the course	Code	Hours	Credits
I	Core Course 1	Plant diversity–I:Algae, Fungi,Lichens and Bryophytes	P23BO1CCT01	6	4
	Core Course 2	Plant diversity-II, Pteridophytes, Gymnosperms and Paleobotany	P23BO1CCT02	5	3
	Core Course 3	Plant embryology,Morphogenesis and Anatomy	P23BO1CCT03	5	3
	Core Course 4 Practical	Practical paper– 1	P23BO1CCP04	6	4
	Elective 1	Conservation of Natural resources and policies/Phytopharmacognosy.	P23BO1ECT01/ P23BO1ECT02	4	3
	Elective 2	Herbal Technology /Horticulture	P23BO1ECT03/ P23BO1ECT04	4	3
	Value Education			**-**	**-**
	Total			**30**	**20**
II	Core Course 5	Genetics,Plant Breeding and Biostatistics	P23BO2CCT05	5	4
	Core Course 6	General Microbiology and Immunology	P23BO2CCT06	4	3
	Core Course 7	Ecology,Phytogeography and Intellectual property rights.	P23BO2CCT07	4	3
	Core Course 8	Practical –II	P23BO2CCP08	4	4
	Elective 3	Research Methodology/ Phytochemistry	P23BO2ECT05/ P23BO2ECT06	4	3
	Elective 4 (Generic - Biochemistry/Biotechnology/Bioinformatics /Botany/Zoology/EVS)	Environmental Biotechnology	P23BO2ECT07	4	3
	SEC I - NME 1 (Discipline Specific)	Agriculture and Food microbiology	P23BO2SET01	**4**	**2**
	Massive Open Online Course (MOOC)	**Online Course**	P23EX2ONC01	**-**	**2 Ex. Credits**
	Value Education			**1**	**-**
	Internship	Internship 1	P23EX2INT01		**2 Ex. Credits**
	Total			**30**	**22+4**

(For Candidates admitted from the academic year 2023 onwards)

HOLY CROSS COLLEGE (AUTONOMOUS) TIRUCHIRAPPALLI–2

SCHOOL OF LIFE SCIENCES

PG AND RESEARCH DEPARTMENT OF BOTANY

CHOICE BASED CREDIT SYSTEM

M.Sc. BOTANY

First Year–Semester-I

Course Title	**PLANT DIVERSITY–I: ALGAE, FUNGI, LICHENS AND BRYOPHYTES**
Total Hours	**90**
Hours/Week	**6**Hrs/**Wk**
Code	**P23BO1CCT01**
Course Type	**Theory**
Credits	**4**
Marks	**100**

GENERAL OBJECTIVE

To enable the students to understand various forms, classification, distinguishing traits, geographic distribution, reproductive cycle and economic importance of algae, fungi, lichens and Bryophytes.

COURSE OBJECTIVES

The learner will be able to

CO.No.	Course Objectives
CO-1	To learn about the classification, distinguishing traits, geographic distribution, and reproductive cycle of algae, fungi, lichens, and bryophytes.
CO-2	To gain knowledge about the ecological and economic importance of algae, fungi, lichens and bryophytes.
CO-3	To spark interest in the evolutionary roots of plant development.

CO-4	To study the biodiversity by describing and explaining the morphology and reproductive processes of algae, fungi, bryophytes and microorganisms.
CO-5	To expose the beneficial and harmful viewpoint.

Unit–I: ALGAE (18hrs)

General account of algology, Contributions of Indian Phycologist (M.O.Parthasarathy Iyengar T.V.Desikachary, V.Krishnamurthy and V.S. Sundaralingam), Classification of algae by F.E. Fritsch (1935-45) &Silva (1982).Salient features of major classes: Cyanophyceae, Chlorophyceae, Xanthophyceae, Chrysophyceae , Cryptophyceae, Dinophyceae, Chloromonadineae,Euglenophyceae,Charophyceae,Bacillariophyceae,PhaeophyceaeandRhodophyceae.Rangeofthallusorganization, algae of diverse habitats, reproduction (vegetative, asexual and sexual) and life cycles. Phylogeny and inter-relationships of algae, origin and evolution of sex in algae. Structure, reproduction and life histories of the following genera: *Oscillatoria, Scytonema, Ulva,Codium,Diatoms,Dictyota*and*Gelidium.*

Extra reading/Keywords:*Algal phylogeny, Macroalgae nursery***,** *Algal biorefineries*

Unit II: FUNGI (18hrs)

General Characteristics, occurrence and distribution. Mode of nutrition in fungi. Contributions ofIndianMycologists(C.V.Subramanian),Classification of Fungi by Alexopoulos and Mims(1979) & Recent trends in the classification of fungi - Phylogeny and inter-relationships of major groups of fungi. General characters of major classes: Mastigomycotina, Zygomycotina, Ascomycotina, Basidiomycotina and Deuteromycotina. Heterothallism in fungi, sexuality infungi, Para sexuality, sex hormones in fungi. Structure, reproduction and life histories of the following genera: *Plasmodiophora, Phytophthora, Rhizopus, Taphrina, Polyporus* and *Colletotrichum.*

Extra reading/Keywords: *Mycotoxins ,funga lmelanin, Calvacin*

Unit III: LICHENS (18hrs)

Introduction and Classification (Hale, 1969). Occurrence and inter-relationship of phycobionts and mycobionts, structure and reproduction in Ascolichens, Basiodiolichens and Deuterolichens.

Extra reading/Keywords: Lichen microbiota with model species *Lobaria pulmonaria.*

Unit IV: BRYOPHYTES (18hrs)

General characters and Classification of Bryophytes by Watson (1971). Distribution, Structuralvariations and evolution of gametophytes and sporophytes in Bryopsida, Anthoceropsida and Mosses. General characters of major groups - Marchantiales, Jungermaniales, Anthocerotales, Sphagnales, Funariales and Polytrichales. Reproduction-Vegetative and sexual,spore dispersal Mechanisms In bryophytes, spore germination patterns in bryophytes. Structure,Reproduction and life histories of the following genera: *Targionia ,Lunularia ,Porella* and *Polytrichum.*

Extrareading/Keywords: *Medicinal bryophytes, bioindicators*

Unit V: ECONOMIC IMPORTANCE (18 hrs)

Algae - Economic importance in Food and feed - Single cell protein, Industrial products (Agar-Agar, Carrageenan, Alginic acid, Iodine, biofertilizers, Vitamins and biofuel), Medicinal value and Diatomaceous earth. Fungi– Economic Importance in food, industries and medicine. Culturing and cultivation of mushrooms *Pleurotus*. Lichen–economic importane and as indicator of pollution. Bryophytes – Ecological and economic importance – industry, horticulture and medicine.

Extra reading/Keywords: *Fontinalis antipyretica, Neckera complanta*

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

Course outcomes: CO	**On completion of this course, the students will be able to:**	**PSOs Addressed**	**Cognetive level**
CO1	Relate to the structural organizations of algae, fungi, lichens and Bryophytes.	PSO1, PSO3	R, U
CO2	Demonstrate both the theoretical and practical knowledge in Understanding the diversity of basic life forms and the importance.	PSO4, PSO3	U
CO3	Explain life cycle patterns in algae, fungi, lichens and Bryophytes.	PSO1, PSO3	U
CO4	Compare and contrast the mode of reproduction in diverse groups of Basic plant forms.	PSO1, PSO5	U
CO5	Discuss and develop skills for effective conservation and utilization Of lower plant forms.	PSO1, PSO5	R,U

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Recommended texts:

1. Kumar,H.D.1999. Introductory Phycology.Affiliated East-WestPress,Delhi.
2. Barsanti, L. and Guadtieri, P. 2014. Algae: Anatomy, Biochemistry and Biotechnology,2nd Edition,CRC Press,ISBN:1439867321.
3. Sharma,O.P.2011.Fungi and Allied Microorganisms, Mc Graw Hill, ISBN:9780070700383,0070700389
4. Kevin.K.2018.Fungi biology and Application,3rdEdition,WileyBlackwell.
5. Pandey,P.B.2014.College Botany-1: Including Algae, Fungi, Lichens, Bacteria,Viruses, Plant Pathology, Industrial Microbiology and Bryophyta. Chand Publishing,New Delhi.

6. Singh,PandeyandJain.2020.AtextbookofBotany,5thEdition,Rastogi Publication, Meerut.
7 .Sharma,O.P.2014.Bryophyta, Mc graw Hill,ISBN: 9781259062872,1259062872

Reference Books:

1. Sundaralingam,V.1991.Marine algae. Bishen Singh and Mahendra Pal Singh Publishers, Dehradun.
2. Edwardlee,R.2018.Phycology,5thEd.,CambridgeUniversityPress,London.
3. Nash,T.H.2008.Lichen Biology, Cambridge University press.
4. Johri, R.M., Lata, S. and Tyagi, K. 2012. A Textbook of Bryophyta. Dominant Publishers & Distributors Pvt., Ltd., New Delhi.ISBN:9789384207335.
5. Alexopoulos,C.J.andMims,M.2007. Introductory Mycology. 4th Edition, Wiley Publishers, ISBN:9780471522294

Web resources:

1. https://www.britannica.com/science/algae
2. https://en.wikipedia.org/wiki/Bryophyte
3. https://www.britannica.com/plant/bryophyte/Ecology-and-habits
4. https://www.livescience.com/53618-fungus.html.
5. http://www.uobabylon.edu.iq/eprints/paper_11_20160_754.pdf
6. https://www.youtube.com/watch?v=vcYPI6y-Udo
7. https://www.youtube.com/watch?v=XQ_ZY57MY64
8. http://www-plb.ucdavis.edu/courses/bis/1c/text/Chapter22nf.pdf

Mapping with Programme Outcomes:

COs	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	3	2	3	2	1	2	2	2	2
CO2	3	3	2	2	3	3	2	3	2	3
CO3	2	2	3	3	1	2	1	3	1	3
CO4	3	3	3	3	3	2	3	3	3	3
CO5	3	3	2	3	2	3	3	3	3	3

S-Strong(3) **M-Medium(2)** **L-Low(1)**

(For Candidates admitted from the academic year 2023 onwards)
HOLY CROSS COLLEGE(AUTONOMOUS) TIRUCHIRAPPALLI–2
SCHOOL OF LIFE SCIENCES
PG AND RESEARCH DEPARTMENT OF BOTANY
CHOICE BASED CREDIT SYSTEM

M.Sc .BOTANY
First Year–Semester-I

Course Title	**PLANT DIVERSITY- II (PTERIDOPHYTES, GYMNOSPERMS AND PALEOBOTANY**)
Total Hours	**75**
Hours/Week	5Hrs/**Wk**
Code	**P23BO1CCT02**
Course Type	**Theory**
Credits	**3**
Marks	**100**

GENERAL OBJECTIVE

To enable the students to understand various forms, classification, distinguishing traits, geographic distribution, phylogeny, reproductive cycle and economic importance of Pteridophytes and Gymnosperms.

COURSE OBJECTIVES

The learner will be able to

CO.No.	Course Objectives
CO-1	To investigate the classification, distinctive traits, distribution and reproduction and life history of the various classes and major types of Pteridophytes and Gymnosperms.
CO-2	To identify and characterize diversity of lower vascular plants in order to comprehend The dynamics of diversity to Realize the importance Of diversity.
CO-3	To research the classification, phylogeny and economic importance of Pteridophytes and Gymnosperms.

CO-4	To study and understand the phylogeny and Paleontology of Pteridophytes and Gymnosperms.
CO-5	To learn about the concept of fossils and process of fossilization; distinctive characteristics of fossil records of Pteridophytes and Gymnosperms.

Unit I: PTERIDOPHYTES (15hrs)

General characteristics and classification (Reimer, 1954). Range of structure, reproduction and evolution of the gametophytes, Gametophyte types – sex organs. Apogamy and Apospory. Life cycles. Stellar evolution. Heterospory and seed habit, Telome theory, morphogenesis, Economic importance of Pteridophytes.

Extra reading/Keywords:*Paleontology,carbon dating*

Unit II: PTERIDOPHYTES (15hrs)

Structure, anatomy, reproduction and life histories of the following genera: *Isoetes, Equisetum Angiopteris, Osmunda, Pteris* and *Azolla.*

Extra reading/ Keywords: *Siphonogamy ,fossil pteridophytes*

Unit III: GYMNOSPERMS (15hrs)

General characters - A general account of distribution of Gymnosperms. Morphology, anatomy, reproduction, phylogeny and classification (K.R.Sporne,1965). Economic importance of Gymnosperms.

Extra reading/Keywords:*Paleozoicovules,Geological timescale*

Unit IV : GYMNOSPERMS (15hrs)

Structure (Exomorphic and endomorphic), anatomy, reproductionand life histories of the following genera: *Thuja ,Cupressus, Araucaria, Podocarpus, Gnetum* and *Ephedra*.

Extra reading/Keywords: *Zamia,Living fossils*

Unit V: PALEOBOTANY (15hrs)

Geological Scale; Radiocarbon dating; Contribution of Birbal Sahni to Paleobotany. Gondwana flora of India. Study of fossils in understanding evolution. Fossilization and fossil types. Economic importance of fossils – fossil fuels and industrial raw materials and uses. Study of organ genera: *Rhynia, Lepidocarpon, Calamites, Cordaites* and *Lyginopteris.*

Extra reading/Keywords: *filmy ferns,Simpson's paradox.*

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

Course Outcomes:	On completion of this course the student will be able to	PSOs Addressed	Cognitive level
CO1	Recall on classification, recent trends in phylogenetic relationship, General characters of Pteridophytes and Gymnosperms.	PSO1, PSO3	R, U
CO2	Learn the morphological / anatomical organization, life history of major types of Pteridophytes and Gymnosperms.	PSO4, PSO3	U
CO3	Comprehend the economic importance of Pteridophytes, Gymnosperms, and fossils.	PSO1, PSO3	U
CO4	Understanding the evolutionary relationship of Pteridophytes and Gymnosperms.	PSO1, PSO5	U
CO5	Awareness on fossil types, fossilization and fossil records of Pteridophytes and Gymnosperms.	PSO1, PSO5	R,U

Recommended Text:

1.Vashishta,P.C.Sinha,A.KandAnilKumar.2016.Botany for Degree students. Gymnosperms. S. Chand and Company Ltd., New Delhi.

2. Singh, V., Pande, P.Cand Jain, D.K.2021.A Text Book of Botany. Rastogi Publications, Meerut.

3. Bhatnagar,S.PandAlokMoitra.2020.Gymnosperms,NewAgeInternational(P)Ltd.,Publishers, Bengaluru.

4. Sharma, O.P.2017.Pteridophyta,McGrawHillEducation,NewYork.

5. Vashishta.P.C.,A.K.Sinhaand Anil Kumar.2018.Botany for Degree students- Gymnosperms .S.Chand and Company Ltd.,New Delhi.

6. Johri, R.M, Lata,S, Tyagi,K. 2005 .A Textbook of Gymnosperms, Dominate pub and Distributer, New Delhi.

Reference books:

1. Parihar,N.S.2019.An Introduction to Embryophyta Pteridophytes.5th Edition,Surjeet Publication,Delhi.
2. Pandey,S.NandTrivedi,P.S.2015.A Text Book of Botany Vol.II-12th edition (Paperback), Vikas Publishing.
3. Rashid,A.2013.An introduction to Pteridophyta–Diversity, Development and differentiation (2nd edition), Vikas Publications.
4. ArnoldA.C. 2005. An Introduction to Paleobotany.Agrobios(India).Jodhpur.
5. Sporne,K.R.2017.The morphology of Pteridophytes (The structure of Ferns and Allied Plants) (Paper back), Andesite Press.
6. Sporne, K.R. 1967.TheMorphologyofGymnosperms.Hutchinson&Co., London.
7. Taylor,E,Taylor,T,Krings,M.2008.Paleobotany:TheBiologyandEvolutionofFossilPlants,2nd Edition,AcademicPress.

Web resources:

1. https://www.toppr.com/guides/biology/plant-kingdom/pteridophytes/
2. http://www.bsienvis.nic.in/Database/Pteridophytes-in-India_23432.aspx
3.https://books.google.co.in/books?hl=en&lr=&id=Pn7CAAAQBAJ&oi=fnd&pg=PA1&dq=Introduction+to+Gymnosperms&ots=sfYSzCL02&sig=ysX1KRvetV0bAza4Sq6RWau4XU8&redir

_esc=y#v=onepage&q=Introduction%20to%20Gymnosperms&f=false
4.https://books.google.co.in/books/about/Botany_for_Degree_Gymnosperm_Multicolor.html?id=HTdFYFNxnWQC&redir_esc=y
5. https://books.google.co.in/books/about/Gymnosperms.html?id=4dvyNckni8wC
6.https://arboretum.harvard.edu/wp-content/uploads/2013-70-4-beyond-pine-cones-an-introduction-to-gymnosperms.pdf
6. https://www.palaeontologyonline.com/
7. https://books.google.co.in/books/about/Paleobotany.html?id=HzYUAQAAIAAJ
8. https://trove.nla.gov.au/work/11471742?q&versionId=46695996

Mapping with Programme Outcomes:

COs	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3	3	3	3	3	3
CO2	3	3	3	3	3	3	3	3	3	3
CO3	2	3	3	3	3	1	3	3	3	3
CO4	3	3	2	3	3	3	3	2	3	2
CO5	3	2	2	2	2	2	2	1	2	1

S-Strong(3) **M-Medium(2)** **L-Low(1)**

(For Candidates admitted from the academic year 2023 onwards)
HOLY CROSS COLLEGE (AUTONOMOUS) TIRUCHIRAPPALLI–2
SCHOOL OF LIFE SCIENCES
PG AND RESEARCH DEPARTMENT OF BOTANY
CHOICE BASED CREDIT SYSTEM

M.Sc.BOTANY
First Year–Semester- I

Course Title	PLANT EMBRYOLOGY, MORPHOGENESIS AND ANATOMY
Total Hours	75
Hours/Week	5 hrs/wk
Code	P23BO1CCT03
Course Type	Theory
Credits	3
Marks	100

GENERAL OBJECTIVE

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

COURSE OBJECTIVES

The learner will be able to

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

UNIT – I Embryology: 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/Keywords:*Palynology, Deceptive pollinator*

UNIT–II: **Embryology:** **15hrs**

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 andsignificance.

Extra reading/Keywords: *Apomeiosis, Stenospermocarpy*

UNIT–III: Morphogenesis: 15hrs

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

Extra reading/Keywords: *Modelling plant growth, architecture*

UNIT–IV: Plant Anatomy: 15hrs

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. Role of Cambium in budding and grafting.

Extrareading/Keywords:*Periodicity,Phytophages*

UNIT–V PlantAnatomy: **15hrs**

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 (*Shorearobust*a).

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

Note: Texts given in the Extra reading/ Keywords 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 structure and functions of pollen grains	PSO 2	An
CO-2	Discuss the methods used to overcome sexual incompatibility	PSO 2	An
CO-3	Describe the various types of endosperm and embryo	PSO 2	An
CO-4	Discuss the basics of genesis of various tissues	PSO 4	U
CO-5	Explain the role of nucleus and cells in differentiation	PSO 4	R,U
CO-6	Explain the apical organization of root and stem	PSO 2	R,U
CO-7	Compare the basic organization of xylem and phloem	PSO 2	An,U
CO-8	Relate the structure and function of wood	PSO2,PSO4	R,U

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

Books for References:

Embryology

1. Maheswari,P.1963.Recent Advances in the Embryology of Angiosperms, Catholic Press, Ranchi.
2. Shivanna, K.R.andRangasamy, N.S.1993. PollenBiology–A Laboratory Manual. Narosa Publishing House, New Delhi.
3. Varghese,T.M.An Introduction to experimental and applied embryology of Angiosperma. Oxford and IBH PublishingCo.,New Delhi.
4. Bhojwani, S.S. Bhatnagar, S.P. and Dantu, P.K. 2015. The Embryology of Angiosperms (6th revised and enlarged edition). Vikas Publishing House,New Delhi.

Morphogenesis

5.ElizabethG.Cutter.1966.TrendsinPlantMorphogeneiss Longmans ,GreenandCo.Ltd.London.

6.Sinnott,E.W.1960.PlantMorphogenesis.McGraw–HillBookCompany,INC.,NewYork.

7. Žárský,V.(Ed),Cvrčková,F.(Ed)(2014).

Plant Parthenogenesis.

1. ElizabethG.Cutter,1979.PlantAnatomy.TheEnglishLanguageBook Society,andEdwardArnoldPublishersLtd.London.
2. KatherineEsau, 1972.PlantAnatomy.WileyEasternPrivateLimited,New Delhi.
3. Varghese,T.M.AnIntroductiontotheAnatomyofAngiosperms.AlliedPublishers,
4. RichardCrang,Lyons,ShielsandRobert2018.Plant Anatomy – A Concept-Based Approach to the Structure of Seed Plants, Springer.
5. Biondi, F. 2010.Tree-ring Analysis of Environmental Change: Principle And Applications Of Dendrochronology. Springer ; 1edition.
6.Richard Crang, Sheila Lyons-Sobaski, Robert Wise , 2018. Plant Anatomy: A Concept-Based Approach to the Structure of Seed Plants, Springer 1st edn, Kindle Edition.

Mapping with Programme Outcomes:

COs	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3	3	3	3	3	3
CO2	3	3	3	3	3	3	3	3	3	3
CO3	2	3	3	3	3	1	3	3	3	3
CO4	3	3	2	3	3	3	3	2	3	2
CO5	3	2	2	2	2	2	2	1	2	1

S-Strong(3)

(For Candidates admitted from the academic year 2023 onwards)
HOLY CROSS COLLEGE (AUTONOMOUS) TIRUCHIRAPPALLI–2
SCHOOL OF LIFE SCIENCES
PG AND RESEARCH DEPARTMENT OF BOTANY
CHOICE BASED CREDIT SYSTEM

M.Sc. BOTANY
First Year–Semester- I

Course Title	**MAJOR CORE III–PRACTICAL PAPER - I**
Total Hours	**90**
Hours/Week	**6 hrs/wk**
Code	**P23BO1CCP04**
Course Type	**Practical**
Credits	**4**
Marks	**100**

GENERAL OBJECTIVE

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

COURSE OBJECTIVES

The learner will beableto

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.

Unit I: Algae **18hrs**

Morphological and anatomical characterial features of *Oscillatoria Scytonema,Ulva, Codium, Diatoms, Dictyota, Gelidium and Padina* ,

Unit II: Fungi **18hrs**

Morphological characterial features of *Plasmodiophora, Phytophthora, Rhizopus, Taphrina, Polyporous, Colletotrichum, Phyllochora, Erysiphe, Phyllachora, Cercospora,*

Alternaria and Cyathus

Lichens- Morphological and reproductive structures of the genera *Parmelia*

Bryophytes- Thallus morphology and anatomy of *Targionia, Notothylas, Pogonatum*

Unit III: **18hrs**

. **Pteridophytes:** *Lepidodendron* (stem genus), *Isoetes, Gleichenia* and *Salvinia. Equisetum and Azolla Fossil slides observation: Lepidocarpon, Calamites.*

Gymnosperms : *Cupressus , Araucaria, Podocarpus, Gnetum* and *Ephedra*. Fossil slides observation*: Cordaites* and *Lyginopteris*

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

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

UnitV: **18hrs**

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

COURSE OUTCOMES(CO)

The Learners will be able to

CONo.	Course Outcomes	PSOs Addressed	Cognitive Level
CO-1	Examine, dissect out, identify, draw, and explain the structure of important algal forms	PSO2	R,U,An
CO-2	Examine, dissect out, identify, draw, and explain the structure of important fungal forms	PSO2	R,U,An
CO-3	Categorize , identify ,draw and explain the plant disease.	PSO2	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	PSO2	R,U
CO-7	Examine the effect of growth substances on pollen germination, tube growth and viability.	PSO2	R,U

Recommended Text:

1. Kumar ,H.D.1999. Introductory Phycology. Affiliated East-West Press,Delhi.
2. Das, SandSaha, R .2020. Microbiology Practical Manual. CBS Publishers and Distributors (P) Ltd., New Delhi,India.
3. Sharma, O.P.2012.Pteridophyta,TataMcGraw-HillsLtd,New Delhi.
4. SharmaO.P and S, Dixit. 2002.Gymnosperms. Pragati Prakashan.

5. Johri, R.M ,Lata,S,Tyagi,K.2005. A text book of Gymnosperms, Dominate pub and Distributer, New Delhi.

Reference Books

1. Chmielewski, J.G and Krayesky,D. 2013. General Botany laboratory Manual. Author House, Bloomington,USA.
2. Webster,JandWeber,R.2007.IntroductiontoFungi,3rdEd.CambridgeUniversityPress,Cambr idge.
3. Sharma,O.P.2017.Bryophyta ,Mac Millan India Ltd, New Delhi.
4. Ashok, M. Bendre and Kumar. 2010. A text book of Practical Botany, Algae, Fungi, Lichen, Bryophyta, Pteridophyta, Gymnosperms and Palaeobotany .Revised edition.Published by Rakesh Kumar Rastogi publication.
5. Gangulee,H.CandA.K.Kar. 2013.College Botany.VthEdition. S.Chand.

Web References

1. https://www.frontiersin.org/articles/10.3389/fmicb.2017.00923/full
2. https://microbiologyonline.org/file/7926d7789d8a2f7b2075109f68c3175e.pdf
3. http://www.cuteri.eu/microbiologia/manuale_microbiologia_pratica.pdf
4. https://www.amazon.in/Manual-Practical-Bryophyta-Suresh-Kumar/dp/B0072GNFX4
5. https://www.amazon.in/Practical-Manual-Pteridophyta-Rajan-Sundara/dp/8126106883
6. https://www.google.co.in/books/edition/Gymnosperms/3YrT5E3Erm8C?hl=en&gbpv=1&dq=gymnosperms&printsec=frontcover
7. https://www.amazon.in/Paleobotany-Biology-Evolution-Fossil-Plants/dp/0123739721

MappingwithProgrammeOutcomes:

Cos	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	2	3	3	3	3	3	3	3	3	3
CO2	3	3	2	3	3	3	1	3	1	3
CO3	3	3	3	3	3	3	2	3	2	3
CO4	3	3	2	1	2	2	1	2	1	3
CO5	3	3	3	3	3	3	3	2	3	2

S-Strong(3) M-Medium(2) L-Low(1)

(For Candidates admitted from the academic year 2023 onwards)

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

M.Sc.BOTANY

First Year–Semester- I

Course Title	**ELECTIVE -1 CONSERVATION OF NATURAL RESOURCES AND POLICIES**
Total Hours	**60**
Hours/Week	**4 hrs/wk**
Code	**P23BO1ECT01**
Course Type	**Theory**
Credits	**3**
Marks	**100**

GENERAL OBJECTIVE

To create awareness of environmental problems and their consequences.

COURSE OBJECTIVES

The learner will be able to

CO.No.	**Course Objectives**
CO-1	To create awareness of environmental problems and their consequences.
CO-2	To explain the term natural resources.
CO-3	To describe the reasons for degradation of natural resources and suggest measures to prevent these.
CO-4	To list the various endangered species of animals and plants.
CO-5	To state the various environmental laws passed to conserve the natural resources.

Unitl: Natural resources 12hrs

Definition – Importance – Classification – Human physiological socio-economic and cultural development – Human Population Explosion – Natural Resource Degradation – Concept of conservation – Value system – Equitable resource use for sustainable life system.

Extra Reading/Key words: Renewable and Non renewable resources, *modern demographic transition, natural restoration, ecosystem sustenance*

Unit II: Forest resources 12hrs

Forest cover in India and the World – Importance – Desertification – Forest Wealth – Afforestation – Vanasamrakshna Samithi– Agroforestry – Social Forestry – Joint Forest Management Strategy for Forest Conservation. Wild Life: Resources – Importance – Benefits – Wild life Extinction – Causes for Extinction – List of Endanger species in India and in the World – Ecological approach in wild life management – Eco Tourism – Wild Life projects in India – Sanctuaries and National Parks In India – Man and Bio sphere Programme.

Extra Reading/Key words: Intricate terrestrial ecosystems, genetic variability, species diversity, biological diversity, ecological integrity

Unit III: Land and soil resources 12hrs

Soil, Complexity of soil nature, regional deposits, Land use and capability classification systems, Land use Planning models and their limitations. Impacts of natural and man-made activities on land characteristics and land use planning– Soil Erosion – Loss of Soil Nutrients – Restoration of Soil Fertility – Soil Conservation Methods and Strategies in India. Wet Land Conservation and Management – Ecological Importance of wet lands in India – Conservation Strategy and ecological Importance. Water Resources: Rivers and Lakes In India – Water Conservation and ground water level increase - Watershed Programme.

Extra Reading/Key words: calcareous soil, vegetation and crop land management, leaching

Unit IV: Mineral resources 12hrs

Use and exploitation – Environmental effects of extracting and using mineral resources – Restoration of mining lands – Expansion of supplies by substitution and conservation. Food Resources: World Food Problems – Changes caused by agriculture – overgrazing effects of modern agriculture – Fertilizer-Pesticide problems – Water Logging – Salinity – Sustainable agriculture, life stock breeding and farming.

Extra Reading/Key words: metallic ores, geophysical survey, food security, fortification heritability,

Unit V: Environmental policy in India 12hrs

Need for policies- Public Policy – Economic policies – Relationship between economic development and environment – Implementing Environmental Public Policy Strategies in pollution control – Constitutional provisions in India regarding environment – Public Awareness and Participation in Environmental Management – National Land Use Policy 1988 – Industrial Policy 1991.

Extra Reading/Key words: Environmental Assessment (EA), Community Advisory Board, Human Health Risk Assessment, High Pollution Advistory, Environmental Monitoring

RSE OUTCOMES(CO)

The Learners will be able to

CONo.	Course Outcomes	PSOs Addressed	Cognitive Level

CO-1	Examine, dissect out, identify, draw, and explain the structure of important algal forms	PSO2	R,U,An
CO-2	Examine, dissect out, identify, draw, and explain the structure of important fungal forms	PSO2	R,U,An
CO-3	Categorize , identify ,draw and explain the plant disease.	PSO2	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

Recommended Text :

1. Trivedi R.K.1994. Environment and Natural Resources Conservation.
2. Murthy J.V.S.1994. Watershed Management in India.
3. Raymond, F Dasmann. 1984. Environmental Conservation, John Wiley.
4. Nalini, K.S. 1993. Environmental Resources and Management, Anmol Publishers, New Delhi.
5. Shyam Divan and Armin Rosencranz. 2001. Environmental Law and Policy in India, Oxford Uni.Press.

Reference Books:

1. Haue, R and Freed V.H. 1975. Environmental Dynamics of Pesticides, Menum Press, London
2. Singh, B. 1992. Social Forestry for Rural Development, Anmol Publishers, New Delhi.
3. Shafi. R. 1992. Forest Ecosystem of the World.
4. Stacy Keach. 2016. Natural Resources Management. Syrawood Publishing House.
5. Rathor B.S. 2013. Management of Natural Resource for Sustainable Development. Daya Publishing House, New Delhi.

Web resources:

1. https://www.amazon.in/conservation-natural-resources-Gifford-Pinchot-ebook/dp/B07HX76TVN
2. https://books.google.co.in/books/about/Natural_Resource_Conservation_and_Enviro.html?id=T2SRuhxpUW8C&redir_esc=y
3. https://www.kobo.com/ww/en/ebook/natural-resources-conservation-law
4. https://www.scribd.com/book/552185119/Natural-Resources-Conservation-and-Advances-for-Sustainability
5. https://www.scribd.com/document/354699536/Conservation-of-Natural-Resources

Mapping with Programme Outcomes:

Cos	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3	3	3	3	3	3
CO2	3	3	3	3	3	3	3	3	3	3

CO3	2	3	3	3	3	1	3	3	3	3
CO4	3	3	2	3	3	3	3	2	3	2
CO5	3	2	2	2	2	2	2	1	2	1

S-Strong(3) **M-Medium(2)** **L-Low(1)**

(For Candidates admitted from the academic year 2023 onwards)

HOLY CROSS COLLEGE(AUTONOMOUS) TIRUCHIRAPPALLI–2

SCHOOL OF LIFE SCIENCES

PG AND RESEARCH DEPARTMENT OF BOTANY

CHOICE BASED CREDIT SYSTEM

M.Sc. BOTANY

First Year–Semester- I

Course Title	**ELECTIVE I- PHYTOPHARMACOGNOSY**
Total Hours	**60**
Hours/Week	**4 hrs/wk**
Code	**P23BO1ECT02**
Course Type	**Theory**
Credits	**3**
Marks	**100**

GENERAL OBJECTIVE:

Students should aware of traditional use of plant derived drugs in world.

COURSE OBJECTIVES

The learner will be able to

CO.No.	Course Objectives
CO-1	To learn the traditional knowledge on plant derived drugs and their conventional classification.

CO-2	To elucidate the biosynthetic pathway of major classes of secondary metabolites.
CO-3	To study the general pharmacological mode of action of crude drugs of few medicinal plants.
CO-4	To elucidate the isolation and characterization of plant derived drugs using modern bio techniques.
CO-5	Knowledge on pharmacological action of drugs.
CO-6	To learn the traditional knowledge on plant derived drugs and their conventional classification.

Unit I **12hrs**

General introduction – History and scope of Pharmacognosy including indigenous system of medicine. Various systems of classification of drugs. Pharmacological action of plant drugs. Significance of Pharmacopoeial standards.

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

Unit II **12hrs**

Morphological and Microscopical Biosynthetic pathway of secondary metabolites: Acetate pathway (fatty acids and polyketides), mevalonate and deoxyxylulose phosphate pathway (terpenoids and steroids),shikimate pathway (phenols, amino acids etc.).

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

Unit III **12hrs**

Characterization of Therapeutic drugs: Extraction, separation, isolation (Chromatographic techniques) and characterization of secondary metabolites (Spectroscopic techniques). Quality control of plant drugs: Classical and modern approaches of drugs. Significance of Pharmacopoeial standards.

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

Unit IV **12hrs**

Pharmacological action of Plant Drugs: Anti-cancer, Bitter tonic, Carminatives and G.I. regulators, Cardiotonics, CNS-Stimulant, Expectorant, Laxatives, Purgatives. Outline of pharmacogenomics functions.

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

Unit V **12hrs**

Hallucinogenic, allergenic and other toxic plants, poisonous plants - bio pesticides -biocides – bio fungicides

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

Course outcomes: **CO**	**On completion of this course the student will be able to**	**Programme outcomes**	**Cognitive level**

CO1	Review on the traditional knowledge and classification of plant derived drugs.	PSO4, PSO3	K1
CO2	Knowledge on biosynthetic pathway of different classes of plant metabolites.	PSO1, PSO3	K2
CO3	Knowledge on modern instrumentation on characterization of plant metabolites.	PSO1, PSO5	K3, K6
CO4	Discuss various aspects of Pharmacological action of herbal drugs.	PSO1, PSO5	K4 K5
CO5	Understanding medical and non-medical potential of plant derived in various sectors.	PSO1, PSO3	K6

Recommended Text:

1. Dewick P.M., 2002. Medicinal Natural Products: A biosynthetic approach, John Wiley &Sons Ltd.
2. Evans W.C., 2002, Trease and Evan's Pharmacognosy, W.B. Saunders.
3. Harborne, J.B., 1998. Phytochemical Methods, Chapman and Hall.
4. Harborne, J.B., 1998. Phytochemical Methods, Chapman and Hall.

Vickery M.L. and B. Vickery, 1981. Secondary Plant Metabolism, The MacMillan PressLtd.

Reference books:

1. Bruneton, J. 1999. Pharmacognosy, Phytochemistry, Medicinal Plants, Intercept Ltd., Paris.
2. Evans W.C. 2002, Trease and Evan's Pharmacognosy, W.B. Saunders.
3. Harborne, J.B. 1998. Phytochemical Methods, Chapman and Hall.
4. Vickery M.L and B. Vickery, 1981. Secondary Plant Metabolism, The MacMillan PressLtd.

Wagner H., S. Bladt and E.M. Zgainski (Translated by A. Scott) 1984, Plant Drug Analysis, Springer-Verlag.

Web resources:

1. https://pharmabookbank.files.wordpress.com/2019/03/14.2.pharmacognosy-by-biren-shahavinash-seth-1.pdf
2. https://www.pdfdrive.com/pharmacognosy-books.html
3. https://www.amazon.in/Textbook-Pharmacognosy-Phytochemistry-Kumar-Jayaveera-ebook/dp/B06XKSY76H
4. https://www.amazon.in/Pharmacognosy-Dr-C-K-Kokate-ebook/dp/B07JHNNMWB
5. https://www.amazon.in/EXPERIMENTAL-PHYTOPHARMACOGNOSY-Comprehensive-Guide-Khadabadi-ebook/dp/B07ZFMYQK8

Mapping with Programme Outcomes:

Cos	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3	3	2	1	2	1
CO2	3	2	3	3	3	2	2	1	2	1
CO3	3	2	3	3	3	3	2	2	3	2
CO4	3	2	2	3	3	3	3	2	3	2
CO5	3	2	2	3	3	3	3	2	3	2

S-Strong (3) M-Medium (2) L-Low(1)

(For Candidates admitted from the academic year 2023 onwards)

HOLY CROSS COLLEGE (AUTONOMOUS) TIRUCHIRAPPALLI–2

SCHOOL OF LIFE SCIENCES

PG AND RESEARCH DEPARTMENT OF BOTANY

CHOICE BASED CREDIT SYSTEM

M.Sc., BOTANY

First Year–Semester- I

Course Title	ELECTIVE II- HERBAL TECHNOLOGY
Total Hours	60
Hours/Week	4 hrs/wk
Code	P23BO1ECT03
Course Type	Theory
Credits	3
Marks	100

ERAL OBJECTIVE

To understand the importance of herbal technology.

RSE OBJECTIVES

The learner will be able to

CO.No.	Course Objectives
CO-1	To understand various plants based drugs used in ayurvedha, unani, homeopathy, siddha etc.
CO-2	To apply the knowledge to cultivate medical plants.
CO-3	To know the pharmacological importance of medicinal plants.
CO-4	To enlist phytochemical and secondary metabolites of market and commercial value.
CO-5	To design and develop their own business prepositions such as the in the making of herbal insecticides.

Unit I: **Pharmacognosy** **12hrs**

Pharmacognosy scope and importance - source - Crude Drugs – Scope and Importance, Classification (Taxonomical, Morphological Chemical, Pharmacological); Cultivation, Collection and processing of crude drugs. Cultivation and utilization of medicinal and aromatic plants in India.

Extra Reading/Key words: Eclectic medicine, Aroma therapy**,** Aetheroleum, Pharmacopoeia, Kampo

Unit II - Plant tissue culture as source of medicines **12hrs**

Plant tissue culture as source of medicines, Role of plant tissue culture in enhancing secondary metabolite production (*Withania somnifera, Rauwolfia serpentina, Catheranthus roseus, Andrographis paniculata* and *Dioscorea sp*) - Elicitation - Biotransformation, Hairy root culture. Factors affecting secondary metabolites production. Biogenesis of phytopharmaceuticals.

Extra Reading/Key words: *Plant metabolomics, drug Quality control, active pharmaceutical ingredient*

Unit III - Plant propagation analysis of phytochemicals **12hrs**

Methods of Drug evaluation (Morphological, microscopic, physical and chemical). Phytochemical investigations – standardization and quality control of herbal drugs. Preliminary screening, Assay of Drugs - Biological evaluation/assays, Microbiological methods - Chemical Methods of Analysis, Detection of Adulterants: Chemical estimations, Spectrophotometry and fluorescence analysis. Drug adulteration - Types of adulterants.

Extra Reading/Key words: *Food safety act, IFOAM*

Unit IV - General methods of phytochemical and biological screening **12hrs**

Carbohydrates and derived products: Glycosides - extraction methods (*Digitalis, Dioscorea*); Tannins (Hydrolysable and Condensed types); Volatile oils - extraction methods (Clove, Mentha). Study of some herbal formulation techniques as drug cosmetics.

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

Unit V: Types of phytochemicals **12hrs**

Alkaloids - extraction methods (*Taxus, Cinchona*); Flavonoids- extraction methods, Resins- extraction method: Application of phytochemicals in phytopharmacueticals; Biocides, Biofungicides, Biopesticides. Women entrepreneurship development – marketing cultivated medicinal plants – National Medicinal Plants Board of India.

Extra Reading/**Key words:**NMPB,Ayush

Course outcomes: CO	**On completion of this course, the students will be able to:**	**Programme outcomes**	**Cognitive level**
CO1	Recollect the importance of herbal technology.	PSO4, PSO3	K1
CO2	Understand the classification of crude drugs from various botanical sources.	PSO1, PSO3	K2
CO3	Analyze on the application of secondary metabolites in modern medicine.	PSO1, PSO5	K3
CO4	Create new drug formulations using therapeutically valuable phytochemical compounds for the healthy life of society.	PSO1, PSO5	K4
CO5	Comprehend the current trade status and role of medicinal plants in socio economic growth.	PSO1, PSO3	K5 & K6

Recommended Text

1. Kokate, C.K., Purohit, A.P and S.B. Gokhale. 1996. Pharmacognosy. NiraliPrakashan, 4th Ed.
2. Roseline, A. 2011. Pharmacognosy. MJP publishers, Chennai.
3. Tilgner, Sharol Marie. 2018. Herbal ABC's: The Foundation of Herbal Medicine.
4. Natural Products in medicine: A Biosynthetic approach. 1997. Wiley. Hornok, L. (ed.).
5. Chichister, U.K.J. 1999. Cultivation and Processing of Medicinal Plants, Wiley & Sons. Treaseand Evans.
6. Mukherjee, P.K. 2008. Quality control of herbal drugs. 3rd edition. Business Horizons Pharmaceutical Publishers, New Delhi, India.
7. Kirthikar and Basu. 2012. Indian Medicinal Plants. University Bookstore, Delhi. India
8. Biswas, P.K. 2006. Encyclopedia of Medicinal plants (Vol. I-VII). Dominant Publishers, New Delhi.
9. Tilgner, Sharol Marie. 2018. Herbal ABC's: The Foundation of Herbal Medicine.
10. Chaudhuri, A.B. 2007. Endangered Medicinal Plants. Daya Publishing House, New Delhi

Reference Books:

1. Lewis, W.H and M.P.F. Elwin Lewis. 1976. Medical Botany. Plants affecting Man's Health. A Wiley Inter Science Publication. John Wiley and Sons, New York.
2. Wallis, T.E. 1999. Text book of Pharmacognosy. CBS Publishers and Distributors, New Delhi.
3. Kumaresan, V and Annie Regland. 2004. Taxonomy of Angiosperms systematic Botany, Economic Botany, Botany &Ethnobotany.
4. Anonymous, 2004. Cultivation of Selected Medicinal Plants. National MedicinalPlants Board, Govt. of India, New Delhi.
5. Vallabh. 2000. Practical Pharmacognosy, Kolkata. New Delhi.
6. Acharya Vipul Rao. 2000. Herbal cure for common diseases. Diamond books, Pvt. Ltd.
7. Dey, A.C. 1998. Indian medicinal plants used in Ayurvedic preparations, Bishen Singh Mahendra Pal Singh.
8. Sathya, S., Jaiganesh, K.P and Sudha, T. 2019. Current Trends in Herbal Drug Technology. Pharmacy Council of India New Delhi.

Web resources:

1. https://www.kopykitab.com/Herbal-Science
2. https://kadampa.org/books/free-ebook-download-howtotyl?gclid=CjwKCAiA6vXwBRBKEiwAYE7iS5t8yenurClUCTdV9olKo9TbyAh4fsoFqPYWGs5qBTbytD22z7lo0BoCYnUQAvD_BwE
3. https://www.barnesandnoble.com/b/free-ebooks/nook-books/alternative-medicine-natural-healing/herbal-medicine/_/N-ry0Z8qaZ11iu
4. http://cms.herbalgram.org/heg/volume8/07July/HerbalEBooks.html?t=1310004932&ts=1579066352&signature=1dd0d5aef818b19bcdcd6c063a78e404
5. https://www.dattanibookagency.com/books-herbs-science.html
6. https://www.springer.com/gp/book/9783540791157

Mapping with Programme Outcomes:

Cos	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5

CO1	3	3	3	3	3	3	3	2	1	3
CO2	3	3	3	3	3	3	3	1	3	3
CO3	3	3	3	3	3	3	3	2	3	3
CO4	3	3	3	3	3	3	3	1	3	3
CO5	3	3	3	3	3	3	3	1	2	3

S-Strong (3) M-Medium (2) L-Low(1)

(For Candidates admitted from the academic year 2023 onwards)

HOLY CROSS COLLEGE (AUTONOMOUS) TIRUCHIRAPPALLI–2
SCHOOL OF LIFE SCIENCES
PG AND RESEARCH DEPARTMENT OFBOTANY
CHOICE BASED CREDIT SYSTEM

M.Sc.BOTANY

First Year–Semester- I

Course Title	**ELECTIVE II- HORTICULTURE**
Total Hours	**60**
Hours/Week	**4 hrs/wk**
Code	**P23BO1ECT04**
Course Type	**Theory**
Credits	**3**
Marks	**100**

GENERAL OBJECTIVE

Students should know fundamental knowledge on horticulture applications.

COURSE OBJECTIVES

The learner will be able to

CO. No.	**Course Objectives**
CO-1	Know about the brief history, divisions, classification and structure of horticultural plants.

CO-2	Acquire knowledge on plant growth processes and stages of plant growth.
CO-3	Understand the plant growth environment in relation to soil, nutrients, fertilizers, and bio inoculants.
CO-4	Study the sexual and vegetative propagation methods including propagation through specialized vegetative structures.
CO-5	Develop practical skills in micro propagation techniques and soil-less production of horticultural crops.

Unit I: Introduction to Horticulture **12hrs**

Definition; Brief History, Divisions of Horticulture, Classification of horticultural plants, Structure of Horticultural Plants – Cell and Tissue systems, Anatomy of stem root and leaf, Morphological structures, Plant growth processes-A brief account of Photosynthesis, Respiration, Transpiration and Translocation, Stages of plant growth.

Extra Reading/**Key words:** *Pomology, olericulture*

Unit II: Factors affecting plant growth **12hrs**

Plant Growth Environment: Abiotic factors, Soil –Profile structure, Primary and Secondary nutrients and their functions, Organic matter, Fertilizers –organic, Inorganic and Potting Media, Bio inoculants, Methods of fertilizer application, Directing Plant growth-Training -Pruning and thinning.

Extra Reading/**Key words:** *Dappled shade, slow release fertilizers.*

Unit III: Plant propagation **12hrs**

Plant propagation: Seeds –Advantages, Viability, Mechanism of Dormancy and Dormancy Breaking: Methods of Direct and Indirect Seedling Production in Nurseries and Transplantation; Propagation through specialized underground structures –Corm, Tuber, Sucker, Bulb, Bulbil, Rhizome; Vegetative Propagation –Cutting, Layering, Grafting and Budding.

Extra Reading/**Key words:** *Microclimate, mulching*

Unit IV: Micropropagation techniques **12hrs**

Stages, multiplication by shoot tip, Nodal culture and Callus culture - Application and Limitations, Somatic embryogenesis, Synthetic seeds –Preparation and Potential uses of artificial seeds, Embryo Rescue, Soil - less Production of Horticultural crops –Hydroponics, sand culture, gravel culture.

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

Unit V: Aesthetics of horticulture **12hrs**

Design: Elements and Principles of Design, Flower Arrangement, Terrarium Culture, Bonsai, Growing Plants Indoors, Turf Production, Landscaping - Principles, Types of Parks, Xeriscaping. Postharvest handling of Horticultural Products – Harvesting, Storage, Processing, Elements of Marketing. Robotics in Horticulture.

Extra Reading/**Key words:** *Gamma garden, somatic hybridization*

Course outcomes:	**On completion of this course, the students will be able to:**	**Programme Outcomes**	**Cognitive level**
CO -1	Identify and categorize various horticultural plants an conditions that affect their growth and productivity.	PSO4, PSO3	K1
CO2	Explain the various structures and growth processes of horticultural plants.	PSO1, PSO3	K2

CO3	Demonstrate the propagation, growth, and maintenance of Plants in horticulture systems.	PSO1, PSO5	K3
CO4	Correlate the soil characteristics and fertility to good plant growth.	PSO1, PSO5	K4
CO5	Utilize the role plant tissue culture techniques in the production of quality planting stock in horticulture.	PSO1, PSO3	K5

Recommended Text:

1. Acquaah, G. 2011.Horticulture: Principles and Practices. (4th ed), Pearson Education, London, UK.
2. Janik, J. 1972. Horticultural Science. W.H. Freeman & Company, San Francisco.
3. Kumar, N. 1994. Introduction to Horticulture, Rajalakshmi Publication, India.
4. Manibhushan Rao, K. 2005. Text Book of Horticulture. (2nd ed), Macmillan India Ltd., New Delhi.
5. Schilletter, J. C. and Richey, H. W. 2005. Text Book of general Horticulture. 2nd ed. Biotech Books, Delhi.
6. Sharma, R.R. 2016. Propagation of horticultural crops. Kalyani Publishers, New Delhi.
   Subba Rao, N.S. 1997. Biofertilizers in Agriculture and Forestry. India Book House Limited, Oxford and IBH publishing Co. Pvt. Ltd, New Delhi.

Reference Books:

1. Acquaah, G. 2002. Horticulture Principles and Practices. 2nd ed. Pearson Education (Singapore) Pvt. Ltd.
2. Ashman, M.A. and Puri, G. 2002. Essential soil science-A clear and concise introduction to soil science. Blackwell scientific publishers, London.
3. Denisen, E.L. 1979. Principles of Horticulture. MacMillan Publishing co, Inc. New York.
4. Dirr, M. and Heuser, C.W. 2009. The Reference Manual of Woody Plant Propagation: From Seed to Tissue Culture. Timber Press, Oregon, USA.
5. Thomson, L.M. and Troen, F.R. 1975. Soils and soil fertility Tata, McGraw Hill Publication Co. Ltd. New Delhi.
6. Tolanus, S. 2006. Soil fertility, Fertilizer and Integrated Nutrient management. CBS Publication, Delhi, India.

Web resources:

1. https://www.kobo.com/in/en/ebooks/horticulture
2. https://www.gale.com/gardening-and-horticulture
3. https://www.iaritoppers.com/p/horticulture-icar-ecourse-pdf-books.html
4. https://www.amazon.in/Introduction-Horticulture-N-Kumar-ebook/dp/B08M4289M6
5. https://www.researchgate.net/publication/316438576_Polyembryony_in_Horticulture_and_its_significance

Mapping with Programme Outcomes:

Cos	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3	3	3	3	3	3
CO2	2	1	3	3	3	3	3	3	3	2
CO3	3	1	3	3	3	3	3	2	3	3
CO4	3	3	3	1	1	2	2	3	1	3
CO5	3	3	3	3	3	3	2	3	3	2

S-Strong (3) M-Medium (2) L-Low(1)

(For Candidates admitted from the academic year 2023-24 onwards)
I M.Sc.,BOTANY – Semester II

Course Title	**CC-V- GENETICS, PLANT BREEDING AND BIOSTATISTICS**
Total Hours	**75**
Hours/Week	**5Hrs./Wk**
Code	**P23BO2CCT05**
Course Type	**Theory**
Credits	**4**
Marks	**100**

General Objectives:

To enable the students to understand gene interaction, regulation of gene action, population genetics and plant breeding techniques for crop improvement and acquire knowledge on collection and presentation of data, measures of central location, variability, probability, correlation, regression and test of significance in biostatistics.

Course Objectives:

The learner will be able to

CO. No.	Course Objectives
CO-1	To understand the laws of inheritance, genetic basis of loci and alleles and their linkage.
CO-2	To develop critical understanding of chemical basis of genes and their interactions at population and evolutionary levels.
CO-3	To familiarize with genetic basis of heterosis and reflect the role of various methods used in crop improvement.
CO-4	To solve the problems quantitatively using appropriate arithmetical, algebraic, or statistical methods.
CO-5	To analyze the methods of studying probability, correlation & regression and apply the test of significance and analysis of variance.

UNIT – I GENETICS: 15 Hrs.

Mendel's Law of inheritance. Gene interactions- allelic and non-allelic. Sex determination in plants. Sex linked characters. Structure of gene. Regulation of gene expression in prokaryotes – role of operators, repressors, co- repressors and inducers. Operon concept – lac and trp operon. Regulation of gene in eukaryotes. Regulation of gene expression in *Arabidopsis* flower. Quantitative inheritance. Recombination: Homologous and non-homologous recombination, site-specific

recombination. Population genetics: - Hardy – Weinberg's principle & application.

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

UNIT – II GENETICS: **15 Hrs.**

Gene mapping methods**:** Linkage maps, tetrad analysis, mapping with molecular markers, mapping by using somatic cell hybrids. Extra chromosomal inheritance. Organelle genomes- Organization and functions of chloroplast and mitochondrial DNA. Mutation types- Point and frame shift mutation- addition, deletion, substitution, transition and transversion. DNA damage and repair mechanisms (photoreactivation, excision repair and recombination repair & mismatch repair).

Extra reading/Key words: *cytoplasmic inheritance in haploid, diploid organisms*

UNIT–III PLANT BREEDING: **15 Hrs.**

Scope and Objectives of plant breeding, Principles and techniques in plant breeding. Selection methods- mass selection, clonal selection and pure line selection. Genetic basis of breeding self and cross – pollinated crops. Hybridization techniques. Genetics and physiological basis of heterosis. Types of Polyploidy.

Extra reading/Key words: *adaptation, assortative mating*

UNIT–IV BIOSTATISTICS: **15 Hrs.**

Introduction. 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–V BIOSTATISTICS: **15 Hrs.**

Probability – Basic concepts. Measure of probability: addition, multiplication & conditional probabilities. Theoretical distribution: Binomial, Poisson & normal distributions. Correlation : Types, methods of studying correlation, rank correlation. Regression : Types of regression, methods of studying regression.Tests of significance: Large samples, tests of significance of small samples (t-test), chi – square test. Analysis of variance : ANOVA One-way analysis.

Extra reading/Key words: *R- analysis, permutation and combination*

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

Course Outcomes:

The Learner will be able to

Course outcomes:	**On completion of this course, the students will be able to:**	**Programme outcomes**
CO-1	Understand the Mendal's Law of inheritance and gene interactions.	K1
CO-2	Analyze the various factors determining the heredity from one generation to another and explain gene mapping methods: Linkage maps.	K2
CO-3	Compare and contrast the genetic basis of breeding self and cross – pollinated crops.	K3

CO-4	Discuss and develop skills for statistical analysis of biological problems.	K4
CO-5	Compare and apply the different theories of Probability and Explain the procedure for test of significance.	K5

(K1-Remeber, K2-Understand, K3-Apply, K4-Analyze, K5-Evaluate)

Recommended Text:

1. Benjamin, A. Pierce. 2012. Genetics- A conceptual Approach. W.H. Freeman and Company, New York, England.
2. Stansfield, W.D. 1969. Theory and problems of Genetics. McGraw-Hill
3. Sinnott, E.W.Dunn, L.E and Dobzhansky, T. 1973. Principles of Genetics. McGraw-Hill. New York.
4. Singh, B.D. 2013. Plant Breeding: Principles and Methods, Kalyani Publishers, New Delhi
5. Singh, P. 2017. Fundamentals of Plant Breeding, Kalyani Publishers.
6. Chaudhary, R.C. 2017. Introductory principles of plant breeding, Oxford IBH Publishers, New Delhi.
7. Gupta, P.K. 2009. Genetics. Rastogi publications, Meerut, New Delhi.
8. Gupta, S.C. 2013. Fundamentals of statistics, Himalaya Publishers, Mumbai.
9. Kothari, C.R and Garg, G. 2014. Research methodology –Method and techniques. New Age International (P) Ltd. New Delhi.

Reference Books:

1. Watson, J.D. *et al.* 2003. Molecular Biology of the Gene. Fourth Edition. The Benjamin Cummings Pub. Co.
2. Lewin, B. 2003. Genes VIII. Oxford University Press.
3. Friefelder, D. 2005. Molecular Biology. Second Edition. Narosa Pub. House.
4. Sobtir.C. and Gobe. 1991. Eukaryotic chromosomes. Narosa Publishing house.
5. Smith-Keary, P. 1991. Molecular Genetics. Macmillan Pub. Co. Ltd. London.

Web Resourses:

1. https://www.cdc.gov/genomics/about/basics.htm
2. https://ocw.mit.edu/courses/biology/7-03-genetics-fall-2004/lecture-notes/
3. http://galaxy.ustc.edu.cn:30803/zhangwen/Biostatistics/Fundamentals+of +Biostatistics+8th+edition.pdf
4. https://www.britannica.com/science/evolution-scientific-theory

Mapping with Programme Outcomes:

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	3	1	1	3	2	1	2	2	2
CO2	3	3	2	2	3	3	2	3	3
CO3	2	2	3	3	1	3	1	3	1
CO4	3	3	3	3	3	2	3	3	3
CO5	3	3	2	3	2	3	3	3	2

S-Strong (3) M-Medium (2) L-Low(1)

PSO-CO Mapping

CO/PSO	PSO1	PSO2	PSO3
CO1	3	1	3
CO2	3	2	2
CO3	2	3	3

CO4	3	3	3
CO5	3	2	3

(For Candidates admitted from the academic year 2023-24 onwards)
I M.Sc., BOTANY SEMESTER II

Course Title	**CORE COURSE VI - GENERAL MICROBIOLOGY AND IMMUNOLOGY**
Total Hours	**60**
Hours/Week	**4 Hrs. /wk**
Code	**P23B02CCT06**
Course Type	**Theory**
Credits	**3**
Marks	**100**

General objectives:

It enables the students to learn about the basic knowledge on general microbiology and immunology concepts with considerable emphasis on the etiology of specific diseases. It also imparts the acquaintance on main classes of microbes which has direct inter-relationship between man and the environment.

Course Objectives:

The learner will be able to

CO No.	Course Objectives
CO -1	To provide basic understanding of general microbiology, immunology and the role of immune system in conferring disease resistance.
CO -2	To provide comprehensive knowledge about microbes and its effect on man and environment.
CO -3	To provide comparative analysis of major groups of microbes.
CO -4	To study the principles of immune system, immunizing agents like antibodies and vaccines and gene therapy methods.
CO -5	To enhance the knowledge and skills needed for self-employment using the microbial derived products.

UNIT- I BACTERIOLOGY: 12 Hrs.

Outline classification of Bergey's manual of 9th edition. Types of microorganisms. Classification of bacteria based on Morphological, cultural, physiological and molecular characteristics. Bacterial Growth curve. Nutritional types. Reproduction - Fission and sporulation. Cultivation of aerobic and anaerobic bacteria. Maintenance of bacterial culture (Short term & long term). Staining techniques – simple, differential (Gram staining and acid fast staining), Special staining (negative, endospore staining and flagella staining). Sterilization techniques

Extra Reading /Key Words*:* *Haemocytometer; Inoculation*

UNIT-II VIROLOGY: 12 Hrs.

General characters, Classification, Structure and Multiplication. Overview of Phycoviruses and Myco viruses. Viruses of Eukaryotes – Plant viruses. Multiplication of viruses – in embryonated egg and in plants. Bacteriophages- classification, Lytic and Lysogenic cycle-replication of DNA and RNA phages. Viroids and prions. Genetic recombination-Transformation, Transduction and Conjugation.

Extra Reading /Key Words*:* *RNA Viruses; Animal virus*

UNIT-III FOOD MICROBIOLOGY: 12 Hrs.

Normal microflora of fruits, vegetables, eggs, poultry and meats. Food poisoning (botulism) and food borne infection (Salmonellosis). Pasteurization methods. Test for the quality of milk. Microorganisms in the production of milk products (yogurt, butter &

cheese). Industrial production of vinegar. Food Preservation – temperature, drying (freeze drying), radiation and chemicals.

Extra Reading /Key Words*:* *Endolysins; Enterobacteriaceae*

UNIT-IV ENVIRONMENTAL MICROBIOLOGY: 12 Hrs.

Microbiology of Soil: Importance of Microbial flora of soil and factors affecting the microbial community in soil. Interaction among soil microbes: Positive interaction - mutualism; Negative interaction – parasitism. Microbial interaction with higher plants (rhizosphere & phyllosphere).

Microbiology of water and air: Assay for drinking water (MPN tests) & purification of water. Water borne diseases - typhoid. Aeromicroflora – sources and types. Air borne bacterial diseases -Tuberculosis.

Extra Reading /Key Words*:* *Actinomycetes; Aspergillosis; Coliform bacteria*

UNIT-V IMMUNOLOGY: 12 Hrs.

Types of Immunity - Innate and Acquired. Immune Response – Humoral and Cell Mediated. Immune Cells - Hematopoiesis, B and T lymphocytes - Maturation, NK cells. Antibody – Structure, types and function. Types of antigen. Antigen - Antibody interactions: Precipitation, Agglutination, Complement fixation. Immunodiagnosis – Blood Grouping, Widal test, Enzyme-Linked Immunosorbent Assay (ELISA),

Extra Reading /Key Words*:* *Dendritic cells; Immuno-blotting*

Course Outcomes (CO): The Learner will be able to

CO No.	Course Outcomes	Programme outcomes
CO-1	Recognize the general characteristics of microbes, plant defense and immune cells.	K1
CO-2	Explain about the stages in disease development and various defense mechanisms in plants and humans.	K2
CO-3	Elucidate concepts of microbial interactions with plant and humans.	K3
CO-4	Analyze the importance of harmful and beneficial microbes and immune system	K4
CO-5	Determine and interpret the detection of pathogens and appreciate their adaptive strategies.	K5

(K1-Remeber, K2-Understand, K3-Apply, K4-Analyze, K5-Evaluate)

References Text Books:

1. Dube, H.C. 2010. A text Book of Fungi, Bacteria and Viruses, 3rd Edition, Agrobios India, ISBN: 8188826383.
2. Vaman Rao, C. 2006. Immunology. 2nd Edition. Narosa Publisher.
3. Kenneth, M. 2017. Janeway's Immunobiology. 9th Edition. Garland Publisher.

Reference Books:

1. Jeffery, C., Pommerville. 2014. Alcamos Fundalmedals of Microbiology. 10th Edition. Johnsand Bartlett Learning.
2. Pelczar, M. J. 2007. Microbiology. 35th Edition, Tata-McGraw Hill Publications, New York, ISBN: 0074623260.
3. Willie, J. and Sherwood, L. 2016. Prescott's Microbiology McGraw-Hill Education; 10th Edition, ISBN: 978-1259281594

Web Resources:

1. https://www.elsevier.com/life-sciences/immunology-and-microbiology/books
2. https://www.amazon.in/INTRODUCTION-IMMUNOLOGY-RAFIA-IMRAN- ebook/dp/B09B66SD3J

Mapping with Programme Outcomes:

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	3	3	3	3	3	3	3	2	3
CO2	3	3	2	2	3	3	2	1	2
CO3	3	3	3	3	3	3	1	3	1
CO4	3	3	2	2	3	3	2	1	2
CO5	3	3	3	3	3	3	3	2	3

PSO-CO Mapping

CO/PSO	PSO 1	PSO2	PSO3
CO 1	3	3	3
CO2	2	3	2
CO3	2	3	3
CO4	3	2	3
CO5	3	3	2

H-High (3) M-Moderate (2) L-Low (1)

(For Candidates admitted from the academic year 2023-24 onwards)
I M.Sc.,BOTANY – Semester II

Course Title	**CC-VII- ECOLOGY, PHYTOGEOGRAPHY AND INTELLECTUAL PROPERTY RIGHTS**
Total Hours	**60**
Hours/Week	**4Hrs./Wk**
Code	**P23BO2CCT07**
Course Type	**Theory**
Credits	3
Marks	**100**

General Objectives:

To enable the students to understand the environmental factors impacting biodiversity. The crucial importance of the environmental awareness and to understand and follow how laws are structured and interpreted.

Course Objectives :

The learner will be able to

CO. No.	Course Objectives
CO-1	To analyze and comprehend the fundamental ideas of plant ecology as a scientific study of environment.
CO-2	To study the plant communities and plant succession stages.
CO-3	To be aware of the causes, impacts and control measures of pollution. .
CO-4	To study biodiversity management and conservation.
CO-5	To enhance the knowledge of the students about IPR components and to save natural resources by applying the laws and regulations through copyrights and patenting.

UNIT – I ECOLOGICAL PRINCIPLES: 12 Hrs.

Introduction – History, scope, concepts. Diversity of plant life; growth form, life form. Basic concepts of population ecology– population dynamics – Regulation of population density. Basics concepts of community– characteristics, composition, structure, origin and development–community dynamics–trends of succession.

Extra reading/Key words: *Hypothetical population, Natality rate*

UNIT–II ECOSYSTEM ECOLOGY 12 Hrs.

Introduction – kinds – major types – functional aspects of ecosystem: Food chain and food web,energy flow, laws of thermodynamics. Integrated study of Biotic and Abiotic components of eco sytem. Productivity–primary and secondary productivity –GPP&BPP.

Extra reading/Key words: *Functional biosphere, Ecosystem bioprocesser*

UNIT–III RESOURCE ECOLOGY 12 Hrs.

Soil: Formation, types and profile-erosion and conservation,Water resources– conservation and management. Energy resources; renewable and non-renewable.

Environment Deterioration: Climate change -Green house effect and global warming, ozone depletion and acid rain. Waste management - Solid and e-waste, recycling of wastes. Eco-restoration/remediation ecological foot prints - carbon foot print – eco labeling -

environmental auditing.

Extra reading/Key words*:* *Green space creation, Restoration period*

UNIT–IV PHYTOGEOGRAPHY **12 Hrs.**

Phytogeographical Zones - Vegetation types of India and Tamil Nadu, Distribution: Continuous, Discontinuous and Endemism. Theories of discontinuous distribution: Continental drift, Age and area hypothesis. Geographical Information System (GIS) Principles of remote sensing and its applications.

Extra reading/Key words: *Adaptation, Assortative mating*

UNIT–V INTELLECTUAL PROPERTY RIGHTS: **12 Hrs.**

Intellectual Property Rights – Introduction, Kinds of Intellectual Property Rights- Patents, Trademarks, Copyrights, Trade Secrets.Advantages and Disadvantages of IPR. International Regime Relating to IPR – TRIPS, WIPO, WTO, GATTS. IPR in India genesis and development. Geographical Indication – introduction, types. Patent filing procedure for ordinary application.

Extra reading/Key words: *Resemblence analysis, permutation and combination*

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

Course Outcomes:

The Learner will be able to

Course outcomes:	**On completion of this course, the students will be able to:**	**Programme outcomes**
CO-1	Understand the scope and importance of population ecology, plant communities and ecosystem ecology.	K1& K2
CO-2	Understand the applied aspect of environmental botany.	K1&K4
CO-3	Students will spot the sources and pollution and seek remedies to mitigate and rectify them.	K2
CO-4	Identify different plant communities, categorize plant biomes and identify threatened, endangered plant species and create awareness program in protection of biodiversity.	K3
CO-5	Analyze insight into the components of IPR and its categories to avail patent and other copyright.	K5

(K1-Remeber, K2-Understand, K3-Apply, K4-Analyze, K5-Evaluate)

Recommended Text:

1. Sharma, P.D. 2017. Ecology and Environment- Rastogi Publication, Meerut.
2. Pushpa Dahiya and Manisha Ahlawat. 2013. Environmental Science- A New Approach, Narosa Pub. House, New Delhi.pp.2.1-2.60.
3. Eugene Odum, 2017. Fundamentals of Ecology 5th Ed. Cengage, Bengaluru.
4. Sharma P.D. 2019. Plant ecology and phytogeography, Rastogi Publications, Meerut.
5. Neeraj Nachiketa. 2018 Environmental & Ecology A Dynamic approach. 2nd Edition GKP Access Publishing.
6. Chandra, A.M and Ghosh, S.K. 2010. Remote sensing and Geographical Information System, Narosa Publishing House Pvt. Ltd. New Delhi.

Reference Books:

1. Keddy, P.A. 2017. Plant Ecology: Origins, processes, consequences. 2nd ed. Cambridge

2. University Press. ISBN. 978-1107114234.
3. Krishnamurthy, K.V. 2004. An Advanced Text Book of Biodiversity- Principles and
4. Practices. Oxford and IBH Publications Co. Pvt. Ltd. New Delhi.
5. Ahuja, V.K. 2017. Law relating to Intellectual Property Rights. India, IN: Lexis Nexis.
6. Nithyananda, K.V. 2019. Intellectual Property Rights: Protection and Management. India, IN: Cengage Learning India Private Limited.
7. Venkataraman M. 2015. An introduction to Intellectual property rights. Create space Independent Pub.North Charleston, USA.
8. Kormondy, E.J. 2017. Concepts of Ecology. Prentice Hall, U.S.A. 4th edition.

Gillson, L. 2015. Biodiversity Conservation and Environmental Change, Oxford University Press, Oxford.

Web Resourses:

1. https://www.intechopen.com/chapters/56171
2. https://plato.stanford.edu/entries/biodiversity/
3. https://sciencing.com/four-types-biodiversity-8714.html.
4. https://www.iaea.org/topics/plant-biodiversity-and-genetic-resources
5. http://www.bsienvis.nic.in/Database/Status_of_Plant_Diversity_in_India_17566.aspx
6. https://www.youtube.com/watch?v=qtTLiQoYTyQ

Mapping with Programme Outcomes:

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	3	3	3	3	2	3	2	1	2
CO2	3	3	2	3	3	2	3	3	2
CO3	3	2	3	2	2	3	1	1	2
CO4	3	3	2	3	3	2	2	3	1
CO5	3	3	3	3	3	3	3	3	3

S-Strong (3) M-Medium (2) L-Low(1)

PSO-CO Mapping

CO/PSO	PSO1	PSO2	PSO3
CO1	3	1	3
CO2	3	2	2
CO3	2	3	3
CO4	3	3	3
CO5	3	2	3
CO6	3	2	3

(For Candidates admitted from the academic year 2023-24 onwards)

I M.Sc., BOTANY – Semester II

Course Title	**CC-VIII- PRACTICAL -II**
Total Hours	**60**
Hours/Week	**4Hrs./Wk**
Code	**P23BO2CCP08**
Course Type	**Practical**
Credits	3
Marks	**100**

General Objectives:

To enable the students to understand the environmental factors impacting biodiversity. The crucial importance of the environmental awareness and to understand and follow how laws are structured and interpreted.

Course Objectives :

The learner will be able to

CO. No.	Course Objectives
CO-1	To analyze and comprehend the fundamental ideas of plant ecology as a scientific study of environment.
CO-2	To study the plant communities and plant succession stages..
CO-3	To be aware of the causes, impacts and control measures of pollution. .
CO-4	To study biodiversity management and conservation.
CO-5	To enhance the knowledge of the students and equip them in evaluate and protecting invaluable components of nature and interactions with the environment.

Unit I: Genetics 12Hrs.

Problem solving on dihybrid phenotypic, genotypic and test cross ratios. Incomplete dominance & Co-Dominance allele. Lethal alleles. Interactions of factors- Complementary & Duplicate factor. Epistasis- Dominant & Recessive. Multiple gene.

Unit-II Genetics, Plant breeding and Biostatistics 12Hrs.

Analysis of linkage, Chromosome mapping from three point test cross data, Percentage of crossing over. Determination of gene sequence and map distances.

Plant breeding- Techniques in plant hybridization.

Biostatistics- Presentation of Data,Standard deviation,Correlation,Regression,t-test and Chi-square test.

UNIT–III General Microbiology and Immunology 12 Hrs.

Preparation of serial dilution, Isolation , 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. Immuno agglutination reaction – Blood grouping.

Extra reading/Key words: *adaptation, assortative mating*

UNIT–IV Ecology 12 Hrs.

1.Determination of the quantitative characters of a plant community by random quadrat method (abundance, density, dominance, species diversity, frequency) in grazing land, forests.

2.Estimation of above ground and below ground biomass in a grazing land employing minimum size of quadrat.

3.To determine soil moisture, porosity and water holding capacity of soil collected from varying depth at different locations.

4.Determination of pH of soil and water by universal indicator (or) pH meter.
5.Determination of dissolved oxygen.
6.Estimation of carbonate.Estimation of bicarbonate.

UNIT–V Phytogeography and Intellectual property rights 12 Hrs.

1.Mapping of world vegetation
2.Mapping of Indian vegetation.
3.Remote sensing – Analyzing and interpretation of Satellite photographs- Vegetation/ weather.
4.Visit to remote sensing laboratory (Regional Meteorological Centre at Bharathidasan University,Trichy).
5.Preparation of patent filling procedure for ordinary application.

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

Course Outcomes:

The Learner will be able to

Course outcomes:	**On completion of this course, the students will be able to:**	**Programme outcomes**
CO-1	Understand the scope and importance of population ecology, plant communities and ecosystem ecology.	K1 & K2
CO-2	Understand the applied aspect of environmental botany.	K1 & K4
CO-3	Students will spot the sources and pollution and seek remedies to mitigate and rectify them.	K2
CO-4	Identify different plant communities, categorize plant biomes and identify threatened, endangered plant species and create awareness program in protection of biodiversity.	K3
CO-5	Analyze insight into the vegetation types, species interaction and their importance and the factors influencing the environmental conditions	K5

Recommended Text:

1. Sharma, P.D. 2017. Ecology and Environment- Rastogi Publication, Meerut.
2. Pushpa Dahiya and Manisha Ahlawat. 2013. Environmental Science- A New Approach, Narosa Pub. House, New Delhi.pp.2.1-2.60.
3. Eugene Odum, 2017. Fundamentals of Ecology 5th Ed. Cengage, Bengaluru.
4. Sharma P.D. 2019. Plant ecology and phytogeography, Rastogi Publications, Meerut.
5. Neeraj Nachiketa. 2018 Environmental & Ecology A Dynamic approach. 2nd Edition GKP Access Publishing.
6. Chandra, A.M and Ghosh, S.K. 2010. Remote sensing and Geographical Information System, Narosa Publishing House Pvt. Ltd. New Delhi.

Reference Books:

1. Keddy, P.A. 2017. Plant Ecology: Origins, processes, consequences. 2nd ed. Cambridge
2. University Press. ISBN. 978-1107114234.
3. Krishnamurthy, K.V. 2004. An Advanced Text Book of Biodiversity- Principles and
4. Practices. Oxford and IBH Publications Co. Pvt. Ltd. New Delhi.
5. Ahuja, V.K. 2017. Law relating to Intellectual Property Rights. India, IN: Lexis Nexis.
6. Nithyananda, K.V. 2019. Intellectual Property Rights: Protection and Management. India, IN: Cengage Learning India Private Limited.
7. Venkataraman M. 2015. An introduction to Intellectual property rights. Create space

Independent Pub.North Charleston, USA.
8. Kormondy, E.J. 2017. Concepts of Ecology. Prentice Hall, U.S.A. 4th edition.
9. Gillson, L. 2015. Biodiversity Conservation and Environmental Change, Oxford University Press, Oxford.

Web Resourses:

1. https://www.intechopen.com/chapters/56171
2. https://plato.stanford.edu/entries/biodiversity/
3. https://sciencing.com/four-types-biodiversity- 8714.html.
4. https://www.iaea.org/topics/plant-biodiversity-and-genetic-resources
5. http://www.bsienvis.nic.in/Database/Status_of_Plant_Diversity_in_India_17566.asp
6. https://www.youtube.com/watch?v=qtTLiQoYTyQ

Mapping with Programme Outcomes:

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	3	3	3	3	2	3	2	1	2
CO2	3	3	2	3	3	2	3	3	2
CO3	3	2	3	2	2	3	1	1	2
CO4	3	3	2	3	3	2	2	3	1
CO5	3	3	3	3	3	3	3	3	3

S-Strong (3) M-Medium (2) L-Low(1)

PSO-CO Mapping

CO/PSO	PSO1	PSO2	PSO3
CO1	3	1	3
CO2	3	2	2
CO3	2	3	3
CO4	3	3	3
CO5	3	2	3

(For Candidates admitted from the academic year 2023-24 onwards)

I M.Sc., BOTANY - Semester II

Course Title	**ELECTIVE III - RESEARCH METHODOLOGY**
Total Hours	**60**
Hours/Week	**4 Hrs. /wk**
Code	**P23BO2ECT05**
Course Type	**Theory**
Credits	**3**
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 histo chemistry
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: 12 Hrs.

Construction, working principles of Bright & Dark Field, Phase Contrast, Fluorescent, Electron (TEM,SEM & STEM) and Confocal microscopy. Micrometry. Histochemistry of starch, total proteins, lipids.

Extra Reading /Key Words*: Antioxidant, Apoptosis, structure of Nanopartilces*

UNIT - II Preparation of material for light & electron microscopy: 12 Hrs.

Fixing. Types of fixatives & fixations of sample for light microscopy. Processing of materials (dehydration,clearing, infiltration & embedding). Preparation of material for TEM & SEM. Principles of staining, double staining and mounting of materials for hand sections. Microtomy, types (Rotary, Ultra & Cryo microtome) and their applications.

Extra Reading/Key Words: *Staining, processing of DNA samples*

UNIT–III Instrumentation for qualitative & quantitative analysis of biomolecules: 12Hrs. Principle, components and applications of pH meters and preparation of buffers. Colorimeter & Spectrophotometer – principle, laws of absorption of light- uses. Principles of biophysical methods used for the analysis of biopolymer structure- XRD (X-ray Diffraction), ORD (optical rotary dispersion) /CD (Circular dichroism), NMR (nuclear magnetic resonance) & ESR (electronspin resonance) spectroscopy. Centrifugation-Principle and types.

Extra Reading /Key Words: *Applications of UV-Vis Spectroscopy , FT-IR.*

UNIT- IV Separation and Tracer Techniques: 12Hrs.

Principles and uses of Chromatography with reference to Gel Filtration, Ion exchange, Gas & High Performance Liquid Chromatography. Principles & uses of Atomic Absorption Spectroscopy. Electrophoresis – principles, types – paper & gel electrophoresis (Agarose, SDS- PAGE), operation and their applications. Radio isotopes - nature of radioactivity - type of radiations. 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: 12Hrs.

.Problem selection-preliminary survey of literature for the topic selected-project design-experimental plan for given duration. Structure, components and compilation of project report, Plagiarism and Software, Preparation of scientific manuscript, Manuscript for publication and proof correction, Indexed Journals in Life Sciences – Scopus, Web of Sciences. UGC care list of journals. Impact factor of Journals, Ethical issues related to publishing papers.

Extra Reading / Key Words*: i10 index, H index*

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

COURSE OUTCOMES (CO)

The Learner will be able to

Course outcomes:	**On completion of this course, the students will be able to:**	**Programme outcomes**
CO-1	Outline the construction and application of different types of microscope	K1 & K2
CO-2	Explain the techniques of histo chemistry, centrifuges and chromatography and their uses in research	K2 & K3
CO-3	Compare and contrast the different types of electrophoresis and techniques used to trace, quantify the radioisotopes	K5
CO-4	Explain the principle and construction of the instruments used for the qualitative and quantitative of biopolymers	K3 & K4
CO-5	Develop the Employability skills by learning the application of various instruments and their function with the principle applied in research field.	K4 & K5

(K1-Remeber, K2-Understand, K3-Apply, K4-Analyze, K5-Evaluate)

Prescribed Text books

1. Baidyanath Mishra, 2018. Research Methodology, Chaukhambha Orientalia publication
2. Gurumani, N. 2011 Research Methodology : For Biological Sciences**,** MJP Publisher
3. Avinash Updhayay, Kakoli Updhayay and Nirmalendu Nath. 1998. Biophysical chemistry –Principles and techniques. Himalaya Publishing House, Mumbai.
4. Dr.N.Arumugam, 2015. Research Methodology for Life Sciences.Sara's Publication.

Books for References

1. Shirish C. and Ashok T. 2009. An introduction to Research. Cambridge University Press, India Pvt. Ltd. New Delhi.
2. Wilson K. & Walker J. 1994. Practical biochemistry. 4th edition, Cambridge University,London.
3. Gahan P.B.1984. Plant histochemistry & cytochemistry – An introduction. Academic Press, London.
4. Krishnamurthy, K.V. 1988. Methods in Plant Histochemistry.Viswanathan Publishers,Madras.
5. Saravanavel P. 1985 Research report writing. Emerald Publishers, Madras.

Mapping with Programme Outcomes:

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	3	2	2	2	3	3	3	1	3
CO2	3	2	2	3	3	3	3	2	3
CO3	3	1	2	3	3	3	3	1	3
CO4	3	2	1	3	3	3	2	1	3
CO5	3	1	2	2	3	3	3	2	3

S-Strong (3) M-Medium (2) L-Low(1)

PSO-CO Mapping

CO/PSO	PSO 1	PSO2	PSO3
CO 1	3	3	3
CO2	2	3	2
CO3	2	3	3
CO4	3	2	3
CO5	3	3	2

H-High M-Moderate L-Low

(For Candidates admitted from the academic year 2023-24 onwards)

I M.Sc., BOTANY Semester II

Course Title	**ELECTIVE III – PHYTOCHEMISTRY**
Total Hours	**60**
Hours/Week	**4 Hrs. /wk**
Code	**P23BO2ECT06**
Course Type	**Theory**
Credits	**3**
Marks	**100**

GENERAL OBJECTIVE

To enable the students to learn the application of different phytochemicals to cure diseases in human and animals, biosynthetic isolation of different phytochemicals using the state of the art techniques, to understand the information of the traditional system of medicine.

COURSE OBJECTIVES

The learner will be able to

CO. No.	Course Objectives
CO-1	To comprehend the various classes of phytochemicals present in the plant kingdom**.**
CO-2	To understand the biosynthetic processes through which diverse phytochemicals are synthesized and to study their structural and functional characteristics**.**
CO-3	To learn about the isolation of different phytochemicals using the state-of-the art techniques**.**
CO-4	To learn about the application of different phytochemicals to cure diseases in human andanimals**.**
CO-5	To understand the information of the traditional system of medicine.

UNIT – I Secondary Metabolites And Classification 12Hrs.

Phytochemistry: Definition, history, principles. Secondary metabolites: definition, classification, occurrence and distribution in plants, functions, chemical constituents. Alkaloids, terpenoids, flavonoids, steroids, and coumarins.

Extra Reading /Key Words*: Antioxidant, Chemotaxonomy*

UNIT – II Isolation and quantification of phytochemicals 12Hrs.

Techniques for isolation of medicinally important biomolecules: solvent extraction, chemical separations, steam distillation, soxhlet extraction. Purification, concentration, determination and quantification of compounds (TLC, Column, HPLC). Characterization of phytochemicals: spectroscopic methods

Extra Reading/Key Words: *GC,Ion exchange chromatography*

UNIT–III Biosynthetic pathways of secondary compounds: 12Hrs.

Biosynthetic pathways of secondary compounds: Shikimic pathway; Mevalonic Acid Pathway;Pathways for commercially important phytochemicals: Taxol and *Vinca* alkaloids. Applications of phytochemicals in medicine, pharmaceuticals, food, flavour and cosmetic industries

Extra Reading /Key Words: *Spectrophotometry,Spectrofluorimetry*

UNIT- IV Herbalism and ethnobotany 12Hrs.

Herbs and healing: Historical perspectives: local, national and global level; Herbal cultures: origin and development of human civilizations; Ethnobotany and Ethno medicine;Development of European, South and Central American, African, Indian, Chinese, and South East Asian Herbal Cultures.

Extra Reading/Key Words: *Dietary Phytochemicals,Nutraceuticals*

UNIT-V Traditional system of medicine **12 Hrs.**

Classical health traditions: Systems of medicine: origin and development of biomedicine; Indian Systems of Medicine (Ayurveda, Siddha, Unani, Tibetan, Yoga and Naturopathy) Ayurveda: Historical perspective, *Athuravritta* (disease management and treatment which involves eight specialties including Internal medicine and surgery); Fundamental principles of Ayurveda: Panchabhootha theory, Thridosha theory, Saptadhatu theory and *Mala* theory; Ayurvedic Pharmacology AyurvedicPharmacopoeia; *Vrikshayurveda.*

Extra Reading / Key Words*:* *Traditional Japanese and Adaptation of Chinese medicine*

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

Course outcomes:	On completion of this course, the students will be able to:	Programme outcomes
CO-1	Understand the role of plants in the survival of human beings and other Organisms.	K1 & K2
CO-2	Recognition of the contribution made by primitive people in exploration of plant knowledge to alleviate common diseases and development of systems of medicine.	K2 & K3
CO-3	contrast the different types of lectrophoresis and techniques used to trace, quantify the adioisotopes	K5
CO-4	Demonstrate the various aspects of extraction, isolation and characterization of secondary metabolites.	K3 & K4
CO-5	Know the methods of screening of secondary metabolites for various biological properties.	K4 & K5

(K1-Remeber, K2-Understand, K3-Apply, K4-Analyze, K5-Evaluate)

Prescribed Text books

1.Kokate, C.K., Purohit, A.P and Gokhale, S.B. 2010. Pharmacognosy. Vol. I & II. Nirali Prakashan, Pune.

2.Mohamed Ali. 2012. Textbook of Pharmacognosy. CBS Publishers & Distributors Pvt. Ltd., New Delhi.

3.Gokhale, S.B., Kokate, C.K. and Gokhale, A. 2016. Pharmacognosy of Traditional Drugs. NiraliPrakashan, 1st Edition. ISBN: 9351642062. 2.

4.Joshi, S.G. 2018. Medicinal Plants. Oxford & IBH Publishing C., Pvt., Ltd., New Delhi.

Kumar, N. 2018. A Textbook of Pharmacognosy. Aitbs Publishers, India.

Books for References

1.Shah, B.N. 2005. Textbook of Pharmacognosy and phytochemistry. Cbs Publishers & Distributors, New Delhi.

2.Harshal A and Pawar. 2018. Practical book of pharmacognosy and phytochemistry-Everest Publishing house.

3.Varsha Tiwari and Shamim Ahmad. 2018. A practical book of pharmacognosy and phytochemistry. Nirali prakashan advancement of knowledge.

4.Braithwaite, A and F.J. Smith. 1996. *Chromatographic Methods* (5^{th} Edition)Blackie Academic & Professional London.

5.Wilson, K and J. Walker (Eds). 1994. Principles and Techniques of PracticalBiochemistry (4^{th}Edition) Cambridge University Press, Cambridge.

Web resources:

https://www.amazon.in/Textbook-Pharmacognosy-Phytochemistry-Kumar-Jayaveera-

ebook/dp/B06XKSY76H
https://www.amazon.in/Computational-Phytochemistry-Satyajit-Dey-Sarker-ebook/dp/B07CV96NZJ
https://studyfrnd.com/pharmacognosy-and-phytochemistry-book/
https://www.worldcat.org/title/textbook-of-pharmacognosy-and-phytochemistry/oclc/802053616
https://www.worldcat.org/title/phytochemistry/oclc/621430002

Mapping with Programme Outcomes:

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	3	2	2	2	3	3	3	1	3
CO2	3	2	2	3	3	3	3	2	3
CO3	3	1	2	3	3	3	3	1	3
CO4	3	2	1	3	3	3	2	1	3
CO5	3	1	2	2	3	3	3	2	3

S-Strong (3) M-Medium (2) L-Low(1)

PSO-CO Mapping

CO/PSO	PSO1	PSO2	PSO3
CO1	1	1	3
CO2	2	2	3
CO3	3	3	2
CO4	3	3	3
CO5	2	2	3

(For Candidates admitted from the academic year 2023-24 onwards)

I M.Sc. BOTANY – Semester- II

Course Title	**Elective Paper- 4 ENVIRONMENTAL BIOTECHNOLOGY**
Total Hours	**60**
Hours/Week	**4 Hrs. /wk**
Code	**P23BO2ECT07**
Course Type	**Theory**
Credits	**3**
Marks	**100**

GENERAL OBJECTIVES

To imparts knowledge on the fundamentals of ecology and pollution, functions of ecosystem and reduction of pollution by biotechnological tools.

COURSE OBJECTIVES

The learner will be able to

CO No.	Course Objectives
CO-1	Remember the types of environmental pollution
CO-2	Understand the soluble microbial products and bioreactor types
CO-3	Understand the microbiology of waste water and their management
CO-4	Understand the Types and Test for evaluating toxicity
CO-5	Analyze the In situ and Ex situ bioremediation of contaminated soils and waste land.

UNIT – I **12Hrs.**

Environment: Basic concepts and issues; Environmental management and Conservation, Environmental Laws & Agencies involved in conservation. Environmental Pollution: Types of pollution & its control strategies -Air pollution, Soil pollution, Water pollution, Oil pollution,noise pollution and Radioactive pollution

Extra reading /Key words: *Microplastic Pollution, plastic neutrality, Air Quality Index*

UNIT – II **12Hrs.**

Biofilm Kinetics: Mixed biofilm reactor-Soluble microbial products and inert biomass-Special-case biofilm solution. Reactor types:- batch reactor - continuous-flow stirred-tank reactor- Plug-flow reactor. Engineering design of reactors.

Extra reading /Key words: *Extracellular Polymeric Substances, Quorum sensing*

UNIT – III **12Hrs.**

Source of waste water ,Waste water management, Waste water treatment- physical, chemical and biological treatment. Microbiology of Waste water; Aerobic and anaerobic process, BOD and COD.

Extra reading /Key words: *Zero liquid discharge, Effluent standards, Sanitary sewer overflow*

UNIT – IV **12Hrs.**

Toxicity: Types and Test for evaluating Toxicity. Biosensors, Biomonitoring of toxic materials .Biomagnification, Biomining and Biofuels

Extra reading /Key words: *Bioindicator, xenobiotics, biological accumulation*

UNIT – V **12Hrs.**

Bioremediation; *In-situ and Ex-situ* Bioremediation of contaminated soils and waste land; Microbiology of degradation of Xenobiotics in environment; Pesticides, Surfactants, Degradative plasmids. Solid waste: Composting, Vermiculture and methane production.

Extra reading/ Key Words**:** *myco remediation, bioaugmentation, bioleaching*

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

Assignment and Seminar

COURSE OUTCOMES (CO):

The Learners will be able to

CO No.	Course Outcomes	PSOs	Cognitive Level
CO-1	explain various waste management methods	PSO 1 PSO 7	K2
CO-2	classify potential methods of biodegrading organic pollutants.	PSO 1 PSO 7	K3
CO-3	examine the techniques involved in remediation of polluted environments	PSO 1 PSO 7	K5
CO-4	assess types of pollution & its control	PSO 1 PSO 7	K4
CO-5	compile biotechnological approaches to degrade xenobiotic compounds	PSO 1 PSO 7	K5

(K1-Remeber, K2-Understand, K3-Apply, K4-Analyze, K5-Evaluate)

Reference Books:

1. Gareth M. Evans, Gareth G. Evans, Judy Furlong 2011
2. Environmental biotechnology: theory and application John Wiley & Sons, Ltd. West Sussex, UK
3. M. Moo-Young, W.A. Anderson, A.M. Chakrabarty, 2010. Environmental Biotechnology: Principles and Applications. Springer.
4. M. H. Fulekar, 2010 Environmental Biotechnology, by Science Publishers Department of Life Sciences, University of Mumbai, India,
5. Stanley E. Manahan, 2009. Environmental Chemistry, Ninth Edition, CRC Press.
6. Environmental chemistry 5th edition by A.K.De. 1997.

Websites:

lbewww.epfl.ch/LBE/Default_E.htm

http://lbe.epfl.ch

PO– CO MAPPING and PSO/CO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	3	2	2	3	3	2	2	2	3
CO2	3	2	3	3	3	2	3	2	3
CO3	3	3	2	2	3	3	3	2	3
CO4	3	3	3	3	3	2	2	2	2
CO5	3	3	3	3	3	2	3	2	3

CO/PSO	PSO1	PSO2	PSO3
CO1	3	3	3
CO2	3	2	2
CO3	2	3	3
CO4	3	2	3
CO5	3	3	3

(For Candidates admitted from the academic year 2023-2024onwards)

I M.Sc. BOTANY – Semester- II

Course Title	**NME – 1 AGRICULTURE AND FOOD MICROBIOLOGY**
Total Hours	**60**
Hours/Week	**4 Hrs./wk**
Code	**P23BO2SET01**
Course Type	**Theory**
Credits	**2**
Marks	**100**

GENERALOBJECTIVE

To understand the benefits of microbes in agriculture and food industry.

COURSE OBJECTIVES

The learner will be able to

CO.No.	Course Objectives
CO-1	provide comprehensive knowledge about plant – microbe interactions.
CO-2	provide basic understanding about factors affecting growth of microbes
CO-3	appreciate the role of microbes in food preservation.
CO-4	understand about the benefits of microbes in agriculture and food industry.
CO-5	gain knowledge about practices involved in food industry.

Unit –I Role of Microorganisms in Agriculture:

12Hrs.

Role of symbiotic and free-living bacteria and cyanobacteria in agriculture, Mycorrhiza, Plant Growth Promoting Microorganism (PGPM) and Phosphate Solubilizing Microorganisms (PSM).

Extra Reading/Keywords: Microbial consortia, Microbiome Resilience, MISR - Microbiome- Induced Systemic Resistance

Unit –II Biocontrol and biofertilization:

12Hrs.

Biocontrol of plant pathogens, pests and weeds, Restoration of waste and degraded lands, Biofertilizer: Types, technology for their production and application, vermi-compost.

Extra Reading/Keywords: biostimulants, biofertilizer coatings

Unit – III Food Microbiology:

12Hrs.

Intrinsic and extrinsic factors influencing growth of microorganisms in food, Microbes as source of food: Mushrooms, single cell protein.

Extra Reading/Keywords: *Lactobacillus acidophilus, Bifidobacterium bifidum*

Unit – IV Food Microbiology

12Hrs.

Microbial spoilage of food and food products: Cereals, vegetables, pickles, fish and dairy products. Food poisoning and food intoxication. Microbes and fermented foods: Butter, cheese and bread.

Extra Reading/Keywords: biogenic amines, mycotoxins, botulism

Unit –V

12Hrs.

Principle and Methods of food preservation: Principles, physical methods of food preservation: temperature, Pasteurization, types (canning, drying); High pressure and Irradiation; chemical methods of food preservation: salt, sugar, organic acids, SO2 and antibiotics.

Extra Reading/Keywords: controlled atmosphere storage, smoke house, pulsed electric field

Course outcomes

CO .NO	Course outcomes	Programme outcomes	Cognitive level
CO1	Recognize the general characteristics of microbes and factors affecting its growth	PSO1,PSO3	R
CO2	Explain the significance of microbes in increasing soil fertility	PSO1,PSO3	U
CO3	Elucidate concepts of microbial interactions with plant and food.	PSO1,PSO3	Ap
CO4	Analyze the impact of harmful microbes in agriculture and food Industry.	PSO1,PSO2	An
CO5	Determine the role of microbes in food preservation and as biocontrol.	PSO1,PSO3	Ap

(K1-Remeber, K2-Understand, K3-Apply, K4-Analy, K5-Evaluate)

Recommended Text Books

1. Pelczar M.J., Chan E.C.S. and Krieg N.R. 2003. Microbiology. 5th Edition, Tata McGraw- Hill Publishing Company Limited, New Delhi.
2. Rangaswami, G. and Bagyaraj, D.J. 2006. Agricultural Microbiology. 2nd Unit 2nd Edition, PHI Learning, New Delhi, India.
3. Prescott,L.M.,HarleyJ.P.,KleinD. A. 2005.Microbiology,McGrawHill,India. 6thedition. Goldman,E.andGreen,L.H.2015.Practical Handbook of Microbiology(3rd Ed.).CRCPress.

Reference Books

1. Adams, M.R. and Moss M. O. 2008. Food Microbiology, 3rd Edition, Royal Society of Chemistry, Cambridge, U.K.
2. Sylvia D.M. 2004. Principles and Applications of Soil Microbiology, 2nd Edition, Prentice Hall, USA.
3. Frazier, W.C. 1995. Food Microbiology, 4th Edition, Tata McGraw Hill Education, Noida, India.
4. Das,S.andSaha,R.2020.MicrobiologyPracticalManual.CBSPublishe rsandDistributors(P) Ltd., New Delhi,India.

Web resources:

1. https://www.kopykitab.com/Agriculture-And-Food-Microbiology-In-Hindi-by-Dr-Q-J- Shammi
2. https://agrimoon.com/agricultural-microbiology-icar-ecourse-pdf-book/
3. https://play.google.com/store/books/details/Applied_Microbiology_Agriculture_Environmental_Foo?id=D

Mapping with Programme Outcomes:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	3	3	1	3	2	1	2	2	2
CO2	3	3	2	2	3	3	2	3	3
CO3	2	2	3	3	1	2	1	3	1
CO4	3	3	3	3	3	2	3	3	3
CO5	3	3	2	3	2	3	3	3	2

PSO & CO Mapping

CO/PSO	PSO1	PSO2	PSO3	PSO4

CO1	2	2	2	2
CO 2	2	1	2	1
CO 3	1	3	1	3
CO 4	3	3	3	3
CO 5	3	3	3	3

-Strong (3) M-Medium (2) L-Low(1)

II M.Sc., BOTANY

III	Major Core – 10	Angiosperm Systematics	P22BO3MCT10	6	5	100
	Major Core – 11	Research methodology	P22BO3MCT11	6	5	100
	Major Core – 12	Practical 3- Angiosperm Systematics and Research Methodology	P22BO3MCP12			
	Major Elective – 1	Recombinant DNA Technology/Pharmacognosy	P22BO3MET01/ P22BO3MET02			
	Non Major Elective 2	Microbes in Human welfare	P22BO3NMT02	5	3	100
		Library		1		
	Extra credit	Internship/Field work/Field Project 30 Hours-extra Credit.	P22EX3INT03		2	100
		Online Course	P22EX3ONC02		1	
		Total		**30**	**23+3**	**600**
IV	Major Core – 13	Plant Physiology, Biochemistry and Biophysics	P22BO4MCT13	7	5	100
	Major Core – 14	Practical 4- Plant Physiology, Biochemistry and Biophysics	P22BO4MCP14	4	4	100
	Major Core – 15	Project	P22BO4DIS01			
	Major Elective -2	Biostatistics and Bioinformatics/Genomics and Proteomics	P22BO4MET03/ P22BO4MET04			
	Major Elective 3	Clinical Microbiology and Basics of Immunology/Plant diseases and Pest management	P22BO4MET05/ P22BO4MET06			
		Library		1		
	Extra credit self-study paper	Nursery Maintenance and Home Gardening	P22B04SST01		2	100
	Extra credit	Internship/Field work/Field Project 30 Hours-extra Credit.	P22EX4INT04		2	100
		Total		**30**	**22+4**	**700**
		Grand Total		**120**	**90+12 =102**	**2000**

(For Candidates admitted from the academic year 2022 onwards)

HOLY CROSS COLLEGE (AUTONOMOUS) TIRUCHIRAPPALLI – 2

PG AND RESEARCH DEPARTMENT OF BOTANY
CHOICE BASED CREDIT SYSTEM

M.Sc. BOTANY

Second Year - Semester- III

Course Title	**MC 10- ANGIOSPERM SYSTEMATICS**
Total Hours	**90**
Hours/Week	**6Hrs/week**
Code	**P22BO3MCT10**
Course Type	**Theory**
Credits	**5**
Marks	**100**

GENERAL OBJECTIVE

To enable the students to learn the importance and types of classification of angiosperms and their characters and economic importance, herbarium technique, botanical nomenclature, modern trendsin taxonomy

COURSE OBJECTIVES

The learner will be able to

CO No.	Course Objectives
CO-1	Understand and analyse the types of classification, taxonomic literature and BSI
CO-2	Understand and remember the herbarium technique, botanical nomenclature and key preparation.
CO-3	Understand and remember the recent techniques in taxonomy.
CO-4	Uunderstand and analyse the poly and gamopetalae families.
CO-5	Remember and analyse the monochlamydea and monocot families.

UNIT-I Scope and importance of plant taxonomy. 18 hrs

Purpose of classification of plants. Types of classification- Artificial (Linnaeus), natural (Bentham and Hooker). and phylogenetic systems (Engler and Prantl). Current systems of classifications- Phylogenetic system (Takhtajan's system and Dahlgren's system) with meritsand demerits. Taxonomic literature: Manuals, Monographs & revisions - need, methodology and applications. BSI - History, organization, achievements and functions.

Extra reading /Key words: *Ethnotaxonomy, IUCN red data book*

UNIT – II Plant taxonomy 18 hrs

Specimen preparation and Herbarium management and its functions. Major botanical gardens & herbaria of India and world.History of ICBN, ranks and nomenclature of taxa, typification, principles of priority and their limitations. Effective and valid publication. Citation of authors, retention, choice and rejection of names, nomina conservanda. Nomenclature terminologies, procedure for publication of species. Key preparation-types.

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

UNIT-III Modern trends in taxonomy: 18 hrs

Anatomy, palynology, embryology, cytology, in relation to taxonomy, molecular taxonomy, chemotaxonomy, serotaxonomy, numerical taxonomy. Computerized systematics- use of computers in taxonomy (numeric and word processing), converting data-card systems, paper tape system, scanning & sensing system, online system. Documented characters of plants in computers.

Extra reading /Key words: *Semantics, DELTA, DAISY, bar coding*

UNIT – IV Polypetalae & Gamopetalae: 18 hrs

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

Polypetalae:- Nymphaeaceae, Menispermaceae, Portulacaceae, Rosaceae, Vitaceae, Meliaceae, Myrtaceae, Sapindaceae.

Gamopetalae:- Sapotaceae, Apocynaceae, Boraginaceae, Convolvulaceae, Scrophulariaceae, Bignoniaceae, Pedaliaceae, Verbenaceae.

Extra reading /Key words: *Rare medicinal plants in Gamopetalae and Polypetalae*

UNIT – V Monochlamydeae & Monocotyledons 18 hrs

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

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

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

Extra reading /Key words: *Rare medicinal plants in Monochlamydeae, endangered speciesinmonocot plants.*

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

COURSE OUTCOMES (CO)

The Learner will be able to

CO No.	Course Outcomes	PSOs Addressed	Cognitive Level
CO-1	Distinguish the types of classification	PSO 2, PSO 5	An
CO-2	Describe the taxonomic literature and BSI	PSO 3, PSO 5	R
CO-3	Explain the herbarium technique, botanical nomenclature and key preparation	PSO 2, PSO 5	R, An
CO-4	Describe the recent techniques in taxonomy	PSO 2, PSO 5	R,U
CO-5	Illustrate and compare the floral characters of Polypetalae	PSO 3, PSO 4	R, U
CO-6	Explain the taxonomical characters of gamopetalae families	PSO 2, PSO 5	R,U
CO-7	Identify and Differentiate the characters ofmonochlamydeae	PSO 3, PSO 4	R, U, An
CO-8	Explain the characters of monocot families	PSO 2, PSO 4	R, An
CO-9	Enumerate the economic importance of Angiosperms	PSO 1, PSO 3	U

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

Prescribed Text Books:

1. Sharma, O.P. 2017. Plant Taxonomy. 2nd edition. Tata Mc Graw Hill EducationPrivateLimited. New Delhi.
2. Pandey, S.N. & S.P. Misra. 2008. Taxonomy of Angiosperms. .Ane Books India, NewDelhi,Chennai, Mumbai.
3. Rendle, A. B. 1979. Classification of flowering plants (Vol I & II). Vikas Publishing House Pvt Ltd, Ghaziabad.
4. Lawrence, G. H. M. 1967. Taxonomy of vascular plants. Oxford and IBH PublishingCo. Pvt. Ltd, New Delhi.

Books for References:

1. Henry and Chandrabose. 1980. Botanical nomenclature. Today and Tomarrow printersand Publishers, New Delhi.
2. Heywood, V. H. 1968. Modern methods in plant taxonomy. Academic press, London.
3. Davis, P. H. and Heywood, V. H. 1973. Principles of angiosperm taxonomy.Robert E.Erieger Publishing Company, New York.
4. Heywood, V. K. and Moore, D. M. 1984. Current concepts in plant taxonomy. Academic Press, London.
5. Grant, W. F. 1984. Plant biosystematics. Academic Press, London.
6. Jeffrey, C. 1989. Botanical nomenclature. Edward Arnold, London.
7. Jeffrey, C. 1982. Introduction to plant taxonomy. Cambridge University Press,London.
8. Nashiq, A. R. 1993. An introduction to botanical nomenclature. Scientific

Publishers.Jodhpur.
9. Clive A. Stace. 1980. Biosystematics. Edward Arnold. A division of HodderandStoughton, London Melbourne, Auckland.

For Candidates admitted from the academic year 2022 onwards) HOLY CROSS COLLEGE (AUTONOMOUS) TIRUCHIRAPPALLI – 2

PG AND RESEARCH DEPARTMENT OF BOTANY
CHOICE BASED CREDIT SYSTEM

M.Sc. BOTANY
Second Year - Semester- III

Course Title	**MAJOR CORE 11- RESEARCH METHODOLOGY**
Total Hours	**90**
Hours/Week	**6 hrs /wk**
Code	**P22BO3MCT11**
Course Type	**Theory**
Credits	**6**
Marks	**100**

GENERAL OBJECTIVE

To enable the students to learn the application of various instruments and their function with the principle applied in research field. To enable the students to evaluate and consolidate their project work into thesis and manuscript.

COURSE OBJECTIVES

The learner will be able to

CO. No.	Course Objectives
CO-1	Remember, understand and evaluate the application of different types of microscope and the techniques of histochemistry
CO-2	Understand and apply the preparation of material for light & electron microscopy
CO-3	Understand and apply the basic principle of physical instruments
CO-4	Apply and analyse the basic principle and functions of instruments used in separation of bioactive compounds
CO-5	Remember, understand and apply the methodologies adopted to consolidate the research findings into thesis and manuscript

UNIT – I Microscopy & Histochemistry: 18 hrs Construction, working principles of Bright Field, Phase Contrast, Fluorescent, Electron (TEM,SEM & STEM) and Confocal microscopy. Micrometry. Histochemistry of starch, total proteins,lipids, DNA & RNA.

Extra Reading /Key Words*: Antioxidant, Apoptosis, structure of Nanopartilces*

UNIT - II Preparation of material for light & electron microscopy: 18 hrs

Killing and Fixing. Types of fixatives for light microscopy. Processing of materials

(dehydration,clearing, infiltration & embedding). Principles of staining, double staining and mounting ofmaterials for hand sections. Microtomy, types (Rotary & Ultra microtome) and theirapplications. Preparation of material for TEM & SEM.
Extra Reading/Key Words: *Staining, processing of DNA samples*

UNIT –III Instrumentation for qualitative and quantitative analysis of biomolecules: 18 Hrs Principle, components and applications of pH meters and preparation of buffers. Colorimeter &Spectrophotometer – principle, laws of absorption of light- uses. Principles of biophysical methods used for the analysis of biopolymer structure- X ray, ORD (optical rotary dispersion) /CD (Circular dichroism), NMR (nuclear magnetic resonance) & ESR (electron

spin resonance)spectroscopy. Centrifugation-Principle and types.
Extra Reading /Key Words: *Applications of UV-Vis Spectroscopy , FT-IR.*

UNIT- IV Separation and Tracer Techniques: 18 hrs
Principles and uses of Chromatography with reference to Ion exchange, Gas & High Performance Liquid Chromatography. Principles &uses of Atomic AbsorptionSpectroscopy. Electrophoresis – principles, types – paper & gel electrophoresis (SDS-PAGE, 2D-PAGE), operation and their applications. 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. Structure, components and compilation of project report,Plagiarism and Software, Manuscript for publication and proof correction, Indexed Journalsin Life Sciences – scopus, web of sciences, UGC care list. Impact factor of Journals, Ethical issues related to publishing papers.

Extra Reading / Key Words*:* *i10 index, H index*

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

COURSE OUTCOMES (CO)
The Learner will be able to

CO No.	Course Outcomes	PSOs Addressed	Cognitive Level
CO-1	Outline the construction and application of different types of microscope	PSO 2, PSO 5	An
CO-2	Explain the techniques of histochemistry	PSO 2, PSO 5	An
CO-3	Explain the preparation of material for light and electron microscopy	PSO 2, PSO 5	An
CO-4	Explain the principle and construction of the instruments used for the qualitative and quantitative of biopolymers	PSO 4, PSO 5	U
CO-5	Identify the applications of the various instruments used for the qualitative and quantitative of biopolymers	PSO 4, PSO 5	R, U

CO-6	Compare and contrast the different types of chromatographic and electrophoretic techniques mentioned in the syllabus	PSO 2, PSO 5	R,U
CO-7	Develops the techniques used to trace and quantify the Radioisotopes	PSO 2	An, U
CO-8	Discuss the methodologies adopted to consolidate the research findings into thesis and manuscript	PSO 2, PSO 4	C
CO-9	Develop the Employability skills by learning the application of various instruments and their function with the principle applied in research field.	PSO-1	C

Prescribed Text books

1. Baidyanath Mishra, 2018. Research Methodology, Chaukhambha Orientalia publication
2. Gurumani, N. 2011 Research Methodology : For Biological Sciences**,** MJP Publisher
3. Avinash Updhayay, Kakoli Updhayay and Nirmalendu Nath. 1998. Biophysicalchemistry –Principles and techniques. Himalaya Publishing House, Mumbai.

4. **Dr.N.Arumugam, 2015. Research Methodology for Life Sciences.Sara's Publication.**

Books for References

1. Shirish C. and Ashok T. 2009. An introduction to Research. Cambridge UniversityPress, India Pvt. Ltd. New Delhi.
2. Wilson K. & Walker J. 1994. Practical biochemistry. 4th edition, CambridgeUniversity,London.
3. Berlyn & Mische, 1976. Botanical microtechnique & cytochemistry. Iowa StateUniversity Press.
4. Gahan P.B.1984. Plant histochemistry & cytochemistry – An introduction.AcademicPress, London.
5. Krishnamurthy, K.V. 1988. Methods in Plant Histochemistry.ViswanathanPublishers,Madras.
6. Van Norman R.W. 1971. Experimental biology. Iind Edition, Prentice Hall, Inc.,New Jersey.
7. Saravanavel P. 1985 Research report writing. Emerald Publishers, Madras.

(For Candidates admitted from the academic year 2022 onwards)HOLY CROSS COLLEGE (AUTONOMOUS)

TIRUCHIRAPPALLI – 2

PG AND RESEARCH DEPARTMENT OF BOTANY

CHOICE BASED CREDIT SYSTEM

M.Sc. BOTANY

Second Year – Semester- III

Course Title	**MAJOR CORE-12 PRACTICAL 3 ANGIOSPERM SYSTEMATICS AND RESEARCH METHODOLOGY**
Total Hours	**90**
Hours/Week	**6Hrs/Wk**
Code	**P22BO3MCP12**
Course Type	**Practical**
Credits	**3**
Marks	**100**

GENERAL OBJECTIVE

To enable the students to identify the Angiospermic plants, prepare dichotomous key,preparepermanent slides, prepare standard graph and preparation of buffers.

COURSE OBJECTIVES

The learner will be able to

CO. No.	**Course Objectives**
CO-1	Understand to prepare dichotomous key, rules of nomenclature and method of preparation of herbaria
CO-2	Understand the characters and Identify local specimens of Gamopetalae**,** Polypetalae mentioned in the syllabus
CO-3	Identify local specimens of Monocotyledons and Monochlamydeae mentioned in 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 syllabus suchas 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 syllabus suchas Monochlamydeae:- Nyctaginaceae, Chenopodiaceae, Aristolochiaceae, Piperaceae, Polygonaceae, Loranthaceae, Amaranthaceae.

Monocotyledons:- Amaryllidaceae, 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 Monochlamydeae mentioned in the syllabus	PSO2,	R,U,An
CO-5	Understand and apply the method of hand and microtome sectioning and staining	PSO5	R,U, An
CO-6	Understand and apply the procedure for histochemical test, buffer preparation and standard graph	PSO5	R, U, An
CO-7	Develop the practical skills by identify the Angiospermic plants, prepare dichotomous key, prepare permanent slides, prepare standard graph and preparation of buffers	PSO-1	R.U

(For Candidates admitted from the academic year 2022 onwards)

HOLY CROSS COLLEGE (AUTONOMOUS) TIRUCHIRAPPALLI – 2

PG AND RESEARCH DEPARTMENT OF BOTANY

CHOICE BASED CREDIT SYSTEM

M.Sc. BOTANY

Second Year – Semester- III

Course Title	**ME 1- RECOMBINANT DNA TECHNOLOGY**
Total Hours	**90**
Hours/Week	**6Hrs/Wk**
Code	**P22BO3MET01**
Course Type	**Theory**
Credits	**5**
Marks	**100**

GENERAL OBJECTIVE

To enable the students to learn the basic principles and recent techniques of genetic engineering, DNA amplification, Pharmaceutical products of DNA and DNA in disease diagnosis and medicalforensics.

COURSE OBJECTIVES

The learner will be able to

CO. No.	Course Objectives
CO-1	understand, analyze the role of molecular tools and cloning vectors in genetic engineering.
CO-2	understand, apply and analyze the techniques of genetic engineering.
CO-3	understand and apply the tools and techniques adopted in amplification ofDNA
CO-4	remember and apply the pharmaceutical products of DNA
CO-5	analyze the disease by DNA assay

UNIT-I Introduction, history, scope and principles of genetic engineering.

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 anduses. Phage vectors (phage λ and M13 vectors), cosmid and shuttle vectors and yeast vectors.Construction of rDNA and applications of rDNA technology.

Extra reading /Key words: *Neurosciences*

UNIT – II Techniques in genetic engineering : 18 hrs

Agarose gel electrophoresis, PFGE and PAGE and its uses. Isolation and purification of DNA (cellular and plasmid DNA). Blotting techniques – Southern, Northern, Western, colony and plaque hybridization. DNA sequencing - Maxam & Gilbert, Sanger's and automated gene sequencing methods. DNA chips (micro arrays).

Extra reading /Key words: *Stem cell culture, Fluorescence-Activated Cell Sorting*

UNIT - III DNA amplification: 18 hrs

PCR – principle, types, techniques and its application. RFLP and RAPD. Cloning in prokaryotes and in higher organisms through Agrobacterium mediated gene transfer. Screening strategies: screening by DNA hybridization, DNA probes, immunological and protein assay.Gene libraries: construction and screening of genomic libraries, cDNA libraries and chromosome jumping libraries.

Extra reading /Key words: *Loop mediated isothermal amplification (LAMP), nucleic acidsequence based amplification (NASBA)*

UNIT - IVPharmaceutical products of DNA: 18 hrs

Production of recombinant insulin and human growth hormones. Recombinant vaccines and DNAvaccines (Herpes simplex virus, BCG and meningitis). Hybridoma technology: principles,productions, advantages and applications of monoclonal antibodies. Gene therapy methods &applications. Antisense RNA technology: principles, methods and applications.

Extra reading /Key words: *Therapeutic enzymes, immuno modulators.*

UNIT - V DNA in disease diagnosis and medical forensics: 18 hrs

Methods of DNA assay and its diagnosis in infectious diseases (Tuberculosis, AIDs and malaria),genetic diseases (cancer, diabetes and obesity). DNA finger printing: techniques andits applications. Human Genome project: approach, mile stones, achievements, applications and ethical issues.

Extra reading /Key words: *West Nile Virus, forensic dentistry.*

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

COURSE OUTCOMES (CO)

The Learner will be able to

CO No.	Course Outcomes	PSOs Addressed	Cognitive Level
CO-1	Explain the role of molecular tools and cloning vectors in genetic engineering.	PSO1, PSO3	R, U
CO-2	Describe the techniques of genetic engineering.	PSO4, PSO3	U
CO-3	Discuss the different types of blottingtechniques	PSO1, PSO3	U
CO-4	Explain the tools and techniques adopted in amplification of DNA	PSO1, PSO5	U
CO-5	Relate the different kinds of screening strategies	PSO1, PSO5	R,U

CO-6	Describe the pharmaceutical products of DNA	PSO1, PSO5	R, U
CO-6	Explain gene therapy methods and its application	PSO1, PSO3	R, U
CO-6	Analyze the disease by DNA assay	PSO1, PSO5	R, U, An
CO-7	Develop the Employability skills by learning the basic principles and recent techniques of genetic engineering, DNA amplification, Pharmaceutical products of DNA and DNA in disease diagnosis and medical forensics	PSO-1	C

Prescribed Text books

1. Dubey, R. C. 2001. A Text Book of Biotechnology. S. Chand and Co, New Delhi.
2. Shikha Jain, 2011.Text book of rDNA technology. Kalyani Publishers, NewDelhi.
3. Satyanarayana U. 2015. Biotechnology. Books and Allied (P) Ltd. Kolkata.
4. Keya Chaudhuri. 2013. Recombinant DNA Technology. The Energy andResources Institute (TERI) Publishers.
5. Monika Jain, 2012. Recombinant DNA Techniques: A Textbook Alpha Science InternationalPublishers.

Books for References

1. Gupta, P. K. 1999. Elements of Biotechnology – First Edition. RastogiPublication,Meerut.

2. Ignacimuthu, S. 1996. Applied Plant Biotechnology. Tata Mc Graw – HillPublishing Company Ltd., New Delhi.

3. Kumar, H. D. 1993. Molecular Biology and Biotechnology. Vikas PublishingHouse Pvt. Ltd,New Delhi.

4. John E. Smith. 1996. Biotechnology. Cambridge University Press, UnitedKingdom.

5. Sandhya Mitra. 1996. Genetic Engineering. MacMillan India Ltd., New Delhi.

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

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

8. David P. Clark and Nanette Pazdernik, 2010. Academic Cell, 1st Edition,Cambridge.

(For candidates admitted from 2015 onwards)

HOLY CROSS COLLEGE (AUTONOMOUS) TIRUCHIRAPPALLI – 2

PG AND RESEARCHDEPARTMENT OF BOTANY

M.Sc. BOTANY

Second Year - Semester – III

Course Title	**MAJOR ELECTIVE – PHARMACOGNOSY**
Total Hours	**90**
Hours/Week	**6Hrs/Wk**
Code	**P22BO3MET04**
Course Type	**Theory**
Credits	**5**
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 throughAssignmentand 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 2022 onwards)

HOLY CROSS COLLEGE (AUTONOMOUS) TIRUCHIRAPPALLI – 2

PG AND RESEARCH DEPARTMENT OF BOTANY
CHOICE BASED CREDIT SYSTEM

M.Sc. BOTANY
Second Year – Semester- III

Course Title	**NME 2 – MICROBES IN HUMAN WELFARE**
Total Hours	**75**
Hours/Week	**5Hrs/Wk**
Code	**P22BO3NMT02**
Course Type	**Theory**
Credits	**3**
Marks	**100**

GENERAL OBJECTIVE

To enable the students to learn and understand the basics of microbiology and uses ofmicrobes (beneficial and detrimental).

COURSE OBJECTIVES

The learner will be able to

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

Extra reading/Key words: *Natural growth hormone, Vermi compost*

UNIT III Role of microbes in environment: 15 hrs

Treatment of waste water; solid waste management and Microbial degradation of xenobiotics. Production of organic compost from plant and animal waste and its uses.Biogas production from animal waste. Use of microbes in septic tank. Microbial biodecomposition of cellulose (coconut fibre & paddy straw).

Extra reading/Key words: *Spirulina, organic manure*

UNIT IV Role of microbes in industry: 15 hrs

Bioreactors, stock cultures of microorganisms, large scale production of ethanol, vinegar (acetic acid), antibiotic (penicillin), production of vitamin B_2 and vaccines.

Extra reading/Key words: *Effect of Hydrocarbon, Streptomycin production*

UNIT V Role of microbes in human health: 15 hrs

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

Extra reading/Key words: *Dengue, Swine flu*

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

COURSE OUTCOMES (CO)

The Learner will be able to

CO No.	Course Outcomes	PSOs Addressed	Cognitive Level
CO-1	Explain the basic inventory of microbes and their role in food processing	PSO1, PSO3	R, U
CO-2	Analyse the role of microbes in agriculture	PSO1, PSO3	R,U
CO-3	Explain the role of microbes in environment and the techniques adopted in treating waste solid and liquid	PSO1, PSO3	R,U

CO-4	Analyse the role of microbes in industry	PSO1, PSO3	R,U
CO-5	Explain the major disease of human caused by microbes	PSO1, PSO3	R,U
CO-6	Summarize the role of beneficial microbes in human health	PSO1, PSO3	R, U, An
CO-7	Develop the Employability skills by understanding the basics of microbiology and uses of microbes (beneficial and detrimental)	PSO-1	C

Prescribed Text books

1. Ajar Nath Yadav, Jay Shankar Singh, 2020. Microbes in Agriculture and EnvironmentDevelopment, CRC Press
2. Reddy, S.M. 2017. Basic Fermentation Technology. New Age International Publishers.
3. R. G. Buckley, 2016. Environmental Microbiology, CBS Publishers and Distributors.

Books for References:

1. Ian L. Pepper, Charles P. Gerba, Terry J. Gentry, 2015. Environmental Microbiology,3rd edition, New York.
2. Michel J. Pelczar, Chan, E. C. S. and Noel R. Krieg. 1993. Microbiology concepts &applications. Mc Graw- Hill, Inc, New York.
3. Rangaswami, G. and Bagyaraj, D. J. 1993. Agricultural Microbiology. Prentice –Hall ofIndia private Ltd, New Delhi.
4. Power, C. B. And Daginawala, H. F. 1993. General Microbiology Vol I & II.HimalayaPublishing House, New Delhi.
4. Tauro, P., Kapoor, K. K. and Yadav, K. S. 1997. An introduction to microbiology.Wiley Eastern Company Ltd., New Delhi.

(For candidates admitted from 2022onwards)

HOLY CROSS COLLEGE (AUTONOMOUS) TIRUCHIRAPPALLI-2.

PG AND RESEARCH DEPARTMENT OF BOTANY

M.Sc.BOTANY

Second Year – SEMESTER IV

Course Title	**MC 13 PLANT PHYSIOLOGY, BIOCHEMISTRY AND BIOPHYSICS**
Total Hours	105
Hours/Week	7 hrs /wk
Code	**P22BO4MCT13**
Course Type	Theory
Credits	6
Marks	100

GENERAL OBJECTIVE

To enable the students to understand the water relations and types of photosynthesis of plants, mechanism of nitrogen metabolism, phytochrome acitivity, stress physiology, Chemistry of biomolecules, aminoacids, enzyme kinetics and photobiology of plants.

COURSE OBJECTIVES

The learner will be able to

CO. No.	Course Objectives
CO-1	Remember, understand and analyze the mechanism of photosynthesis and Respiration
CO-2	Understand and apply the Molecular mechanisms of biological nitrogen fixation, Phytochrome and stress physiology of plants
CO-3	Describe, illustrate and classify the biomolecules of plants.
CO-4	Summarize, classify and demonstrate amino acids, enzymes and enzyme kinetics
CO-5	Understand and analyze the energy transfer processes in plants through energy rich molecules

UNIT – I Plant physiology: 21 hrs

Water relation: Chemical potential, water potential and osmotic potential. Soil Plant Atmosphere Continuum (SPAC). Uptake, transport & translocation of water & minerals. Chelating agents. Importance of foliar nutrition. Photosynthesis: Electron flow through cyclic & non-cyclic photophosphorylation, C3& C4 cycles, types of C4 cycle. Difference between C3 and C4 cycles. CAM pathway & its adaptive advantages. Respiration: Glycolysis & Kreb's cycle. Plant

mitochondrial electron transport & ATP synthesis. Photo respiratory pathway and intermediatory metabolism.
Extra reading/ key words: CO2 concentrating mechanism and Pseudo phosphorylation

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 : Arabino galactans, glucomannans, chemical bonds

UNIT – IV Biochemistry: 21 hrs

Amino acids: Classification and general properties- Optical activity, stereoisomers and amphoteric properties. Non – protein aminoacids and their functions. Proteins: Classification, structure and biological importance. Enzymes: Classification, enzyme as biocatalyst, mode of action, enzyme specificity, and active centers. Isozymes & ribozymes– occurrence & functions. Enzyme Kinetics - Effects of temperature, pH, inhibitors, end products, concentration of enzyme on reaction rate, concentration of substrate on enzyme action. Michaelis – Menton constant, Vmax, significance of Km, Line – Weaver Burk plot. Allosteric enzymes or feedback inhibition.
Extra reading /key words: Protein isoform, RACK protein, tau protein, Keratinases

UNIT – V Biophysics: 21 hrs

Photobiology- dual nature of light, Electromagnetic spectrum, absorption spectrum and photosynthesis. Energy states – singlet and triplet states-excitation and de-excitation and light emissions (Fluorescence, Phosphorescence and Bioluminescence), Laws of Thermodynamics (First and Second) – Entropy in Biological systems, Redox potential- Redox couples – ATP as high-energy compound.

Extra reading/ key words: Mitochondrial Bioenergetics, Chloroplast Bioenergetics and Efficiency of Photosynthesis

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

COURSE OUTCOMES (CO)
The Learner will be able to

CO No.	Course Outcomes	PSOs Addressed	Cognitive Level
CO-1	Compare the different cycles and pathways of Photosynthesis and Respiration	PSO2, PSO5	R, U
CO-2	Explain the Molecular mechanisms of biological nitrogen fixation	PSO2, PSO5	R,U
CO-3	Discuss the importance of Phytochrome and stress physiology of plants	PSO2, PSO5	R,U
CO-4	Describe and classify the biomolecules of plants.	PSO2, PSO6	R,U, An
CO-5	Explain the structure of amino acids, enzymes and enzymekinetics	PSO2, PSO6	R, U
CO-6	Explain the energy transfer processes and energy richmolecules 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 andDistributors, 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, NewDelhi.
3. Satyanarayana, U. 2003. Biochemistry. Books and Allied (P) Ltd., Kolkatta.
4. Satyanarayana, U., and U.Chakrapani. 2017. Biochemistry. Fifth edition. Elsevier.
5. Salil Bose., 1981, Elementary Biophysics, Vijaya Printers, Madurai.

Books for References

1. William G. Hopkins. 1995. Introduction to Plant Physiology – Second Edition. John Wileyand Sons, Inc. New York.
2. Noggle, G. R. and Fritz, G. J. 1992. Introductory Plant Physiology. Prentice – Hall of IndiaPrivate 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 – Hillpublishing company, Ltd, New Delhi.
2. Voet, D. and Voet, J. G. 1990. Biochemistry. John Wiley and sons, Inc, New York.
3. Voet, D. and Voet, J. G. 2011. Biochemistry. Fourth Edition. John Wiley and sons, Inc, New York.

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

M.Sc. BOTANY
Second Year – Semester- IV

Course Title	**MAJOR CORE 14 -PRACTICAL 4 -PLANT PHYSIOLOGY,BIOCHEMISTRY AND BIOPHYSICS**
Total Hours	60
Hours/Week	4Hrs/Wk
Code	**P22BO4MCP14**
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 andestimation of proline
CO-5	Understand and analyze ATP molecule, absorption spectrum

Unit 1 **12 hrs**

Plant Physiology:

1. Determination of water potential
2. Measurement of osmotic potential and plasmolysis.
3. Sensitivities of membrane to external factors - chemicals, pH and temperature.

Unit 2 **12 hrs**

1. Separation of chloroplast pigments by column chromatography and study of absorption Spectrum.
2. Hill reaction of isolated chloroplast.
3. Effect of GA3 on Amylase activity.
4. Measurement of Nitrate reductase activity.

Unit 3 **12 hrs**

Plant Biochemistry Extraction and estimation of the following: Reducing sugars, Proteins, Ascorbic acid (titrimetric).

Estimation of the following enzymes- catalase, peroxidase, & amylase. Estimation of secondary metabolites - Phenols.

Unit 4 **12 hrs**

Demostration

1. Saponification value of vegetable oils.
2. Separation of lipids by TLC.
3. Separation of amino acids by paper chromatography.
4. Calculation of V max of enzyme.
5. Estimation of proline

Unit 5 **12 hrs**

Biophysics

COURSE OUTCOMES (CO)

The Learner will be able to

CO No.	Course Outcomes	PSOs Addressed	Cognitive Level
CO-1	Understand and determine water potential, osmotic potential In room temperature	PSO5	R, U, An
CO-2	Understand and analyze the types of pigments using chromatography, rate of photosynthesis, and amylase and Nitrate reductase activity enzyme Activity	PSO5	R,U, An
CO-3	Understand and determine the estimation of Reducing sugars, Proteins, Ascorbic acid, total phenols and enzymes	PSO5	R,U, An

CO-4	Understand and apply the procedure for saponification value, chromatography and estimation of proline	PSO5	R,U, An
CO-5	Explain the structure of amino acids, enzymes and enzyme kinetics	PSO5	R, U, An
CO-6	Develop the practical skills by determining and analyzing the water potential, osmotic potential, pigments, rate of photosynthesis, enzyme activity, Reducing sugars, Proteins, Ascorbic acid, total phenol and enzymes, proline, ATP molecule, absorption spectrum and apply the procedure for saponification value and chromatography	PSO-1	C

(For Candidates admitted from the academic year 2022-23 onwards)
HOLY CROSS COLLEGE (AUTONOMOUS) TIRUCHIRAPPALLI – 2
PG AND RESEARCH DEPARTMENT OF BOTANY CHOICE BASED CREDIT SYSTEM

M.Sc. BOTANY
Second Year – Semester- IV

Course Title	**MAJOR ELECTIVE 2- BIOSTATISTICS AND BIOINFORMATICS**
Total Hours	90
Hours/Week	6Hrs/Wk
Code	**P22BO4MET03**
Course Type	Theory
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 ofcentral 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 andsoftwares

UNIT – I Introduction and measures of central tendency and Dispersion: 18 hrs

Introduction – Definition & applications of statistics. Collection and presentation of data. Population and sample. Methods of sampling, advantages & disadvantages of sampling, random & non – random sampling. Measures of central location : mean, median & mode.

Measures of variability : Range, mean deviation, variance, standard deviation & coefficient of variation.

Extra reading/Key words:Manifestation, Biometric process

UNIT – II Probability, Correlation and Regression: 18 Hrs

Skewness & Kurtosis. Probability – Basic concepts. Measure of probability: addition, multiplication & conditional probabilities. Theoretical distribution: Binomial, Poisson & normal distributions. Correlation : Types, methods of studying correlation, rank correlation.

Regression : Types of regression, methods of studying regression.

Extra reading/Key words:Resemblence analysis, permutation and combination

UNIT – III Test of significance : 18 Hrs

Null hypothesis, standard error, large samples & small samples. Tests of significance of large samples, tests of significance of small samples (t-test), chi – square test. Analysis of variance : One way and two way analysis.

Designs of experiments : CRD, RBD & LSD.

Extra reading/Key words:\Duncan analysis and applications of SPSS

UNIT – IV Bioinformatics 18 hrs

Bioinformatics – introduction – need of computer in Biological research. Internet – a virtual library. Searching biological informations using internet.

Biological data base – generalized and specialized data base. Premier institutions maintaining data base - EMBL, NCBI, DDBJ.

Extra reading/Key words: OMIM, Microarray databases

UNIT - V Bioinformatics 18 hrs

Pairwise Alignment- dot matrix and BLOSUM matrix. Database Similarity search- FASTA, BLAST. Multiple sequence analysis –Logic behind MSA, software 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 software

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 methods of data collection and presentation of data	PSO 2, PSO 5	An
CO-2	Calculate the measure of central location and variability andco-efficient of correlation and Regression	PSO 2, PSO 5	An, Ap

CO-3	Compare and apply the different theories of Probability	2, PSO5	An
CO-4	Explain the procedure for test of significance	O 4, PSO5	An
CO-5	Apply the different types of test of significance	O 4, PSO5	Ap
CO-6	Recall and relate the application of information technology inthe field of biology	, PSO5	R,U
CO-7	Make use of various bioinformatics tools to analyse moleculardata	O 2	An,U
CO-8	Demonstrate pairwise and multiple sequence alignment usingbioinformatics tools	2, PSO4	C
CO-9	Develop the Employability skills by understanding the collection and presentation of data, measures of central location, variability, probability, correlation, regression and test of significance in biometrics	PSO-1	C

Prescribed Text books

Biostatistics

1. Palanichamy, S. and Manoharan, M. 1990. Statistical methods for Biologists. Palani Paramount, Palani.
2. Ramakrishnan, P. 2003. Biostatistics. Saras Publications, Nagercoil.

Bioinformatics

1. Lohar, P.S. 2009. Bioinformatics.MJP Publishers, Chennai.
2. Mani. K. and Vijayraj. D., 2002. Bioinformatics to beginners, Kalaikathir pathippagam,Coimbatore.
3. Jin Xiong. 2009. Essentials of Bioinformatics. Cambridge University Press, USA.

Books for References

1. Satguru Prasad. 1992. Fundamentals of Biostatistics. Emkay publications, New Delhi.
3. Khan, I. A. and Khanum, A. k. 1994. Fundamentals of BioStatistics. Ukaaz Publications, Andra Pradesh.
4. Misra, B. N. and Misra, M. K. 1992. Introductory practical Biostatistics. Darbari Prakashan, Calcutta.
5. Mahajan, B. K. 1991. Methods in Biostatistics. Jaypee Brothers Medical Publishers (Pvt)Ltd, New Delhi.
6. Kenneth Mather. 1973. Statistical analysis in Biology. Chapman and Hall and Science Paperbacks.
7. Rangaswamy, R. 1995. Agricutural statistics. New age International Publishers Ltd. Wiley Eastern Ltd., New Delhi.

8. Gupta, B. N. 1989. An introduction to mathematical statistics. Sahityabavan, Agra.
9. Normal, T. J. and Bailey. 1965. Statistical methods in Biology. The English Language Book Society and the English Universities Press Ltd, Britain.

Bioinformatics

1. Zhumur Ghosh, Bibekan and Mallick, 2008. Bioinformatics – Principles and Applications. OUP India.
2. Teresa Attwood and David Parry-Smith. 2007. Introduction to Bioinformatics. Pearson Education, India.

(For Candidates admitted from the academic year 2022-23 onwards)
HOLY CROSS COLLEGE (AUTONOMOUS) TIRUCHIRAPPALLI – 2
PG AND RESEARCH DEPARTMENT OF BOTANY
CHOICE BASED CREDIT SYSTEM

M.Sc. BOTANY

Second Year – Semester- IV

Course Title	**MAJOR ELECTIVE 3 – CLINICAL MICROBIOLOGY & BASICS OF IMMUNOLOGY**
Total Hours	90
Hours/Week	6 hrs /wk
Code	**P22BO4MET05**
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 diseases 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 from the hospital
CO -3	Understand and analyze the techniques for common serological test
CO -4	Remember, understand and analyze the major disease of human
CO -5	Understand and analyze the basics of immunology and the antigen-antibody interaction

UNIT – I: Interaction of microbes with human: 18hrs

Normal flora of human body – symbiotic relationships – importance in overall health of human. Pathogenic flora: Nosocomial and community infection.Mechanism of pathogenesis –

reservoirs, portals of entry and mode of transmission (direct – droplets; indirect – food, water & air). Colonization & establishment. Microbial virulence – exotoxins (botulism), endotoxins (gram negative bacteria).

Extra reading/Key words: Commensals, zoonotic infections

UNIT – II : Laboratory safety& hazardous waste treatment: 18hrs

Safety in handling of infectious materials – blood collection, specimen handling and transport. Containment equipment – biological safety cabinet (HEPA). Devices for protection against infection – laboratory garments (Apron, cloves, masks, caps) – sterilization, disinfection antisepsis in clinical labs, hospitals and equipment's. Infectious waste management in hospitals and laboratories and disposal of treated waste.

Extra reading/Key words: Hospital visits and case studies

UNIT – III : Techniques for diagnosis : 18hrs

Common serological tests – agglutination, immunoprecipitation, viral neutralization, complement fixation, Immunofluorescence technique, radio immuno assay, ELISA test.

Extra reading/Key words: Electro immunophoresis, biosensor

UNIT – IV: Diseases of human organs: 18hrs

Causative agent, symptoms, clinical diagnosis and control measures of the following: Skin – Varicella or chicken pox (Herpes virus), Cutaneous mycoses (Ringworm diseases). Eyes – conjunctivitis (Bacteria & Virus). Nervous system – bacterial meningitis (Neisseria meningitidis). Respiratory system – Diphtheria. Digestive system – Jaundice (Hepatitis virus) and amoebiasis. Urinogenital system – Gonorrhea (Neisseria gonorrhoeae).

Extra reading/Key words: Dengue, Swine flu

UNIT –V: Basics of immunology: 18hrs

Natural host resistance – types of immunity – innate & acquired. The immune system – lymphocytes (T & B cells). Role of lymphocytes in specific immunity. Antigen – Antibodies. Nature of antigens – epitopes – haptens – their functions. Nature of antibodies (immunoglobulins)-types & properties. Cell mediated immunity – natural killer cells.

Extra reading/Key words: Vaccination, Stem cell

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

COURSE OUTCOMES (CO)

The Learner will be able to

CO No.	Course Outcomes	PSOs Addressed	Cognitive Level
CO-1	Discuss the exact role of microbes	PSO 2, PSO 5	An

CO-2	Explain the safety measures adopted in pathological laboratory	PSO 2, PSO 5	An, Ap
CO-3	Elaborate the safety disposal of hazardous waste generated from the hospital	PSO 2, PSO 5	An
CO-4	List out the techniques for common serological test	PSO 4, PSO 5	An
CO-5	recall and analyze 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 diseases and basics of immunology	PSO-1	C

Prescribed Text Books:

1. R.C. Dubey and D.K.Maheswari. A text book of microbiology. S.Chand & Company Ltd., New Delhi.
2. Nandini Shetty. 2006. Immunology – Introductory text book, New Age International Publishers, New Delhi.
3. Subhash Chandra Parija. 2012. Textbook of Microbiology and Immunology, Elsevier IndiaPublishers. P. 684.
4. Banerjee and Banerjee. 2008. Fundamentals of Microbiology and Immunology. New CentralBook Agency (P) Limited Publishers.

Books for References:

1. Michel J. Pelczar, Chan, E. C. S. and Noel R. Krieg. 1993. Microbiology concepts & applications. Mc Graw- Hill, Inc,New York.
2. Prescott, Harley and Klein. 1999. Microbiology. Irwin Mc Graw – Hill / Bos.
3. Nester, E. W., Roberts, C. E., Pearsall, N. N. & Anderson. 1998. Microbiology – A Human Perspective. Irwin Mc Graw– Hill / Bos.
4. Albert and Balows, W.J.Hausler, JR. K.L.Herrmann, H.D.Isenberg, H.Geneshadomy. 1992. Manual of Clinical Microbiology. American society for Microbiology, Washington.
5. Sell, S. 1996. Basic immunology. North Holland, London.

(For candidates admitted from 2022-23onwards)

HOLY CROSS COLLEGE (AUTONOMOUS) TIRUCHIRAPPALLI-2.

PG AND RESEARCH DEPARTMENT OF BOTANY

M.Sc. BOTANY

Second Year – Semester IV

Course Title	**MAJOR ELECTIVE 2- GENOMICS AND PROTEOMICS**
Total Hours	**90**
Hours/Week	**6Hrs/Wk**
Code	**P22BO4MET04**
Course Type	**Theory**
Credits	**5**
Marks	**100**

General Objectives:

To enable the students to understand the introduction to genomics, sequencing techniques and whole genome sequencing, assessing genomic variations, proteomic technologies, interaction of proteomics.

Course Objectives :

The learner will be able to

CO. No.	Course Objectives
CO-1	Remember, understand the introduction to genomics
CO-2	Apply and analyze the sequencing techniques and whole genome sequencing
CO-3	Understand and assessing genomic variations
CO-4	Remember and understand the proteomic technologies
CO-5	Understand and analyse the interaction of proteomics

GENOMICS

UNIT-I Introduction to Genomics: 18 hrs

Genome definition, Genomics and its diversifications, Structural organization of Prokaryotic and eukaryotic genomes; C value paradox, types and significance of repeats in the genome, Organelle genomes

UNIT-II Sequencing techniques and Whole Genome Sequencing: 18 hrs

Conventional Sequencing techniques (Maxam Gilbert and Sanger Sequencing), Strategies for Whole Genome Sequencing – Hierarchical and Whole Genome Shotgun Sequencing, role of Genetic and Physical maps in Genome assembly, De novo and reference based assembly, Genome finishing – Gaps and their resolution, basic concepts of genome annotation – ORF, ab initio and homology based Gene prediction Second generation sequencing techniques – Pyrosequencing and Virtual terminator Sequencing.

UNIT-III Assessing genomic variations: 18 hrs

Dominant and codominant markers, Homoplasy concept, Identical by state Vs Identical by descent markers, Hybridization based marker system – RFLP, PCR based marker systems – RAPD, AFLP, CAPS, SCAR, SSRs, Microarray based SNP detection techniques, Applications of DNA markers

PROTEOMICS

UNIT-IV Proteomic technologies: 18 hrs

Transcriptomes and analysis; SAGE, Microarray technology; Analytical proteomics tools (1-D & 2-D gel electrophoresis); Mass spectrometry and analysis (ESI, MALDI and Hybrid), LC/MS-MS; Applications of mass spectrometry (PMF and PTMs)

UNIT-V Interaction Proteomics: 18 hrs

Interactomes and Proteomic interactions (Y2H approaches, Co-IP); Proteome- wide interaction maps; Protein structure determinations and Structural proteomics tools (experimental and computational); Concepts of protein engineering.

Course Outcomes:
The Learner will be able to

CO No.	Course Outcomes	PSOs Addressed	Cognitive Level
CO-1	Explain the structural organization of Prokaryotic and eukaryotic genomes	PSO 2, PSO 5	An
CO-2	Describe the methods of conventional Sequencing techniques	PSO 2, PSO 5	An, Ap
CO-3	Compare the dominant and codominant markers	PSO 2, PSO 5	An

CO-4	List the applications of DNA markers	PSO 4, PSO 5	An
CO-5	Explain the microarray technology	PSO 4, PSO 5	Ap
CO-6	Describe the concept of protein engineering	PSO 2, PSO 5	R,U

Reference Books:

1. Discovering Genomics, Proteomics and Bioinformatics, 2nd Edition. Campbell AM & Heyer LJ, Benjamin Cummings 2007; CSH Press, NY. ISBN-10: 8131715590
2. Introduction to Genomics. A.M Lesk, Oxford University press, 2007. ISBN-10: 0199557489
3. Genome III – T.A. Brown Garland Science Publ. June 08, 2006. ISBN-10: 0815341385
4. Introduction to Proteomics: Tools for the New Biology. Daniel C. Liebler, Humana Press Inc., 2002. ISBN-10: 0896039919
5. Bioinformatics and Functional Genomics – Jonathan Pevsner - 2nd edition, Wiley-Blackwell, 2009. ISBN-10: 0471210048

(For candidates admitted from 2022-23 onwards)

HOLY CROSS COLLEGE (AUTONOMOUS) TIRUCHIRAPPALLI-2.

PG AND RESEARCH DEPARTMENT OF BOTANY

M.Sc. BOTANY
Second Year – SEMESTER IV

Course Title	**MAJOR ELECTIVE 3 – PLANT DISEASES AND PEST MANAGEMENT**
Total Hours	**90**
Hours/Week	**6 hrs /wk**
Code	**P22BO4MET06**
Course Type	**Theory**
Credits	**5**
Marks	**100**

General Objectives:

To enable the students to learn and remember the plant diseases,host-parasite interactions, plant disease management, food grain situation & principles of grain storage and principles of insect control.

Course Objectives :

The learner will be able to

CO. No.	Course Objectives
CO -1	understand the classification of plant diseases
CO -2	understand and remember the host-parasite interactions
CO -3	understand and remember the plant disease management
CO -4	Remember, understand and apply the food grain situation & principles of grain storage
CO -5	Understand, analyse and apply the principles of insect control

UNIT-1 Plant diseases: 18 hrs

Concept, importance and classification. Study of under metioned diseases: Fungal diseases- Leaf spot of paddy & ergot of cholam.
Bacterial diseases- Blight of paddy and Angular leaf spot of cotton.
Mycoplasmal disease- Citrus Greening.
Viral diseases- Cucumber mosaic and Bhendi yellow leaf banding.

UNIT II Host-Parasite Interactions 18 hrs

Pathogenesis- Penetration and entry by plant pathogen- development inside the host tissue.
Role of Enzymes and Toxins in disease development.
Effect of infection on the physiology of the host- permeability changes in diseased plant. Photosynthesis and respiration under pathogenesis. Changes in nitrogen metabolism and phenol content in infected plants.
Defence mechanisms in plants- Structural and biochemical defence mechanism.

UNIT III Plant disease management 18 hrs
Regulatory methods- Quarantines, Inspections. Cultural methods, physical and chemical methods.
Biological control- Role of biotechnology in plant disease control (chitinase gene, Bt gene, Meri cloning, in vitro- thio-uracil inclusion in tissue culture media).
IPM (Integrated Pest Management) IPM for rice, cotton, sugarcane, banana & ground nut.

UNIT IV Food grain situation and principles of grain storage 18 hrs

Insect pests of stored commodities- their ecology and infestation patterns. Damage and loses of stored commodities due to insect infestations. Detection and monitoring of insect infestation in stored products. Detection and estimation of contaminants in grains. Micro organisms and their role in commodity deterioration and their control.

UNIT V Insect control 18 hrs

Principles of insect control- physical, mechanical, biological, biochemical and chemical methods. Fumigants, their properties and fumigations. Pesticides formulations, prophylaxis of bags, storage premises, application equipments. House hold insects and their control. Sanitation in food processing and handling units. Rodent test of food grain and their control. Birds and their control.

Course Outcomes:
The Learner will be able to

CO No.	Course Outcomes	PSOs Addressed	Cognitive Level
CO-1	Explain the classification of plant diseases	PSO 2, PSO 5	An
CO-2	Discuss the host-parasite interactions	PSO 2, PSO 5	An, Ap
CO-3	Elaborate the plant disease management	PSO 2, PSO 5	An
CO-4	Discuss the food grain situation & principles of grain storage	PSO 4, PSO 5	An
CO-5	Explain the principles of insect control- physical, mechanical, biological, biochemical and chemical methods	PSO 4, PSO 5	Ap

Reference Books:

1. Chiang, HC 1977. Pest management in the people's Republic of China monitoring and forecasting insect population in Rice, Wheat, Cotton, Maize, FAO Plant Protection Bulletin 25(1-8)

2. Agarwal, RA, Gupta, GP, Kishore, P and Chandra, D (Eds) 1983: Principles and concepts of Integrated Pest Management, Entomology Division, IARI, New Delhi 8

3. Atwal, A. S 1986: Agricultural Pests of India and South-East Asia. Kalyani Publishers, Ludhiana 4. Flint, ML and Bosch, R Vanden 1981: Introduction of Integrated Pest Management Plenum Press, London. S

(For candidates admitted from 2022 onwards)

HOLY CROSS COLLEGE (AUTONOMOUS) TIRUCHIRAPPALLI-2

PG AND RESEARCH DEPARTMENT OF BOTANY

M.Sc., BOTANY

SEMESTER IV

Course Title	**SELF STUDY PAPER- NURSERY MAINTENANCE AND HOME GARDENING**
Code	**P22B04SST01**
Course Type	**Theory**
Credits	**2**
Marks	**100**

General objectives:

To enable the students to learn about cultivation of plants at different conditions, propagation of plants by various methods and laying of kitchen garden and ornamental garden. Considerable emphasis is also given on the cultivation of vegetables and fruits, floriculture and role of growth hormones in horticulture. It also imparts knowledge on management of gardens and horticultural organizations.

Course Objectives :

The learner will be able to

CO No.	Course Objectives
CO -1	Understand and apply the different types of cultivation methods of plants for Nursery
CO -2	Understand and apply the vegetative propagation of plants for gardening
CO -3	Remember and Understand cultivation of vegetables and fruits
CO -4	Understand the different cultivation methods of ornamental plants in home Gardening
CO -5	Remember the role of growth hormones in horticulture and different horticultural organizations.

UNIT – I Establishment & maintenance of Nursery, cultivation of potted plants, bonsai culture. Green house: glass house, cloth house, plastic house and mist chamber.

UNIT-II Preparation of soil, home manures, compost and fertilizers. Propagation of plants by seeds, vegetative propagation – cutting, layering & grafting.

UNIT-III Kitchen garden, lay outs and garden designing, classification of vegetables, cultivation of tropical vegetables – Leafy vegetables – *Alternanthera*, Root vegetable –Radish, Fruit vegetable – Brinjal & Lady's finger. Cultivation of fruits - Banana and Citrus.

UNIT-IV Ornamental garden: Layout and establishment, lawns, rockery, indoor garden,

terrace garden. Floriculture.

UNIT-V Role of hormones in horticulture. Plant after care. Management of common pests, diseases, and weeds in gardens. Horticultural organizations: IIHR, NHB.

Course Outcomes (CO):

The Learner will be able to

CO No.	Course Outcomes	PSOs Addressed	Cognitive Level
CO-1	Discuss the steps involved in establishment of nursery and it's maintenance	PSO3 , PSO 5	Ap
CO-2	Differentiate the various culturing methods of plants for nursery	PSO 3, PSO 5	U, Ap
CO-3	Explain different vegetative propagation of plants	PSO 3, PSO 5	U, Ap
CO-4	Outline the kitchen garden designing	PSO 3, PSO 5	U, Ap
CO-5	Describe various culture methods of fruits and vegetables	PSO 3, PSO 5	U, Ap
CO-6	Explain the method of establishing ornamental garden.	PSO 3, PSO 5	R,U
CO-7	Discuss the roles of horticultural organizations.	PSO 3	U, Ap

Text Books:

1. Mani Bhusahan Rao, K.1991. Text book of Horticulture-MacMillan India Ltd., Madras.
2. Soule, Judith D. and Piper, Jon K. 1992. Farming in Nature's Image: An Ecological Approach to Agriculture. Island Press, Washington, D. C.
3. Prasad and Kumar, 2014. Principles of Horticulture 2nd Edn. Agrobios (India).
4. Kausal Kumar Misra and Rajesh Kumar, 2014. Fundamentals of Horticulture Biotech Books.

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1. Edmond J.B., Senn, T.L. and Andrews, F.S. 1964 Fundamentals of Horticulture- Tata Mc Graw –Hill Publishing Company Ltd., New Delhi.
2. Masanobu Fukuoka.1985.Natural Way of Farming: The Theory and Practice of Green Philosophy.
3. Edmond J.B., Senn,T.L. and Andrews,F.S.1964 Fundamentals of Horticulture- Tata Mc Graw–Hill Publishing Company Ltd., New Delhi.
4. Peter M. And TessaEve. 2007. Garden planning and Garden design. South water Publishing. London.