B.Sc. Botany

Syllabus

AFFILIATED COLLEGES

Program Code: 22E

2022 – 2023 Batch

BHARATHIAR UNIVERSITY

(A State University, Accredited with "A++" Grade by NAAC,
Ranked 21st among Indian Universities by MHRD-NIRF)

Coimbatore - 641 046, Tamil Nadu, India

B.Sc. BOTANY

Syllabus

(For affiliated colleges)

(For 2022-2023 Academic Year Batch)

Revised Scheme of Examination with

Inclusion of Naan Muthalvan Skill courses

Program Code: 22E

Bharathiyar University
(A State University, Accredited with "A" Grade by NAAC and 13th Rank among Indian Universities by MHRD-NIRF)
Coimbatore 641 046, INDIA

BHARATHIAR UNIVERSITY, COIMBATORE 641046

DEPARTMENT OF BOTANY

1. MISSION

1) Impart the knowledge about classification, structure, function, reproduction and importance of various plant groups.
2) Discover and convey the scientific knowledge about plants.
3) Promote awareness about the various uses of plants.
4) Help the students to become consultant for ecological survey, environment assessment and biodiversity studies
5) To know the fundamental of Biostatistics, Bioinformatics tools and biophysical principles for the analysis of relevant biological situations and for developing intellectual skills on biological data and databases.
6) To in still societal, cultural and responsibilities in all professional activities.
7) Prepare the student for State and National Competitive Exams
8) Make the students as entrepreneurs in the plant-based industries.
9) Infuse interest in research activities.
10) To produce successful graduates with personal and professional responsibilities.

Instruction: PEOs are:

- **Statement of areas or fields where the graduates find employment**
- **Preparedness of graduates to take up higher studies**

Programme Educational Objectives (PEOs)	
The **B.Sc. Botany** programme describe accomplishments that graduates are expected to attain within five to seven years after graduation	
PEO1	Good scientific knowledge in biology.
PEO2	Critical thinking and problem-solving ability.
PEO3	Analytical ability and administrative skills.
PEO4	Design & development of solutions for health problems with medicinal plants.
PEO5	Effective functioning in Individual and Team works.
PEO6	Project Management.
PEO7	Leadership qualities.
PEO8	Effective communication skills
PEO9	Intellectual skills in various horizons.
PEO10	Application of ethical principles in work.

Instruction: Programme Specific Outcomes (PSOs)

These are what the students should be able to do at the time of graduation. The PSOs are programme specific. PSOs are written by the department offering the programme. There usually are five to seven PSOs for a department.

Programme Specific Outcomes (PSOs)	
After the successful completion of B.Sc Botany programme, the students are expected to	
PSO1	Attaining subject knowledge in terms of individual course as well as holistic programme.
PSO2	Idendify,classify and compare the features of different plant groups.
PSO3	Analytical reasoning through practicals.
PSO4	Acquire knowledge about modern techniques in plant science.
PSO5	Able to present scientific hypothesis and data.

Instruction: Programme Outcomes are narrow statements that describe what the students are expected to know and would be able to do upon the graduation. These relate to the skills, knowledge, and behaviour that students acquire through the programme.

Programme Outcomes (POs)	
On successful completion of the B.Sc. Botany programme	
PO1	The students could work in Research Institutes and raise useful crop varieties
PO2	The students become an Entrepreneur in Nurseries, Green house farming and Micro propagation.
PO3	The students become an Ecologist and Environmental Consultant and hence help in developing a pollution – free environment
PO4	After completing the course, the student will be efficient in medical content writing and become Pharmacognosy consultant and therefore help in developing new drugs.
PO5	The students could be employed as Plant Biochemist and analyse biochemical processes specific to plants
PO6	The students can become a farming consultant and thereby use his/her knowledge in scientifically improving the existing agriculture practices
PO7	The students become Plant Pathologist and analyse the pathogenesis of newly identified plant diseases and pests affecting the crops
PO8	The students become a Plant Geneticist and help in producing genetically modified plants to cater the needs of the society
PO9	The students become Plant Explorer, Taxonomist, thereby identifying and classifying new species of plants
PO10	The students get opportunities of becoming an efficient forest and park ranger

BHARATHIAR UNIVERSITY, COIMBATORE: 641 046

B.Sc. BOTANY (Affiliated Colleges)

(Syllabus for the students those who are admitted from the Academic year 2022-2023 onwards)

SCHEME OF EXAMINATION - CBCS PATTERN

Part	Study Components	Course Title	Ins.hrs/week	Examinations				Credits
				Dur.	CIA	Mark	TotalMark	
	SEMESTER I							
I	Language – I		6	3	25	75	100	4
II	English – I		6	3	25	75	100	4
III	Core Paper I– Plant diversity I (Algae, Fungi, Lichen and Plant Pathology).		8	3	25	75	100	4
	Core Practical - I		2	-	-	-	-	-
	Allied -I Paper I Zoology / Chemistry.		4	3	20	55	75	3
	Allied Practical.		2	-	-	-	-	-
IV	Environmental Studies #		2	3	-	50	50	2
	Total		**30**	**15**	**95**	**330**	**425**	**17**
	SEMESTER II							
I	Language – II		6	3	25	75	100	4
II	English – II		4	3	20	30	50	2
	Language proficiency for Employability http://kb.naanmudhalvan.in/Special:Filepath/Cambridge_Course_Details.pdf		2	2	25	25	50	2
III	Core Paper II - Plant diversity II (Bryophytes, Pteridophytes, Gymnosperms & Palaeobotany)		8	3	25	75	100	4
	Core Practical- Paper I and II.		2	3	40	60	100	4
	Allied -II - Paper II Zoology / Chemistry.		4	3	20	55	75	3
	Allied I Practical.		2	3	20	30	50	2
IV	Value Education – Human Rights #		2	3	-	50	50	2
	Total		**30**	**21**	**175**	**400**	**575**	**23**
	SEMESTER III							
I	Language – III		6	3	25	75	100	4
II	English – III		6	3	25	75	100	4
III	Core Paper III Cell Biology & Lab Techniques.		5	3	25	75	100	4
	Core practical		2	-	-	-	-	-
	Allied III - Paper I Chemistry / Zoology		4	3	20	55	75	3
	Allied Practical		2	-	-	-	-	-
	Skill based Subject Paper I –Plant Bioresources		3	3	20	55	75	3
	Tamil @ / Advanced Tamil# (OR) Non-major			3	-	50	50	2

	elective - I (Yoga for Human Excellence) # / Women's Rights#	2					
	Total	**30**	**18**	**115**	**385**	**500**	**20**
	SEMESTER – IV						
I	Language – IV	6	3	25	75	100	4
II	English – IV	6	3	25	75	100	4
III	Core Paper IV-Anatomy& Embryology	4	3	25	75	100	4
	Core Practical II - Paper III &IV	2	3	30	45	75	3
	Allied IV - Paper II Chemistry / Zoology	4	3	20	55	75	3
	Allied II Practical	2	3	20	30	50	2
IV	Skill based subject paper II – Computing Skills for Industry 4.0	2	3	20	30	50	2
NM	NAAN MUDHALVAN: Digital Skills for Employability readiness http://kb.naanmudhalvan.in/Special:Filepath/Microsoft_Course_Details.xlsx	2	-	25	25	50	2
	Tamil @ /Advanced Tamil # (OR) Non-major elective -II (General Awareness #)	2	3	-	50	50	2
	Total	**30**	**24**	**190**	**460**	**650**	**26**
	SEMESTER – V						
III	Core Paper V - Taxonomy of Angiosperms and Economic Botany.	5	3	25	75	100	4
	Core Paper VI – Genetics ,Plant Breeding, Evolution and Biostatistics.	4	3	25	75	100	4
	Core Paper VII -Ecology & Phytogeography.	4	3	25	75	100	4
	Core Paper VIII- Microbiology-Fundamentals of Microbiology.	4	3	25	75	100	4
	Core Practical Paper V,VI&VII	4	-	-	-	-	-
	Elective – I	4	3	25	75	100	4
	Elective Practical	2	-	-	-	-	-
IV	Skill based Subject Paper II - Medicinal Botany and Human Welfare.	3	3	20	55	75	3
	Total	**30**	**18**	**145**	**430**	**575**	**23**
	SEMESTER – VI						
III	Core Paper IX Biophysics, Biochemistry & Plant Physiology.	5	3	25	75	100	4
	Core Paper- X Horticulture	5	3	25	75	100	4
	Elective – II	5	3	25	75	100	4
	Elective – III	5	3	25	75	100	4
	Core Practical III- Paper V, VI &VII		3	40	60	100	4
	Core Practical- IV - Paper IX & X	4	3	30	45	75	3

	Elective Practical - Practical for Elective subjects I, II & III & Core paper VIII.\	2	3	20	30	50	2
	Skill based Subject Practical – for SKB Paper I, II & III	2	3	20	30	50	2
NMS	Medical coding for employability (Under Naan Mudhalvan Scheme) Find the link for syllabus/course content	2	-	25	25	50	2
	Extension Activities @	-	-	50	-	50	2
	Total	**30**	**24**	**280**	**495**	**775**	**31**
	Total	**180**	**120**	**1000**	**2525**	**3500**	**140**

@ No University Examinations. Only Continuous Internal Assessment (CIA)

#No Continuous Internal Assessment (CIA). Only University Examinations.

List of Elective papers (Colleges can choose any one of the paper as electives)

Elective – I	**A**	Microbiology – Applied Microbiology
	B	Plant Pathology
	C	Economic Botany
Elective – II	**A**	Biotechnology – Concepts & Techniques
	B	Seed Biology
	C	Pomology
Elective - III	**A**	Biotechnology – Applied biotechnology
	B	Ethnobotany
	C	Bioinformatics

Course code		PLANT DIVERSITY - I	L	T	P	C
Core/Elective/ Supportive		Core paper - I	120			4
Pre-requisite		Basic knowledge in Algae, Fungi and Lichens and basic knowledge in host pathogen interaction gained in previous classes.	Syllabus Version		2021-2022	

Course Objectives:

The main objectives of this course are :

1. To get a thorough knowledge of general characters and classification of algae and life cycle of Chlorophyceae members.
2. To obtain a clear picture of Navicula, Sargassum, Polysiphonia and Nostoc.
3. To acquire knowledge about general characters and classification of fungi and structure and reproduction of type specimens.
4. To understand the types, distribution, structure and reproduction of Lichens.
5. To learn the different pathogenic organisms of plants causing various diseases.

Expected Course Outcomes:

On the successful completion of the course, students are able :

1	To understand thallus organization, reproduction and classification of algae, structure and reproduction of Chlorophyceae members	K2
2	To get clear idea about members of Bacillariophyceae, Phaeophyceae, Rhodophyceae and Cyanophyceae	K2
3	To learn the classification and salient features of fungi	K4
4	To overview the structure and reproduction of Lichens.	K3
5	To Implement knowledge on management of plant diseases to increase crop yield.	K3

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

Unit:1	Algae - Introduction	30 hours
Range of thallus organization, pigmentation, reserve food and reproduction; Classification of Algae - G.M. Smith, Study of the structure, reproduction and life cycle of Volvox, Ulva, Spirogyra and Caulerpa.		
Unit:2	**Algae - II**	**15 hours**
Structure, reproduction and life cycle of Navicula, Sargassum, Polysiphonia and Nostoc.		
Unit:3	**Fungi - Introduction**	**30 hours**
Fungi and Lichen: Range of thallus organization, nutrition and reproduction of fungi; Classification of fungi (Alexopoulos & Mims 1973) structure and reproduction of Albugo, Saccharomyces, Aspergillus.		
Unit:4	**Fungi – II & Lichens**	**30 hours**
Structure and reproduction of Puccinia, Polyporus and Fusarium. Structure, reproduction and ecological importance of Lichens, crustose, foliose and fruticose.		
Unit:5	**Plant pathology**	**15 hours**
Plant Pathology: Study of the following plant diseases with special reference to the symptoms, causal organism and disease cycle and control measure of 1. Blast disease of rice 2. Red rot of sugarcane 3. Tikka disease 4. Citrus canker 5. TMV		
	Total Lecture hours	**120 hours**
Practicals:		
Study the types mentioned in Algae, Fungi, Lichen, and Plant Pathology		

Text Books

1	Vashishta, B.R., Sinha, A.K. and Singh, V.P. (2008) Botany for Degree Students: Algae. S. Chand & Company Ltd., New Delhi.
2	Vashishta, B.R. (1990). Botany for Degree Students: Fungi. S. Chand & Company Ltd., New Delhi.
3	Sambamurthy, A.V.S.S. (2006). A Textbook of Algae. I.K. International Pvt. Ltd., New Delhi.
4	Pandey, B.P. (2001). College Botany Vol. I: Algae, Fungi, Lichens, Bacteria, Viruses, Plant Pathology, Industrial Microbiology and Bryophyta. S. Chand & Company Ltd., New Delhi.
5	Kumar, H.D. (1999). Introductory Phycology (2nd edition). Affiliated EastWest Press Pvt. Ltd. Delhi.

	Reference Books
1	Mehrotra, RS & Aneja, KR. 1999. An Introduction to Mycology, 2nd Ed. New Age International Publishers, New Delhi.
2	Hale, 1996. The biology of Lichens, New Age International Publishers, New Delhi.
3	Sharma OP. 1989. Text Book of fungi. Tata McGraw Hill, New York.
4	Alexopoulos, C.J., Mims, C.W. and Blackwell, M. (1996). Introductory Mycology (4th edition). John Wiley and Sons (Asia), Singapore.
5	Sethi, I.K. and Walia, S.K. (2011). Text book of Fungi & Their Allies. MacMillan Publishers Pvt. Ltd., Delhi.
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://swayam.gov.in/nd2_cec20_bt11/preview
2	https://www.mooc-list.com/course/introduction-algae-coursera
3	https://swayam.gov.in/nd2_cec20_bt13/preview
4	https://www.youtube.com/watch?v=Dd8heneTj9I
5	https://www.youtube.com/watch?v=5ogUuEwjRT8
6	https://www.youtube.com/watch?v=HRcPh7DwcY0
Course Designed By: **Dr.R.Kannan.**	Verified by: **Dr.K.Padmavathi.**

Mapping with Programme Outcomes										
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	M	S	S	S	S	S	S	M	M
CO2	M	S	M	M	S	S	S	S	S	S
CO3	S	S	M	M	S	S	M	S	M	S
CO4	M	S	S	S	M	S	S	M	S	S
CO5	S	M	S	S	S	S	M	S	S	M

*__S__-Strong; __M__-Medium; __L__-Low

Course code		PLANT DIVERSITY - II (Bryophytes, Pteridopytes, Gymnosperms and Palaeobotany)	L	T	P	C
Core/Elective/Supportive		Core paper - II	120			4
Pre-requisite		Knowledge gained in structure reproduction and economic importance of Bryophytes, Pteridopytes and Gymnosperms. Basic knowledge about fossilization studied in H.Sc.	Syllabus Version		2021-2022	

Course Objectives:

The main objectives of this course are :

1. To understand the classification of Bryophytes and structure and reproduction of few members.
2. To learn about the classification of Pteridophytes, evolution of stele and life cycle of Selaginella and Equisetum.
3. To Study of Heterospory and seed habit and members of Pteropsida.
4. To gain knowledge about of classification of Gymnosperm and general characters of Cycas and Gnetum.
5. To Explore Paleobotany, Geological time scale, fossil studies, techniques of carbon dating and few types.

Expected Course Outcomes:

On the successful completion of the course, student are able to:

1	Get an overview about classification of Bryophytes and their representative members.	K2
2	Gain in depth knowledge about Pteridophytes classification, evolution of stele and life cycle of Lycopodium and Equisetum.	K2
3	Know about Heterospory and seed habit and life cycle of Dicranopteris and Marselia.	K3
4	Overall view about Gymnosperms and its type species.	K2
5	Understand Paleobotany, types of fossils and analysis of fossil age with few examples.	K4

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

Unit:1	**Bryophytes**	**15 hours**
Classification of Bryophytes (Rothmaler). Structure and reproduction of Riccia, Anthoceros and Polytrichum..		
Unit:2	**Pteridophytes - I**	**30 hours**
Classification of Pteriodophytes (K.R.Sporne) Stelar evolution, Structure and Reproduction of Lycopodium and Equisetum.		
Unit:3	**Pteridophytes - II**	**30 hours**
Heterospory and Seed Habit, Structure and Reproduction of Dicranopteris and Marsilea.		
Unit:4	**Gymnosperms**	**30 hours**
Classification of Gymnosperms (K.R.Sporne) Structure and Reproduction of Cycas and Gnetum.		
Unit:5	**Palaeobotany**	**15 hours**
Geological time scale, Radio carbon dating, Fossils and kinds of fossils. Study of the following: Lepidodendron (Stem), Lepidocarpon (Fruit) and Williamsonia.		
	Total Lecture hours	**120 hours**

Practicals:

Study the types mentioned below:

Bryophytes: *Riccia, Anthoceros* and *Polytrichum*.

Pteridophytes: *Lycopodium, Equisetum, Dicranopteris* and *Marsilea*.

Gymnosperms: *Cycas* and *Gnetum*.

Palaeobotany*:* *Lepidodendron, Lepidocarpon* and *Williamsonia*.

SKILL BASED COURSE	**UNDER NAAN MUDHALVAN SCHEME**	www.naanmudhalvan.tn.gov.in
01	Organic farming	NPTEL / IIT Kharagpur

Text Books	
1	Palaniyappan, S. (1988). Bryophyta (In Tamil). T.K. Publishing House, Chennai.
2	Rashid, A. (1998). An Introduction to Bryophyta. Vikas Publishing House (P) Ltd., New Delhi.
3	Vashista, P.C. (1997). Botany for Degree Students Pteridophyta. S. Chand and Company Ltd., New Delhi.
4	Vashishta, P.C. (1996). Botany for Degree Students-Gymnosperms (2nd Edn.,). S. Chand and Company Ltd., New Delhi.

5	Sporne, K.R. (1971). The Morphology of Gymnosperms (The Structure and Evolution of Primitive seed Plants). Hutchinson University Library, London.
6	Venkatachala, B.S., Shukla, M. and Sharma, M. (1992). Plant Fossils-a Link with the Past (A Birbal Sahni Birth Centenary Tribute). Birbal Sahni Institute of Paleobotany, Lucknow.

	Reference books
1	Smith, G.M. (1955). Cryptogamic Botany Vol. II Bryophytes and Pteridophytes (2nd edn.). Tata McGraw Hill Publishing Co., New Delhi.
2	Rashhed, A. (1999). An Introduction to Pteridophyta. Vikas Publishing House (P) Ltd., New Delhi.
3	Sporne, K.R. (1970). The Morphology of Pteridophytes (The Structure of Ferns and Allied Plants). Hutchinson University Library, London.
4	Srivastava, H.N. (1998). Gymnosperms. Pradeep Publications, Jalandhar.
5	Pandey et al., 1998. A Text Book of Botany Vol. II. S. Chand & Co. Ltd. 1980.
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://swayam.gov.in/nd2_cec20_bt11/preview
2	https://www.youtube.com/watch?v=sEEVVCQKx68
3	https://www.youtube.com/watch?v=avK7hGnaRAY
4	https://www.youtube.com/watch?v=zZ6XPDDeVwk
5	https://www.youtube.com/watch?v=aNsFLFh--vI

Course Designed By: **Dr.R.Kannan.** Verified by: **Dr.K.Padmavathi.**

Mapping with Programme Outcomes										
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	M	S	S	M	M	M	M	M	S	S
CO2	M	S	S	M	S	S	M	M	M	S
CO3	S	S	S	M	M	S	M	M	S	S
CO4	M	S	S	M	M	S	S	S	S	S
CO5	S	M	S	M	M	M	M	S	S	M

*__S__-Strong; __M__-Medium; __L__-Low

course code		CELL BIOLOGY AND LAB TECHNIQUES	L	T	P	C
Core/Elective/ Supportive		Core paper - III	75			4
Pre-requisite		Basic knowledge about structure and function of cell organelle, cell cycle and instrumentation gained in Std XII	Syllabus Version		2021-2022	

Course Objectives:

The main objectives of this course are :

1. To gain knowledge about cell structure, difference between Prokaryotic and Eukaryotic cell, structure and function of cell wall, plasma membrane and cell organelles.
2. To know about mitochondria, chloroplast, nucleus and chromosome.
3. To study about mitosis and meiosis, DNA structure, its replication along with protein synthesis.
4. To learn the principle of pH meter, calorimeter, spectrometer, centrifugation and microscopy.
5. To study about Chromatography and Electrophoresis.

Expected Course Outcomes:

On the successful completion of the course, students are able to:

1	Get a thorough knowledge of cell, cell wall, plasma membrane and cell organelles.	K1
2	Gaining knowledge about mitochondria, chloroplast, nucleus and chromosome.	K2
3	Understand cell divisions, DNA structure, and its replication along with protein synthesis.	K3
4	Technically able to handle pH meter, calorimeter, spectrometer, centrifugation and microscopy	K3
5	Know technique and applications of Chromatography and Electrophoresis methods.	K4

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

Unit:1	Cell Biology	20 hours
Structure of Plant Cell – Prokaryotic and Eukaryotic cell, Structure and function of cell wall, plasma membrane (fluid mosaic model), endoplasmic reticulum, ribosomes, Golgi bodies and lysosomes.		
Unit:2	**Cell Organelles**	**15 hours**
Mitochondria, Chloroplast, Nucleus, Chromosome and giant chromosomes. (Structure and function only)		
Unit:3	**Nucleic acids and Cell Division**	**15 hours**
Nucleic acid - Structure of DNA (Watson & Crick Model), Replication of DNA (Semi-conservative method). RNA - types, Protein synthesis. Cell division: Mitosis and Meiosis		
Unit:4	**Lab Techniques I**	**15 hours**
Principles, Operation, Techniques and uses of pH meter, Colorimeter, Spectrophotometer, Centrifugation. Microscopy – light, SEM and TEM.		
Unit:5	**Lab Techniques II**	**10 hours**
Principles and elementary knowledge of Chromotography (paper, T L C & Column), Electrophoresis PAGE (Basics).		
	Total Lecture hours	**75 hours**
Practicals:		
1. Study of mitosis using Onion roots 2. Study of cell organelles through slides and Photographs **3.** Demonstration of pH meter, Colorimeter, Spectrophotometer centrifuge, chromatography (leaf pigments - paper only) and Electrophoresis PAGE only		

Text Books	
1	Verma, P.S. and V.K. Agarwal, 2014, Cytology. S. Chand, New Delhi.
2	Verma, P.S. and Agarwal, V.K. (1986). Cell Biology and Molecular Biology (Cytology). S. Chand and Company Ltd., New Delhi.
3	N.Arumugam (2015),Cell Biology,Saras Publication.,Nagercoil., Tamil Nadu
4	L Veerkumari (2011), Bioinstrumentation, MJP Publishers Chennai
5	N.Arumugam and V.Kumaresan(2015), Biophysics and Bioinstrumentation ,Saras Publication.,Nagercoil., Tamil Nadu
6	Veer bala rastogi(2005),Introductory cytology, kedarnath ramnath,meerut

	Reference books
1	De Robertis, E.D.P. and De Robertis, E.M.F. Jr. (1980). Cell and Molecular Biology (7th Ed). Saunders College/Holt, Rinehart and Winson, Philadelphia.
2	Sharma, N.S. (2005). Molecular Cell Biology. International Book distributors, Dehradun.
3	Power, C.B. (1984). Cell Biology. Himalaya Publishing Co., Mumbai.
4	Skoog and Leary. 1992. Principles of Instrumental analysis, 4th Edition. Saunder's College Publishing, New York.
5	Wilson, K. and Walker, J. 2000. Principles and Techniques of Practical Biochemistry, 5th edition, Cambridge University Press, Cambridge.
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://swayam.gov.in/nd2_cec19_bt12/preview
2	https://www.google.com/search?q=neela+bakore+tutorials+cell+the+unit+of+life&oq=neela+bakore+tutorials
3	https://nptel.ac.in/courses/102/103/102103012/
4	https://www.youtube.com/watch?v=zufaN_aetZI
5	https://www.youtube.com/watch?v=NFdeXi9Gfpc
6	https://swayam.gov.in/nd1_noc20_bt31/preview
7	http://www.bio-nica.info/Biblioteca/Bolsover2004CellBiology.pdf
8	https://www.academia.edu/36419728/LECTURE_NOTES_CELL_BIOLOGY
9	https://www.google.com/search?q=meiosis+by+neela+bakore
10	https://www.youtube.com/watch?v=VdNhREmkrmE

Course Designed By: **Dr.R.Kannan.** Verified by: **Dr.K.Padmavathi..**

Mapping with Programme Outcomes										
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	S	M	S	S	M	S	S	M	M
CO2	S	S	M	M	S	S	S	S	M	M
CO3	S	M	M	S	S	M	S	S	M	M
CO4	S	S	S	S	S	S	S	S	S	M
CO5	S	S	S	S	S	S	S	S	S	M

*__S__-Strong; __M__-Medium; __L__-Low

course code		ANATOMY AND EMBRYOLOGY	L	T	P	C
Core/Elective/ Supportive		Core paper - IV	60			4
Pre-requisite		Basic knowledge in structure and function of tissues and its organisation, internal structure of plant parts, pollination and fertilization changes gained in lower classes.	Syllabus Version		2021-2022	

Course Objectives:

The main objectives of this course are to:

1. Learn about Meristems, various theories of Meristems, simple and complex tissues and stomatal types
2. Gain knowledge about anatomy of stem, root and leaf and their secondary growth
3. Understand deviation in normal secondary growth in Dicots and few Arborescent monocots
4. Overview the structure of micro and mega sporangium and gametophytes
5. Grasp the idea of Double fertilization, types of endosperms, dicot embryo development along with Polyembryony, Parthinocarpy and Apomixis.

Expected Course Outcomes:

On the successful completion of the course, students are able to:

1	Gain knowledge about meristem and tissue types.	K1
2	Understand histology of stem, root and leaf and their secondary growth.	K2
3	Appreciate anomalous secondary growth in Dicots and Monocots.	K5
4	Figure out embryology, structure and development of male and female sporangium, micro and mega gametophyte.	K2
5	Get a thorough knowledge of fertilization, types of endosperm, dicot embryo and enjoy Polyembryony, Parthenocarpy and Apomixis	K4

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

Unit:1	Tissues	15 hours
Structure and function of Apical Meristems - Root Apex and Shoot Apex - Theories of Meristems. Structure and function of simple and permanent tissues - Parenchyma, Collenchyma, Sclerenchyma, Xylem and Phloem. Structure and types of stomata. .		
Unit:2	**Anatomy of Plant Parts**	**15 hours**
Types of vascular bundles, Primary Structures of Dicot and Monocot root and stem. Structure of Dicot and Monocot leaf. Secondary growths of Dicot stem and root.		
Unit:3	**Anomalous Secondary Growth**	**10 hours**
Anomalous secondary growth in Dicots - Intraxylary phloem, Successive cambia, cortical and medullary vascular bundles and Arborescent monocots (Primary anomalies)		
Unit:4	**Gametogenesis**	**10 hours**
Structure and development of microsporangium, male gametophyte, Types of ovules, mega sporangium, female gametophyte (Polygonum type)		
Unit:5	**Post Fertilization Changes**	**10 hours**
Double fertilization, endosperm - Structure, development and types of endosperm. Structure and development of dicot embryo (Capsella). Polyembryony, Parthenocarpy and Apomixis		
	Total Lecture hours	**60 hours**

Practicals:

Anatomy:

Study of tissues mentioned in the theory

1. Identifying stomatal types using leaf peel method (Any one example for each type)
2. Stem - Primary structure - *Tridax, Cucurbita* and *Sorghum*
3. Root Primary structure – *Bean and Canna*
4. Leaf – *Nerium*.
5. Anomalous Secondary thickening - *Boerhavia, Nyctanthes* and *Achyranthes*.

Embryology:

1. T.S of anther.
2. Various stages of development of male and female gametophyte, endosperm, embryo sac and polyembryony to be studied from permanent slides.
3. Embryo Mounting - *Tridax* or *Crotalaria.*
4. Types of ovules - (permanent slide)

	Text Books
1	Vasishta, P.C. (1977). A Text Book of Plant Anatomy. S. Nagin and Co., New Delhi.
2	Pandey B.P. 2007 Plant Anatomy, S. Chand & Co. De, New Delhi.
3	Maheswari, P. (1985). An Introduction to the Embryology of Angiosperms. Tata McGraw Hill Publishing Co. Ltd., New Delhi.
4	Bhojwani, S.S. and Bhatnagar, S.P. (2000). The Embryology of Angiosperms (4th Edition). Vikas Publishing House (P) Ltd., UBS Publisher's Distributors, New Delhi.
5	Annie Regland. (2000). Developmental Botany -Saras Publication, Kanyakumari

	Reference Books
1	Fahn, A. (1997). Plant Anatomy. Pergamon Press, Oxford.
2	Esau, K. (1991). Plant Anatomy. Wiley Eastern Ltd. New Delhi. 7th Edition
3	Raghavan, V. (1997). Molecular Embryology of Flowering Plants. Cambridge University Press, Cambridge.
4	Singh, Pandey and Jain, (2007). Anatomy of Seed plants, Rastogi Publications. New Delhi.
5	Swamy, B.G.L. and Krishnamoorthy, K.V. (1980). From Flower to Fruit. Tata McGraw Hill Publishing Co. Ltd., New Delhi.
	Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]
1	http://virtualplant.ru.ac.za/Main/ANATOMY/prac5.htm
2	https://www.youtube.com/watch?v=Q1VosdthSLM
3	https://www.youtube.com/watch?v=WfURKyslthI
4	https://www.youtube.com/watch?v=2_Kj_GtWBdU
5	https://www.biologydiscussion.com/stems-2/dicot-stem/secondary-growth-in-dicot-stem-with-diagram/70397
6	https://www.google.com/search?q=neela+bakore+reproduction+in+flowering+plants
Course Designed By: **Dr.R.Kannan.**	Verified by: **Dr.K.Padmavathi.**

Mapping with Programme Outcomes										
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	S	S	M	S	M	M	M	S	S
CO2	S	S	M	M	M	S	M	M	M	M
CO3	M	M	S	M	S	M	S	M	S	S
CO4	S	S	S	M	M	M	S	S	S	S
CO5	S	S	S	M	M	M	S	S	S	S

*__S__-Strong; __M__-Medium; __L__-Low

Course code		TAXONOMY OF ANGIOSPERMS AND ECONOMIC BOTANY	L	T	P	C
Core/Elective/Supportive		Core paper -V	75			4
Pre-requisite		Basic knowledge in classification of plants, Morphology, Taxonomy and their indigenous uses gained during H.Sc level.	Syllabus Version		2021-2022	

Course Objectives:

The main objectives of this course are:

1. To learn morphology and classification of Angiosperms
2. To understand herbarium preparation, nomenclature, publication and modern trends in taxonomy
3. To describe the characters of families and economic importance of
   i) Polypetalae families
   ii) Gamopetalae families
   iii) Monochlamydeae and monocot families

Expected Course Outcomes:

On the successful completion of the course, student are able to:

1	Get a thorough knowledge of descriptive term used in taxonomy and its classification	K1
2	Know about herbarium techniques, nomenclature, typification, author citation and modern trends in taxonomy	K2
3	Understand the descriptive characters of families/their pollination methods of Polypetalae families and their economic importance	K3
4	Understand the descriptive characters of families/their pollination methods of Gamopetalae families and their economic importance	K3
5	Understand the descriptive characters of families/their pollination methods of Monochlamydeae and Monocot families and their economic importance	K3

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

Unit:1	Morphology and classification	15 hours

Descriptive terms used in taxonomy –Parts of plant, Phyllotaxy, Types of leaves, Inflorescence, floral parts and arrangement, fruits. Taxonomy and its significance. Systems of classification - Natural - Bentham & Hooker, Modern Takhtajan (outline only),APG System of plant classification (outline only).

Unit:2	Herbarium technique and Taxonomy	15 hours

Herbarium technique and uses, Nomenclature -ICBN, Priority, Typification, Effective and Valid publication. Author citation. Modern trends in Taxonomy (general)

Unit:3	Polypetalae families	15 hours

A detailed study of the following families and the economic importance of types and pollination mechanisms wherever applicable. Annonaceae, Capparidaceae, Malvaceae, Rutaceae, Anacardiaceae, Curcurbitaceae and Apiaceae.

Unit:4	Gamopetalae families	15 hours
Rubiaceae, Asteraceae, Asclepiadaceae, Convolvulaceae, Acanthaceae and Lamiaceae.		
Unit:5	**Monochlamydeae and monocot families**	**15 hours**
Amaranthaceae, Moraceae Orchidaceae, Canaceae and Poaceae.		
	Total Lecture hours	**75 hours**

Practicals :

1. Taxonomical studies of selected plant species included in the families mentioned in the theory syllabus.

2. Study of economic products of the plants belonging to the families mentioned in the theory syllabus.

3. Field trip for 5 days to study vegetation in Tamil Nadu and neighbouring states.

4. Students should submit 20 herbarium sheets of local plants (weeds) along with tour/trip report and field note book at the time of practical examination.

Text Books

1	Pandey, BP. 1999. Taxonomy of Angiosperms, S. Chand, New Delhi
2	Singh, V. and D.K. Jain. (1997). Taxonomy of Angiosperms. Rastogi Publications, New Delhi.
3	Sharma, O.P. (1986). Modern taxonomy. Rastogi Publications, New Delhi.
4	Pandey, B.P. (2000). Economic Botany. S. Chand & Company Ltd., New Delhi.
5	Verma, V. (1974). A Text Book of Economic Botany. Emkay Publications, New Delhi.

Reference Books

1	Lawrence, G.H.M. (1955). An Introduction to Plant Taxonomy. The Central Book Depot, Allahabad.
2	Mathews, K.M. (1987-90). Flora of Tamilnadu Carnatic (1-4vols.) Rapinat Herbarium, Trichy.
3	Naik, V.N. (1996). Taxonomy of Angiosperms (9th Ed.). Tata McGraw-Hill Publishing Co., (P) Ltd., New Delhi.
4	Narayanaswamy, R.V. and Rao, K.N. (1976). Outlines of Botany. S. Viswanathan Printers & Publishers, Chennai.

5	Sen, S. (1992). Economic Botany. New Central Book Agency, Calcutta.
6	Hill, A.W. (1952). Economic Botany. Tata McGraw–Hill Publishing Co., New Delhi.
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://swayam.gov.in/nd2_cec19_bt10/preview
2	https://nptel.ac.in/courses/102/107/102107075/
3	https://www.swayamprabha.gov.in/index.php/program/archive/9
4	https://www.youtube.com/watch?v=qIAoMgHtyOc
5	https://www.youtube.com/watch?v=vMs16X1H4tk
6	https://www.youtube.com/watch?v=q3_8pvZebXQ
Course Designed By: **Dr.R.Kannan.**	Verified by: **Dr.K.Padmavathi.**

Mapping with Programme Outcomes										
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	S	S	S	M	S	M	S	S	S
CO2	S	S	S	S	M	S	M	S	S	S
CO3	S	S	S	S	S	S	S	S	S	S
CO4	S	S	S	S	S	S	S	S	S	S
CO5	S	S	S	S	S	S	S	S	S	S

*__S__-Strong; __M__-Medium; __L__-Low

Course code		GENETICS, PLANT BREEDING , EVOLUTION AND BIOSTATISTICS	L	T	P	C
Core/Elective/Supportive		Core paper - VI	60			4
Pre-requisite		Basic knowledge in structure and function of chromosomes, genes and mendelian inheritance gained in Std XII and II UG.	Syllabus Version		2021-2022	

Course Objectives:

The main objectives of this course are to:

1. Overview Mendelian inheritance, basic cross types and gene interaction

2. Understand linkage and crossing over, multiple alleles, blood groups, polyploidy and sex determination

3. Learn mutation types, mutagens, Cytoplasmic inheritance, Gene structure, Genetic code, DNA bar-coding.

4. Impart knowledge about plant breeding methods and basic theories of evolution

5. Learn basics of biostatics in biological context

Expected Course Outcomes:

On the successful completion of the course, student are able to:

1	Learn Mendelian inheritance, monohybrid, dihybrid, back and test cross, incomplete dominance, gene interaction .	K2
2	Appreciate linkage and crossing order, multiple alleles, polyploidy and determination of sex.	K2
3	Get a thorough knowledge of mutation, cytoplasmic inheritance, gene structure, genetic code and DNA bar-coding.	K3
4	Gain knowledge of plant breeding and evolution.	K2
5	Enable to handle Biostatistics problems and analyze biological data.	K4

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

Unit:1	**Classical Genetics-I**	**12 hours**
Mendelian inheritance, Monohybrid and Dihybrid cross, Test cross, Back cross, Incomplete dominance, Gene Interaction (Complementary, Supplementary, Duplicate and Inhibitory), Polygenic inheritance.		
Unit:2	**Classical Genetics-II**	**12 hours**
Linkages and crossing over Multiples alleles - Blood groups in man, Mutation types, physical and Chemical Mutagens, Sex determination in plants.		
Unit:3	**Cytogenetics**	**12 hours**
Polyploidy Cytoplasmic inheritance, Population Genetics, Gene structure and function, Genetic code, DNA barcoding in plants.		
Unit:4	**Plant breeding and Evolution**	**12 hours**
Plant breeding - Objectives, Plant introduction, Selection, Hybridization, hybrid vigour, - Breeding for disease resistance. Evolution – Evolutionary theories- Lamark, Darwin, Deviris- Modern synthetic theory.		
Unit:5	**Biostatistics**	**12 hours**
Biostatistics Data, Types and methods of collection of Data, Sampling techniques, Frequency distribution. Presentation of Data – Tabulation – Parts of Table, Types of table, Graphic representation of data- Histogram. Measures of central tendency– Arithmatic Mean, Median and Mode. Measures of dispersion – Standard Deviation and standard error. Test of significance – Chi-Square test Goodness of fit.		
	Total Lecture hours	**60 hours**

Practicals :

1. Observation of charts for Mendelian ratios, Gene interaction and Linkage - Simple Problems in genetics.
2. Hybridisation techniques

3. Simple problems in Mean, Median and Mode in Biostatistics.

	Text Books
1	Gupta, P.K. & M.S. Swaminathan. (2000). Cytology, genetics and Evolution. Rastogi Publication, Meerut.
2	Gupta, P.K. (2004). Elements of genetics. FNA 2nd Edition.
3	Meyyan, R.P. (2000). Genetics & Evolution. Saras Publication, Nagercoil.
4	Chaudhari, H.K. (2005). Elementary principles of plant breeding (25th Ed.). Oxford & IBH Publishing Co. (P) Ltd., New Delhi.
5	Arumugam, N. (2003). Basic concepts of Biostatistics. Saras Publications, Nagarcoil.
6	Palanichamy, S & M. Manoharan. (1994). Statistical methods for biologists. Paramount Publication, Palani.

	Reference Books
1	Sinha, U. and Sinha, S. (1989). Cytogenetics, Plant Breeding & Evolution. Vikas Publishing House, New Delhi.
2	S.P. Gupta, S.P. (2001). Statistical methods. Sultan Chand & Sons, Educational Publishers, New Delhi.
3	Verma, P.S. and Agarwal, V.K. (1999). Concepts of Evolution. S. Chand & Company Ltd., New Delhi.
4	Sinnott, E.W., Dunn, L.C. and Dobshansky, J. (1958). Principles of Genetics (5th Edition) McGraw Hill Publishing Co., New York.
5	Strickberger, M.W. (1976). Genetics (2nd Ed.). MacMillan Publishing Co. Inc., New York.
6	Shukla, R.S. and Chandel, P.S. (1996). Cytogenetics, Evolution & Plant Breeding. S. Chand & Company Ltd., New Delhi.
7	E. J. Gardener, Principles of Genetics, (5^{th} Ed.), Publication: John Wiley & Sons

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://swayam.gov.in/nd2_cec20_bt03/preview
2	https://swayam.gov.in/nd2_cec20_bt07/preview
3	https://swayam.gov.in/nd2_cec20_bt06/preview
4	https://www.youtube.com/watch?v=8ATRfaiaOLg
5	https://www.google.com/search?q=genetics+principles+of+inheritance+and+variation+neela+bakore
Course Designed By: **Dr.R.Kannan.**	Verified by: **Dr.K.Padmavathi.**

Mapping with Programme Outcomes										
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	S	S	S	S	S	S	S	S	S
CO2	S	S	S	S	S	S	S	S	S	S
CO3	S	S	S	S	S	S	S	S	S	S
CO4	S	S	S	S	S	S	S	S	S	S
CO5	S	S	S	S	S	S	S	S	S	S

*__S__-Strong; __M__-Medium; __L__-Low

Course code		ECOLOGY AND PHYTOGEOGRAPHY	L	T	P	C
Core/Elective/Supportive		Core paper - VII	60			4
Pre-requisite		Basic knowledge in structure, character and function of eco system, types of mineral cycles and types of forest present in India gained in lower classes.	Syllabus Version		2021-2022	

Course Objectives:

The main objectives of this course are :

1. To understand principles of ecology, structure and function of ecosystem, Biogeochemical cycles.

2. To gain knowledge about Autecology and synecology

3. To know plant succession and ecological adaptations.

4. To learn Dispersal mechanism, Migration, Concept of Barriers, Continental drift, Endemism and Plants indictors.

5. To Highlight plant geography vegetational types of India and phytogeographical regions of India

Expected Course Outcomes:

On the successful completion of the course, students are able to:

1	Gain knowledge about ecological principles, ecosystem structure and function	K2
2	Understand units vegetation, physiognomy, methods of studying vegetation	K2
3	Know about plant succession and ecological adaption	K4
4	Overview dispersal mechanism, Migration, concepts of barrier, continental drift, endemism, and plant indicator.	K3
5	Get better under standing about plant geography ,Vegetational types and Phytogeographical regions of India.	K3

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

Unit:1	Fundamentals of Ecology	12 hours
Ecology-Principles and approaches, Structure and function of Ecosystem, Role of climatic, edaphic and Biotic factors on plants, Biogeochemical cycles (Nitrogen, Carbon).		
Unit:2	**Divisions of Ecology**	**12 hours**
Autecology and synecology-vegetation-physiognomy Raunkiaer s life form , units of vegetation (formation, association, consociation, fasciation and society). Methods of studying vegetation - Quadrat, Belt and Line transect.		
Unit:3	**Ecological Adaptations**	**12 hours**
Plant succession, Hydrophytes, Mesophytes , Xerophytes ,Halophytes and Epiphytes - Morphological and Anatomical features in relation to their habitats (Adaptation)		
Unit:4	**Phytogeography**	**12 hours**
Dispersal and migration, concept of Barriers, Continental drift, endemism, plants and plant communities as indictors.		
Unit:5	**Phytogeography of India**	**12 hours**
principles and vegetational types of India - Tropical Rain forest, shoals and deciduous forest - sand dunes and mangroves ,scrub jungle, phytogeographical regions of India, Introduction to GPRS and Remote sensing(basics only).		
	Total Lecture hours	**60 hours**

Practicals:

1. Study of Morphological and Anatomical adaptations of Hydrophytes, Xerophytes, Halophytes and Epiphytes using representative samples.

2. Determination of frequency and density constituent of plant species in a terrestrial community through quadrat and transect (line and belt)

3. Enumerate 25 trees/shrubs (campus flora) with Botanical name, family and vernacular name.

4. Phytogeographical regions of India.

	Text Books
1	Arumugam, N. (1994). Concepts of Ecology (Environmental Biology). Saras Publications, Nagercoil, Tamilnadu.
2	Verma, P.S. and Agarwal, V.K. (1999). Concept of Ecology (Enviromental Biology). S. Chand & Co., New Delhi.
3	Vasishta, P.C. (1993). Plant Ecology. II Edition. Vishal Publications.
4	Sharma, P.D. (2000). Ecology & Environment. Rastogi Publications, Meerut, India.
5	Kumar, H.D. (1992). Modern Concepts of Ecology (7th Edn.). Vikas Publishing Co., New Delhi.
6	Shukla. R.S. and P. S. Chandal. (2000). Plant Ecology and soil science. Chand & Co. Ltd., New Delhi.

	Reference Books
1	Odum, E.P. 1983. Basic Ecology, Saunders, Philadelphia
2	Smith, R.L. 1996. Ecology and Field Biology, Harper Collins, New York.
3	Ambasht R.S. (1992). Text book of Plant Ecology, Students and Friends & Co. Varanashi.
4	Schimper, A.F. (1960). Plant geography. Lubrecht & Cramer Ltd., New York.
5	Mani, M.S. (1974). Ecology & Biogeography of India. Dr. W. Junk Publishers, The Haque.
	Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]
1	https://swayam.gov.in/nd2_cec19_hs10/preview
2	https://swayam.gov.in/nd1_noc20_ge16/preview
3	https://swayam.gov.in/nd1_noc20_hs77/preview
4	https://www.youtube.com/watch?v=yXgUn794TVo
5	https://www.youtube.com/watch?v=0zctBpOxRi4

Course Designed By: **Dr.R.Kannan.** Verified by: **Dr.K.Padmavathi.**

Mapping with Programme Outcomes										
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	S	S	S	M	S	M	S	S	S
CO2	S	S	S	S	M	S	M	S	S	S
CO3	S	S	S	S	M	S	M	S	S	S
CO4	S	S	S	S	M	S	M	S	S	S
CO5	S	S	S	S	M	S	M	S	S	S

*__S__-Strong; __M__-Medium; __L__-Low

Course code		FUNDAMENTALS OF MICROBIOLOGY	L	T	P	C
Core/Elective/Supportive		Core paper - VIII	60			4
Pre-requisite		Basic knowledge on microbes and their applications gained during Class XII.	Syllabus Version		2021-2022	

Course Objectives:

The main objectives of this course are :

1. To understand the scope and definition of Microbiology, historical aspects, classifications and sterilization
2. To know soil microbiology, types, its role in plant growth; air microbiology and air purification
3. To overview detailed structure, growth, reproduction of Bacteria and a note on mycoplasma and Actinomycetes
4. To study salient features of virus
5. To Experiment culture of microorganisms, maintenance and preservation .

Expected Course Outcomes:

On the successful completion of the course, students are able to:

1	Gain knowledge about the scope of microbiology, historical aspects, classification of microbes and sterilization techniques	K1
2	Understand soil and air microbiology	K2
3	Understand bacterial structure, growth and reproduction and features of Mycoplasma and Actinomycetes	K3
4	Study the structure, replication and classification of virus	K2
5	Develop the Skill in preparation of culture of microorganisms, its maintenance and preservation.	K4

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

Unit:1	Basic Microbiology	12 hours
Definition and scope of microbiology. Historical development of industrial microbiology. Concepts, characterization and classification of microorganisms. Sterilization techniques and media preparation		
Unit:2	**Soil and Air Microbiology**	**12 hours**
Soil microbiology-Types of microorganism in soil, Role of microorganisms in plant growth, factors affecting microbial growth. Microbiology of air-Role of microorganism in air, methods of purification of air.		
Unit:3	**Bacteria**	**12 hours**
General characters of Bacteria-, Morphology, ultra structure, nutrition, growth and reproduction. Mycoplasma , Actinomycetes– structure, and reproduction.		
Unit:4	**Viruses**	**12 hours**
General characters, morphology, ultra structure, structure and replication of T2 phage, TMV, HIV, Transmission of viruses. Satellite virus.		
Unit:5	**Culture techniques of Microorganism**	**12 hours**
Culture of microorganism (Bacteria, Fungi, Actinomycetes), Pure culture, Maintenance and preservation of culture, concepts of Gram staining.		
	Total Lecture hours	**60 hours**

Practicals:

1. A study of Rhizosphere and Mycorrhizae.

2. Preparation of culture media for Bacteria, Fungi and Actinomycetes.

3. Enumeration of Bacteria, Fungi and Actinomycetes (plate count) from soil and water by serial dilution method.

4. Sterilization and Inoculation, Preparation of Agar streak and Agar slants,.

5. Identification of Bacteria using Gram staining in Milk or Curd.

6. Observation of microbes using hanging - drop method.

	Text Books
1	Vijaya Ramesh K (2019), Environmental Microbiology, MJP Publisher., Chennai.
2	TrivediPC (2008), Applied Microbiology, Agrobios., Jodhpur.
3	S.S. Purohit, (1994). Microbiology, Fundamentals and applications
4	Dubey, RC & Maheshwari, DK. 2004, Text book of microbiology. S. Chand, Delhi.

	Reference Books
1	Pelczar, J., Chan, ECS & Krieg, R.1999. Microbiology, Tata McGraw Hill, New Delhi.
2	Sullia, SB & Shantharam, S. 2005. General microbiology. Oxford & IBH, New Delhi.
3	Casida, LE.1989. Industrial microbiology, Wiley Eastern, New Delhi.
4	Dubey, RC & Maheshwari, DK. 2004, Text book of microbiology. S. Chand, Delhi.
5	Martin Alexander. 1978. Introduction to Soil Microbiol, Wiley Eastern, New Delhi.
6	Wintrien, G.M. and M.D. Lechtman, (1976). Microbiology, 3rd Edition, Macmillan Publishing Co. London.
	Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]
1	https://swayam.gov.in/nd2_cec20_bt11/preview
2	https://swayam.gov.in/nd2_cec19_bt11/preview
3	https://www.classcentral.com/course/swayam-general-microbiology-14088
4	https://www.swayamprabha.gov.in/index.php/program/archive/9

Course Designed By: **Dr.R.Kannan.** Verified by: **Dr.K.Padmavathi.**

Mapping with Programme Outcomes										
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	S	S	S	S	M	S	S	S	S
CO2	S	S	M	S	S	M	S	S	S	S
CO3	S	S	S	S	S	S	S	S	S	M
CO4	S	S	M	S	S	S	S	S	S	S
CO5	S	S	S	S	S	S	S	S	S	M

*__S__-Strong; __M__-Medium; __L__-Low

Course code		BIOPHYSICS, BIOCHEMISTRY AND PLANT PHYSIOLOGY	L	T	P	C
Core/Elective/Supportive		Core paper - IX	75			4
Pre-requisite		Basic knowledge in laws of thermodynamics, structure and function of enzymes, proteins and lipids. Basic knowledge in plant metabolism and growth regulators studied in the lower classes.	Syllabus Version		2021-2022	

Course Objectives:

The main objectives of this course are:

1. To learn about basic Biophysics concepts, electromagnetic radiation, spectra, laws of thermodynamics and bioenergetics
2. To understand Biochemistry, enzyme study and biomolecules
3. To overview Plant Physiology concepts, water relation, transpiration in detail
4. To gain complete knowledge about photosynthesis and respiration
5. To study about growth regulators and physiology of flowering

Expected Course Outcomes:

On the successful completion of the course, students are able to:

1	Get through knowledge of Biophysics concepts on electromagnetic radiation, action and absorption spectra, laws of thermodynamics, high energy compounds and Bioenergetics	K1
2	Understand Biochemistry, enzyme study and biomolecules	K2
3	Gain knowledge about Plant Physiology concepts, water relationship and stomatal movement	K3
4	Learn photosynthesis and respiration	K4
5	Know about plant growth regulators and physiology of flowering	K2

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

Unit:1	Biophysics	15 hours
Electromagnetic radiation, Absorption and action spectra, Laws of thermodynamics (Basics), High energy compounds,. Bioenergetics of mitochondria and chloroplast. .		
Unit:2	**Biochemistry**	**15 hours**
Enzymes--Characteristics of enzymes, classification of enzymes, mechanism of enzyme action (lock and key method), factors affecting enzyme activity. Structure and Basic functions of protein, lipids and carbohydrates.		
Unit:3	**Plant - Water relations**	**15 hours**
Water relations - Osmosis, Water potential and its components, Absorption of water, Active and passive absorption of water and minerals. Transpiration - its kind, significance and factors. Physiology of stomatal movement, Ascent of sap. Mechanism of phloem transport.		
Unit:4	**Plant Metabolisms**	**15 hours**
Photosynthesis - Pigments system, light and dark reactions. C4 and CAM Pathways Photorespiration. Respiration - aerobic and anaerobic - Glycolysis, Kreb cycle - electron transport system.		
Unit:5	**Growth Regulators**	**15 hours**
Growth regulators - Auxins, Gibberellins, Kinetins, Ethylene and ABA. Physiology of flowering (Photoperiodism).		
	Total Lecture hours	**75 hours**

Practicals :

1. Effect of the Osmotic pressure of the cell sap by plasmolytic method
2. Rate of respiration in flower buds/germinated seeds using Simple Respiroscope.
3. Separation of leaf pigments by Paper Chromatography
4. Measurement of the rate of Photosynthesis under various CO2 concentration
5. Effect of Light intensity on O2 evolution during Photosynthesis.
6. Effect of light intensity on Transpiration. Determining the rate of transpiration using Ganong's potometer.
7. Quantitative estimation of Carbohydrates and Proteins
8. Qualitative analysis for Carbohydrates, Proteins, and Lipids

	Text Books
1	Palanichamy, S. (1986). Principles of biophysics. Paramount Publication, Palani.
2	Narayanan L.M., Dulsy Fathima, K.Nallasingam, R.P. Meyyan Pillai, N.Arumugam, S.Prasanna Kumar. (2010). Biochemistry. Saras Publication
3	JainV.K. 2006. Fundamentals of Plant Physiology, S. Chand & Co, New Delhi.
4	Verma V. 2007. Tex book of Plant Physiology, Ane Books India, New Delhi.
5	Pandey, SN & Sinha, BK. 2006. Plant Physiology, 4th Ed. Vikas Publishing, ND.
6	Annie Ragland, Rajkumar, Rajaatnam and Jayakumar. (2007). Plant Physiology. Saras Publications, Nagarcoil.

	Reference Books
1	Salil Bose. (1981). Elementary biophysics - Part 1. Vija Printers, Madurai.
2	Jain JL 2009 Fundamentals of Biochemistry S. Chand, New Delhi.
3	Albert L. Lehninger. (2002). Principles of Biochemistry. ICAR, Delhi.
4	Chopra. (1995). A text book of Plant Physiology. EMKAY Publications, New Delhi.
5	Malik. (2002). Plant physiology. Kalyani Publishers, New Delhi.
6	Devilin, (1986). Plant physiology. CBS Publishers and distributors, New Delhi.
7	Noggle and Fritz. (1992). Introductory plant physiology. Prentice Hall of India. Pvt. Ltd. New Delhi.
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://swayam.gov.in/nd2_cec20_bt01/preview
2	https://swayam.gov.in/nd2_cec19_bt09/preview
3	https://swayam.gov.in/nd2_cec20_bt12/preview
4	https://swayam.gov.in/nd2_cec20_bt19/preview
5	https://swayam.gov.in/nd2_cec19_bt01/preview
6	https://swayam.gov.in/nd1_noc19_bt17/preview
Course Designed By: **Dr.R.Kannan.**	Verified by: **Dr.K.Padmavathi.**

Mapping with Programme Outcomes										
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	M	S	S	S	M	S	S	S	S
CO2	S	S	M	S	S	S	S	S	S	M
CO3	S	S	S	S	S	M	S	S	S	S
CO4	S	S	M	S	S	S	S	S	S	M
CO5	S	M	S	S	S	S	S	S	S	M

*__S__-Strong; __M__-Medium; __L__-Low

Course code		HORTICULTURE	L	T	P	C
Core/Elective/ Supportive		Core paper - X	75			4
Pre-requisite		Basic knowledge in vegetative reproduction of plants, various types of gardens and cultivation methods of various plants studied during previous classes.	Syllabus Version		2021-2022	

Course Objectives:

The main objectives of this course are to :

1. Learn about Horticulture, vegetative propagation, manures and irrigation
2. Understand types of gardens and lawn making
3. Know about cultivation techniques of vegetables, fruits, use of growth regulators and plant protection methods
4. Study Commercial Horticulture like cultivation of flowers, plantation crops and medicinal plants
5. Overview the extraction of Jasmine concrete and Papain – Bonsai, cut flowers and their preservation

Expected Course Outcomes:

On the successful completion of the course, students are able to:

1	Understand basic horticulture methods, vegetative propagation, manures and irrigation	K2
2	Understand different types of gardens and lawn making	K3
3	Analyze the cultivation techniques of vegetables, fruits, use of growth regulators and plant protection methods	K3
4	Enterpreuner skill in flower cultivation ,plantation crops and medicinal plants	K3
5	Learn about extraction of Jasmine concrete and Papain; – Bonsai, cut flowers and preservation of fruits and vegetables	K4

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

Unit:1	Introduction to Horticulture	15 hours
Scope and divisions of Horticulture - methods of vegetative propagation - cutting, layering and grafting - organic manures - fertilizers - irrigation..		
Unit:2	**Gardening**	**15 hours**
Types of gardens, Indoor garden, Kitchen garden and Public garden. Important Ornamentals - habit and types - Garden components - Lawn making, Glass house, Green house, Rockery, Water garden, Hydroponics and Aeroponics, Terrace gardening Topiary and Terrarium.		
Unit:3	**Production technology**	**15 hours**
Cultivation of vegetables - Brinjal, Tomato and Onion. Cultivation of fruits - Banana, Mango and Apple .Growth regulators in Horticulture. Plant protection measures for Horticulture.		
Unit:4	**Commercial horticulture I**	**15 hours**
Cultivation of flowers - Jasmine, Rose, Orchid, Anthurium. Cultivation of plantation crops - Tea, Cardamom and Coffee. Cultivation of medicinal plants - Periwinkle, Aloe and Gloriosa.		
Unit:5	**Commercial horticulture II**	**15 hours**
Extraction of Jasmine concrete and Papain. Bonsai, Flower arrangement - Cut flowers and its importance, Methods to prolong cut flowers life . Preservation of fruits and vegetables.		
	Total Lecture hours	**75 hours**

Practicals:

Demonstration of vegetative methods of propagation and different Flower arrangements with cut flowers.

Text Books

1	Kumar, N. (1999). An introduction to horticulture. Rajalakshmi Publication, Nagarcoil.
2	Manibhusan Rao K (2005) Text book of Horticulture., Macmillan india ltd.
3	Prasad, 2005, Principles of Horticulture, International Book Dept., Dehradun
4	Trivedi, Pratibha P (2010), Home Gardening, ICAR, New Delhi.

	Reference books
1	Kumar N. (2006). Horticulture: Principles and practices. New India Publishing agency, New Delhi 88.
2	Sundararajan, J.S., Muthuswamy, J., Shanmugavelu, K.G. and Balakrishnan, R. A Guide to Horticulture. Thiruvenkadam Printers, Coimbatore.
3	Bhattacharjee, S.K. (2006). Advances in Ornamental Horticulture. Pointer Publications, Jaipur.
4	Jitendra Singh. (2014). Basic Horticulture. Kalyani Publishers, Chennai.
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://swayam.gov.in/nd2_cec20_ag11/preview
2	https://swayam.gov.in/nd2_cec20_bt13/preview
3	https://swayam.gov.in/nd1_noc20_ce11/preview
4	https://swayam.gov.in/nd1_noc19_ag04/preview
5	http://ugcmoocs.inflibnet.ac.in/ugcmoocs/view_module_ug.php/50
6	https://nptel.ac.in/courses/126/105/126105009/
Course Designed By: **Dr.R.Kannan.**	Verified by: **Dr.K.Padmavathi.**

Mapping with Programme Outcomes										
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	S	S	M	M	S	S	S	S	S
CO2	S	S	S	M	M	S	S	S	S	S
CO3	S	S	S	M	S	S	S	S	S	S
CO4	S	S	S	S	S	S	S	S	S	S
CO5	S	S	S	S	S	S	S	S	S	S

*__S__-Strong; __M__-Medium; __L__-Low

Course code		SKILLED BASED SUBJECT	L	T	P	C
Core/Elective/Supportive		PAPER -1- PLANT BIORESOURCES	45			3
Pre-requisite		Knowledge gained on structure, reproduction & life cycle of different plant groups in XII Std & I yr UG	Syllabus Version			2021-2022

Course Objectives:

The main objectives of this course are :

1. To know the existing usages of various plant Bioresources
2. Gain knowledge on various production process & applications of the plant Bioresources
3. Encourage research and enterpreuner ideas about plant Bioresources & its utilization in different fields

Expected Course Outcomes:

On the successful completion of the course, students are able to:

1	Understand algae as bioresourses in field of soil fertility, medicine and research; role of algae in pollution studies	K1
2	Learn about algal commercial products.	K2
3	Appreciate industrial uses of Fungi.	K3
4	Study the role of fungi in farming, Mycorhizal association , Bio control agents	K4
5	Explore the use of Lichens, Bryophytes, Pteridophytes and Gymnosperms	K5
6	Exposer to production of Industrial products.	K6

K1 – Remember; **K2** – Understand; **K3** – Apply; **K4** – Analyze; **K5** – Evaluate; **K6** – Create

Unit:1	AGRICULTURE USES OF ALGAE	09 hours
Algae- Role of algae in soil fertility, green manure, nitrogen fixation, symbiosis. Medicinal uses, biofuels, research tools. Algae as pollution indicators, algae and sewage disposal (sewage oxidation ponds) water blooms, eutrophication, neurotoxins and parasitic algae.		
Unit:2	**INDUSTRIAL USES OF ALGAE**	**09 hours**
Role of algae as food and fodder. Commercial products- Agar- Agar, Carrageenan, Alginic acid, diatomite and their uses in various industries. Algae and space travel and future food. Methods of cultivation of seaweeds.		
Unit:3	**INDUSTRIAL USES OF MICROBES**	**09 hours**
Fungi and bacteria: Role in medicine, food, industrial uses –alcohol, enzyme, organic acid, hormones, cheese, proteins, vitamins, antibiotics, probiotics.		
Unit:4	**ORGANIC FARMING & BIO-REMEDIATIONS**	**09 hours**
Organic farming- definition and basic concepts, farm manures, mulches, mycorhizal association, types.VAM and its uses. Recycling of biodegradable municipal, agricultural and industrial wastes, bio composting, Effective micro-organisms (EMO).		
Unit:5	**USES OF CRYPTOGAMS AND GYMNOSPERMS**	**09 hours**
Uses of Lichens- Ecological and pollution indicators. Role in soil formation. Uses of Bryophytes, Pteridophytes and Gymnosperms.		

Practicals

1. Determination of soil pH
2. Analysis of two soil samples for moisture, humus, organic matter and chlorides.
3. Methods of preparation of VAM, Vermi compost and EMO.
4. Identification and study of economically useful plants (two in each category) given in the syllabus.

	Total Lecture hours	**45 hours**

Text Books

1	Vashishta, B.R., Sinha, A.K. and Singh, V.P. (2008) Botany for Degree Students: Algae. S. Chand & Company Ltd., New Delhi.
2	Vashishta, B.R. (1990). Botany for Degree Students: Fungi. S. Chand & Company Ltd., New Delhi.

3	Vashista, P.C. (1997). Botany for Degree Students, Pteridophyta. S. Chand and Company Ltd., New Delhi.
4	Vashishta, P.C. (1996). Botany for Degree Students-Gymnosperms (2nd Edn.,). S. Chand and Company Ltd., New Delhi.
5	Pandey, B.P. (2001). College Botany Vol. I: Algae, Fungi, Lichens, Bacteria, Viruses, Plant Pathology, Industrial Microbiology and Bryophyta. S. Chand & Company Ltd., New Delhi.
6	Dr. N. Selvaraj, Dr. B. Anita, Ms. B. Anusha, Ms. M. Gurusrasvathi (2006), Organic Horticulture, Creating a more sustainable farming, Horticultural research station, TNAU, Ooty.

	Reference books
1	Kumar, H.D. (1999). Introductory Phycology (2nd edition). Affiliated East West Press Pvt. Ltd. Delhi.
2	Sharma OP. 1989. Text Book of fungi. Tata McGraw Hill, New York.
3	Hale, 1996. The biology of Lichens, New Age International Publishers, New Delhi.
4	Smith, G.M. (1955). Cryptogamic Botany Vol. II Bryophytes and Pteridophytes (2nd edn.). Tata McGraw Hill Publishing Co., New Delhi.
5	Pandey et al., 1998. A Text Book of Botany Vol. II. S. Chand & Co. Ltd. 1980.
6	Palaniappan, S P and K. Annadurai (2018) Organic farming theory and practice, Scientific Publishers Jodhpur, India.
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://www.mooc-list.com/course/introduction-algae-coursera
2	https://swayam.gov.in/nd2_cec20_bt11/preview
3	https://www.brainkart.com/article/Economic-importance-Plants---Food,-Rice,-Oil,-Fibre,-Timber-yielding-plant_1095/
Course Designed By: **Dr. J. Rose De Leema**	Verified by: **Dr.K.Padmavathi.**

Mapping with Programme Outcomes										
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	M	S	M	S	S	M	M	S	M
CO2	S	M	M	S	S	S	M	M	S	S
CO3	S	M	M	S	S	M	S	M	M	M
CO4	S	S	S	M	M	S	S	M	S	S
CO5	S	S	S	S	M	S	M	S	S	S

*__S__-Strong; __M__-Medium; __L__-Low

Course code	SKILL BASED SUBJECT	L	T	P	C
Core/Elective/ Supportive	PAPER-II COMPUTING SKILLS FOR INDUSTRY 4.0	30			2
Pre-requisite	Basic Knowledge on computer gained through higher secondary class.	Syllabus Version		2021-2022	

Course Objectives:

The main objectives of this course are:

1. To learn about the basics and functions of computer, Study about internet and communication
2. To facilitate students to learn about Microsoft Word and Excel.
3. To find out more about Microsoft PowerPoint, database management systems and MS Access.
4. To introduce AI and ML for Biology students.
5. To know about big data and data analytics.

Expected Course Outcomes:

On the successful completion of the course, students are able to:

1	Learn how to use computer, Internet, e-mail, Web browser, Web server, and Search engines	K 2
2	Create Documents, Tables and Spreadsheets	K 6
3	Know about creation and use of PowerPoint presentations, DBMS and MS Access	K 6
4	Acquire knowledge about AI and ML	K 2
5	Implement the knowledge in big data and data analytics	K 3

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

Unit:1	BASICS OF COMPUTER	06 Hours
Computer - Functions and Components of Computer – Operating System - Windows – Android – Intranet & Internet – www - Browser - Email - URL -Search engines - Websites & Web pages		
Unit:2	**MICROSOFT OFFICE - I**	**06 Hours**
Microsoft word: Creation of document – Formatting of page - Formatting of paragraph -Formatting of text - Creation and formatting of table. Microsoft Power Point: Creation and Designing of slides – Animation options -Applications of MS Word and MS Power point.		
Unit:3	**MICROSOFT OFFICE - II**	**06 Hours**
Microsoft Excel: workbook – work sheet – Formatting of row, column and cell - Creation and formatting of table - Creation and formatting of charts Microsoft Access: Database Management System (DBMS) – Creation and designing of form – Management of data in table – Generation of report Applications of MS Excel and MS Access.		
Unit:4	**ARTIFICIAL INTELLIGENCE**	**06 Hours**
Artificial Intelligence: Artificial Intelligence (AI) - What and Why? - Foundation of AI - The AI-environment - Social Influence of AI - Applications and Future Prospects of AI.		
Unit:5	**BIG DATA AND DATA ANALYTICS**	**06 Hours**
Big Data: Evolution - Data evolution - Big Data Definitions - Merits and Advantages of Big Data - Big Data Characteristics - Big Data Applications - Introduction to Data Analytics - Data Analysis Vs. Data Analytics - Types of Data Analytics - Application of Data Analytics.		

PRACTICAL

1. Creating, editing and printing a document in MS-Word
2. Creating a table in MS-Excel
3. Creating a chart in MS-Excel
4. Creating slide presentation in MS-Power-point
5. Web Browsing
6. E-Mailing

Total Lecture hours	**30 Hours**

Text Books	
1	V. Rajaraman and N. Adabala, (6th Edition, 2015.) Fundamentals of Computers, Prentice Hall of India Pvt. Ltd. New Delhi.
2	Anita Goel,(2010) Computer Fundamentals, Pearson Education.
3	P.K. Sinha, Computer Fundamentals, BPB Publications New Delhi 6th Edition, 2004.
4	Reema Thareja, Fundamentals of Computers, Oxford University Press, 2014.
5	Mooris mano "Digital Design" Prentice Hall of India PVT Ltd., New Delhi, 1996.

	Reference books
1	B. A. Forouzan. Data Communication and Networking, 5th Edition, TMH, 2013.
2	E.Balagurusamy (2011) Fundamentals of computers, Tata Mc Grw-Hill, New Delhi.
3	The Internet-Complete Reference, Harley Hahn, Tata Mc Grw-Hill, New Delhi.
4	Dr.P.Kaliraj, Dr.T.Devi (2020) Higher Education for Industry 4.0 and Transformation of Education 5.0.
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	**swayam***.gov.in/***NPTEL**
2	https://swayam.gov.in/nc_details/NPTEL
3	https://www.classcentral.com/report/swayam-moocs-course-list
4	https://swayam.gov.in
5	https://swayam.gov.in/nd1_noc20_cs52/preview
6	https://nptel.ac.in/courses/106/105/106105183
7	https://www.classcentral.com/institution/nptel
8	https://nptel.ac.in

Course Designed By: **Dr. S. Geetha.** Verified by: **Dr. K. Padmavathi.**

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	M	S	S	S
CO2	S	S	S	S	S	M	M	S	S	S
CO3	S	S	S	S	S	S	M	S	S	S
CO4	S	S	S	S	S	M	M	S	S	S
CO5	S	S	S	S	S	S	M	S	S	S

*__S__-Strong; __M__-Medium; __L__-Low

Course code		SKILL BASED SUBJECT	L	T	P	C
Core/Elective/ Supportive		Paper III - MEDICINAL BOTANY & HUMAN WELFARE	45			3
Pre-requisite		Basic knowledge about medicinal plants gained from XII STD & other resources	Syllabus Version		2021-2022	

Course Objectives:

The main objectives of this course are:

1. To educate, study, develop, cultivate, benefit, market & distribute the medicinal plants.
2. To develop the awareness of local medicinal plants & its conservation.
3. To assess the demand & supply of the medicinal plants.

Expected Course Outcomes:

On the successful completion of the course, students are able to:

1	Understand Pharmacognosy, different systems of Indian medicines, classification of drugs and chemistry of drugs	K2
2	Learn about Morphological and Histological studies along with Chemical constituents and uses of few medicinal plants	K2
3	Study about drugs acting on the Central nervous system, Gastro intestinal disorders and Cardio vascular system	K3
4	Overview of Medicinal plant Biotechnology	K4
5	Know about the Drug research, Identification, adulteration and drug evaluation.	K2
6	Gain about the Genetics & Breeding methods of medicinal plants.	K2

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

Unit:1	GENERAL ACCOUNT ON PHARMAGOGNOSY	09 hours

Pharmacognosy - Definition and History. A general account of different survey of different systems of medicines - Indian system of medicine – Siddha, Ayurveda and Unani. Classification of drugs (elementary). Chemistry of Drugs (Basics)

Unit:2	MORPHOLOGY & HISTOLOGICAL STUDY OF MEDICINAL PLANT PARTS	09 hours

Morphological and Histological studies - Chemical constituents. Therapeutic and other Pharmaceutical uses of Bark - Cinchona, Leaves - Adathoda and Neem, Flower - Clove.

Unit:3	TYPES OF MEDICINAL PLANTS	09 hours

Fruits and seed – Limonia (Wood apple), Emblica (Gooseberry) and Papaver (Poppy) seed, Underground stem – Zingiber (Ginger), Unorganized drugs. Gum - Acacia, Resin - Turpentine, Fixed oil – Ricinus (Castor oil).

Unit:4	THERAPEUTIC ASPECTS OF DRUGS	09 hours

A brief account of the following: a) Drugs acting on the Central nervous system –Belladona and Aswakantha b) Drugs used in the disorders of the Gastro intestinal tract, Piper nigrum (Pepper) and Acorus (vasumbu) c) Cardio vascular drugs – Digitalis and Rawolfia.

Unit:5	CONSERVATION AND PRESERVATION OF MEDICINAL PLANTS	09 hours

Endangered medicinal plants, Conservation – Legislation, In-situ Conservation, Ex-situ Conservation, Field Gene Bank- National active germplasm sites (NAGS), Cryopreservation, Tissue culture technique. Intellectual property rights (IPR) for medicinal and aromatic plants in India

Practical:

1. Study Morphology and Anatomy of Medicinal plants mentioned in the syllabus.
2. Identification of Medicinal plant, uses and their active principles.
3. Exhibit any 20 medicinally useful parts (at least 5 from the syllabus) with Botanical name, family, common name, part used, and disease cured.

	Total Lecture hours	45 hours

	Text Books
1	Kokate, C.K., Purokit A.P and Gokahale, 2008. Pharmacognosy, Nirali Prakashan, Pune
2	T.E. WALLIS (Fifth Edition 2005) Textbook of Pharmacognosy-. CBS Publishers and distributors Delhi.
3	R.S.Satoskar, Nirmala N Rege, Raakhi K. Tripathi and S.D.Bhandarkar (2017)Pharmacognosy & Pharmacotherapeutics.,Popular Pakashan pvt ltd, Bombay.
4	S.S.Handa and V.K.Kapoor(2003) second edition ,Pharmacognosy -. Vallabh Prakash, Delhi
5	Somasundaram, S. (1997). Medicinal Botany (Maruthuva Thavaraviyal) (Tamil Medium Book). Elangovan Publishers, Tirunelveli.

	Reference Books
1	Chopra, R.N., Chopra, I.C., Handa, K.L. and Kapur, L.D. (1994). Indigenous Drugs of India. IBH Publishing Co. Pvt. Ltd., New Delhi.
2	Purohit, S.S and S.P. Vyas (2005). Medicinal Plant Cultivation. A Scientific Approach. Agrobios Publishers,Jodhpur, India.
3	H. Panda, (2001) Hand book of herbal medicines. Asia Pacific Business Press, New Delhi.
4	D.J. Deshpande (2006) A Handbook of Medicinal Herbs, Agrobios (India)
	Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]
1	https://www.swayamprabha.gov.in/index.php/program/archive/9
2	https://swayam.gov.in
3	http://nptel.ac.in
4	https://www.fs.fed.us
5	https://nmpb.nic.in
6	https://medicinalplants.insightconferences.com
7	https://en.m.wikipedia.org
8	https://researchguides.uic.edu>c.php

Course Designed By: **Dr.J.Rose De Leema** Verified by: **Dr.K.Padmavathi.**

Mapping with Programme Outcomes										
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	S	M	S	S	S	S	S	S	S
CO2	S	S	S	S	S	S	M	S	S	S
CO3	S	S	M	S	S	S	S	S	S	S
CO4	S	S	S	S	S	S	M	S	S	S
CO5	S	S	S	S	S	S	S	S	S	S

*__S__-Strong; __M__-Medium; __L__-Low

Course code	ELECTIVE I	L	T	P	C
Core/Elective/ Supportive	A. MICROBIOLOGY-APPLIED MICROBIOLOGY	60	-	-	4
Pre-requisite	Basic knowledge on Microbes, enzymes, and diferrent techniques of the subjects gained during Class XII other sources.	Syllabus Version		2021-2022	

Course Objectives:

The main objectives of this course are to:

1. Learn about the various applied aspects of microbiology, special reference to fermentation and types of fermenters.
2. Find out about water microbiology, purification, antibiotics and mode of action(penicillin), immunology with reference to antigen and antibody reaction
3. Overview food microbiology: - milk- pasteurization, cheese, microbial flora of fresh food and Botulism.
4. Study about Industrial microbiology: Manufacture of alcohol, antibiotics, vitamins, enzyme, amino acids and organic acid.
5. Know about Biocides for microbes, microbial biotechnology and pollution control.

Expected Course Outcomes:

On the successful completion of the course, students are able to:

1	Get a thorough knowledge about water microbiology, water sanitary quality, control of microbes through chemotherapy and antibiotics, basic principles of immunology.	K 1
2	Understand fermentation, kinds of fermenters, media and sterilization.	K 2
3	Know about food microbiology, dairy products, milk preservation, contamination of food and food poisoning.	K 2
4	Learn the methods of industrial production of ethanol, streptomycin, vitamin- B12, cellulose, glutamic acid and citric acid.	K 3
5	Know about food microbiology, dairy products, milk preservation, contamination of food and food poisoning.	K 5
6	Figure out biocides for Bacteria, Protozoa, FungiActinomycetes along with microbial Biotechnology and pollution control.	K 5

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

Unit:1	INTRODUCTION TO APPLIED MICROBIOLOGY	12 Hours
Introduction to applied microbiology. Various applied aspects of microbiology. Fermentation - kinds of fermentors; fermentation media - composition; sterilization, contamination and screening.		
Unit:2	**WATER MICROBIOLOGY**	**12 Hours**
Water microbiology: Water purification, determination of sanitary quality - chemotherapy and control of microorganisms through antibiotics. Source and mode of action of penicillin.		
Unit:3	**FOOD MICROBIOLOGY**	**12 Hours**
Food microbiology: Milk-physical and chemical composition, pasteurization, dairy products (manufacture of cheese) Microbial flora of fresh food, microbial examination of foods-Food poisoning. Botulism.		
Unit:4	**INDUSTRIAL MICROBIOLOGY**	**12 Hours**
Industrial microbiology: Manufacture of alcohol, ethanol, antibiotics - streptomycin, Vitamin- B12, enzyme-cellulase, amino acids, Glutamic, organic acid-citric acid.		
Unit:5	**MICROBIAL BIOTECHNOLOGY**	**12 Hours**
Basic principles of immunology - structure of antigen and antibody and their reaction. Production of microbial biocides-historical background, bacteria, protozoa, fungi, actinomycetes. Microbial Biotechnology and Pollution control.		
PRACTICAL		
1. Microbial analysis of spoiled food. 2. Knowledge on antimicrobial activities using antibiotics. 3. Determination of microbiological quality of milk raw and pasteurized milk samples – using MBR test (Methylene blue reduction)		
	Total Lecture hours	**60 Hours**

	Text Books
1	Vijaya Ramesh K (2019), Environmental Microbiology, MJP Publisher.,Chennai
2	S.S. Purohit, (1994). Microbiology, Fundamentals and applications
3	Trivedi PC (2008), Applied Microbiology, Agrobios., Jodhpur.
4	Dubey, RC & Maheshwari, DK. 2004, Text book of microbiology. S. Chand, Delhi.

	Reference Books
1	Pelczar, J., Chan, ECS & Krieg, R.1999. Microbiology, Tata McGraw Hill, New Delhi.
2	James M. Jay, Martin J. Loessner, David A. Golden (2005), Modern Food Microbiology, CBS Publishers, Delhi.
3	Sullia, SB & Shantharam, S. 2005. General microbiology. Oxford & IBH, New Delhi.
4	Casida, LE.1989. Industrial microbiology, Wiley Eastern, New Delhi.
	Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]
1	https://nptel.ac.in/courses/102/103/102103015
2	https://swayam.gov.in/nc_details/NPTEL
3	https://swayam.gov.in/NPTEL
4	https://www.classcentral.com/course/swayam-applied..
5	https://www.classcentral.com/course/swayam-general-microbiology-14088
6	https://www.classcentral.com/report/swayam-moocs-course-list
7	https://nptel.ac.in/course.html
8	https://nptel.ac.in
9	https://swayam.gov.in
10	https://www.classcentral.com/report/list-of-mooc-based-microcredentials

Course Designed By: **Dr.V.Bhuvaneswari.** Verified by: **Dr.K.Padmavathi.**

Mapping with Programme Outcomes										
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	**S**	**S**	**S**	**S**	**S**	**M**	**S**	**S**	**S**	**S**
CO2	**S**	**S**	**M**	**S**	**S**	**M**	**S**	**S**	**S**	**S**
CO3	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**M**
CO4	**S**	**S**	**M**	**S**	**S**	**S**	**S**	**S**	**S**	**S**
CO5	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**M**
CO6	**S**	**S**	**S**	**S**	**S**	**M**	**S**	**M**	**S**	**S**

*__S__-Strong; __M__-Medium; __L__-Low

Course code	ELECTIVE I	L	T	P	C
Core/Elective/ Supportive	B : PLANT PATHOLOGY	60	-	-	4
Pre-requisite	Knowledge on host, pathogen, disease, symptoms, virulence and management of crops gained during Class XII.	Syllabus Version		2021-2022	

Course Objectives:

The main objectives of this course are to:

1. Study about historical account of plant pathology, various definition and Koch's postulates.
2. Learn about classification of plants diseases, pathogenesis and factors affecting infection.
3. Gain knowledge about the role of enzymes and toxins in relation to plant diseases.
4. Understand few fungal diseases and symptoms along with disease cycle and control measure.
5. Discovery of disease management.

Expected Course Outcomes:

On the successful completion of the course, students are able to:

1	Learn the taxonomic characters and life cycle of pathogens.	K 3
2	Understand, interpretation and synthesis of scientific literature pertaining to plant pathology and related disciplines.	K 2
3	Study of mechanism of disease development. host- pathogen interactions- Pathogenesis.	K 3
4	Analyze the dissemination of pathogens, factors governing outbreak of diseases and Pathogenesis	K 4
5	Know about the role of enzymes and toxins relation to plant diseases	K 3
6	Creating disease management methods, various control methods and producing disease resistant varieties.	K 5

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

Unit:1	INTRODUCTION TO PLANT PATHOLOGY	12 Hours
Introduction, Historical account of plant pathology- Definition- Pathogen ,disease , virulence, resistance/ susceptibility, epidemics ;Brief account of major epidemics, Koch's postulates.		
Unit:2	**HOST PATHOGEN INTERACTION**	**12 Hours**
Classification of plant diseases, dissemination of propagules of pathogens, factors governing outbreak of diseases. Pathogenesis- Inoculum, inoculum potential, penetration and entry, combination of the host, factors affecting infections.		
Unit:3	**PATHOGENESIS**	**12 Hours**
Role of enzymes in disease development, cell wall degrading enzymes. Toxins in relation to plant diseases: A general account, mode of action and types.		
Unit:4	**FUNGAL DISEASES**	**12 Hours**
Fungal diseases and deficiency symptoms: Symptoms, causal organism, disease cycle and control measures of the following fungal diseases. Club root of crucifers, Powdery mildew of wheat, Late blight of potato. Deficiency symptoms: General account, measures to rectify.		
Unit:5	**DISEASE MANAGEMENT**	**12 Hours**
Disease management: Legislative methods, cultural methods, soil and sand treatment, biological control, chemical control, control through resistant varieties.		
PRACTICAL		
Study of plant diseases in the theory- symptoms, causal organisms and control measures.		
	Total Lecture hours	**60 Hours**

Text Books

1	Mehrotra, R.S. (2003). Plant Pathology (Second edition). Tata McGraw-Hill Education, New Delhi.
2	Pandey, B.P. (2001). Plant Pathology. S. Chand & Company Limited, New Delhi
3	Bilgrami, K.S. and Dubey, R.C. (1985). Text book of Modern Plant Pathology. Vikas Publishing House Private Limited, New Delhi.
4	Rangaswamy, G. (1972). Diseases of crop plants in India. Prentice Hall of India. Pvt., Ltd., New Jersey.

	Reference Books
5	Rangasami, G. and Mahadevan, A. (1998). Diseases of Crop Plants in India. Prentice Hall of India Ltd. New Delhi.
6	Bap Reddy, D. and Joshi, N.C. (1991). Plant Protection in India (Second Edition). Allied Publishers Ltd., New Delhi.
7	Vasishta BR & Sinha AK. 2003. Botany for degree students: Fungi. S Chand and Company Ltd., New Delhi.
8	Mehrotra, RS & Aneja, KR. 1999. An Introduction to Mycology, 2nd Ed. New Age International Publishers, New Delhi..
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://www.classcentral.com/course/swayam-plant.
2	https://www.classcentral.com/report/swayam-moocs-course-list
3	https://bsppjournals.onlinelibrary.wiley.com/journal/13653059
4	https://onlinefreecourse.com/a-complete-list-of..
5	https://www.acsedu.com/Courses/plant-pathology-481.aspx
6	https://ugcmoocs.inflibnet.ac.in/ugcmoocs/moocs_courses...
7	https://epp-online.cals.ncsu.edu/plant-pathology
8	https://apniphysics.com/information/swayam-students-learning-portal
9	https://nptel.ac.in/courses/102/103/102103016
Course Designed By: **Dr.V.Bhuvaneswari.**	Verified by: **Dr.K.Padmavathi.**

Mapping with Programme Outcomes										
Cos	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	M	S	S	S	S	S	S	M	S
CO2	S	S	S	M	S	S	S	S	S	S
CO3	S	S	S	M	S	S	M	S	M	S
CO4	S	S	M	S	M	S	S	S	S	S
CO5	S	S	S	S	S	M	S	M	M	S
CO6	S	S	S	S	S	S	S	M	S	M

*__S__-Strong; __M__-Medium; __L__-Low

Course code	ELECTIVE I	L	T	P	C
Core/Elective/ Supportive	C : ECONOMIC BOTANY	60	-	-	4
Pre-requisite	Basic knowledge of pulses, cereals, spices and medicinal plants gained during Class XII.	Syllabus Version		2021-2022	

Course Objectives:

The main objectives of this course are :

1. To introduce the students about Origin of cultivated plants.
2. To introduce the students about Cereals and Legumes, Sources of sugar and starches.
3. To introduce the students about Spices, Sources of Oils and Fats.
4. Exposer to Drug-yielding plants, Bio fuels, Natural Rubbers.
5. To impart knowledge on timber and fibre yielding plants..

Expected Course Outcomes:

On the successful completion of the course, students are able to:

1	Get a thorough knowledge about origin, distribution botanical name, family and economic importance of various plant resources.	K 1
2	Understanding plant morphology terminologies and identifying morphological peculiarities.	K 2
3	Recognize members of the major Angiosperms families by identifying their diagnostic features and economic importance.	K 3
4	Get an idea about storage and preservation techniques.	K 4
5	Evaluate the medicinal importance of certain plant groups..	K 5
6	Inculcating trading, conservation and sustainable utilization of economically important products	K 4

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

Unit:1	INTRODUCTION	12 Hours
Scope of economic botany. Origin, distribution, cultivation and economic importance of Cereal - Paddy,		

Wheat; Pulses- Red gram, Chick pea; Oil crops -Ground nut, Sesame and Nuts- Almond,Cashew.		
Unit:2	**PROCESSING OF PLANT PRODUCTS - I**	**12 Hours**
Origin, distribution, binomial, family, processing and uses of Spices and Condiments -Cinnamon, Mustard; Cosmetics-Henna, Aloe; Essential oils-Clove oil; Beverages- Tea, Coffee.		
Unit:3	**PROCESSING OF PLANT PRODUCTS - II**	**12 Hours**
Origin, distribution, binomial, family, processing and uses of Timber-teak, Fibers- jute, Cotton; Dyes – *Indigofera* Sugar and Rubber.		
Unit:4	**STORAGE OF PLANT PRODUCTS**	**12 Hours**
Storage facilities and post-harvest management of Cereals, Pulses, Oil crops, Nuts and Spices and Condiments.		
Unit:5	**TRADING AND CONSERVATION OF PLANT PRODUCTS**	**12 Hours**
Trading of economically important products. (General account only) Conservation and sustainable utilization of economically important products.		
PRACTICAL		
1. Identification and study of economically useful plants given in syllabus - common name, binomial name, family, useful parts and uses. **2.** Study of processing methods of products given in the syllabus (Aloe, tea, coffee, cotton, sugar and rubber).		
	Total Lecture hours	**60 Hours**

Text books	
1	Pandey, B.P. (2000). Economic Botany. S. Chand & Company Ltd., New Delhi.
2	Verma, V. (2006). A textbook of Economic Botany. Emky Publication, New Delhi.
3	Sambamoorthy A.V and N.S. Subramanyam. (1989). A text book of Economic Botany. Wilay Easters, New Delhi.
4	Ashok Bendre and Ashok Kumar (1998-99). Economic Botany. Rastogi Publications, Meerut

References books	
1	Hill, A.W. (1952). Economic Botany. Tata McGraw–Hill Publishing Co., New Delhi.
2	Sen, S. (1992). Economic Botany. New Central Book Agency, Calcutta.
3	Govinda Praksh and Sharma, S.K. (1975). Introductory Economic Botany. Jai Prakash Nath, Meerut.

4	Gupta, S.K. and Kaushik, M.P. (1973). An Introduction to Economic Botany. K. Nath & Co., Meerut.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://www.springer.com/journal/12231
2	https://en.wikipedia.org/wiki/Santos_Museum_of_Economic_Botany
3	https://en.wikipedia.org/wiki/Economic_Botany_(journal)
4	www.econbot.org/index.php?module=content&type=user&func=view&pid=21.
5	https://swayam.gov.in/NPTEL
6	https://swayam.gov.in/nc_details/NPTEL
7	https://ugcmoocs.inflibnet.ac.in/ugcmoocs/moocs_courses.php
8	https://nptel.ac.in/course.html
Course Designed By: **Dr.V.Bhuvaneswari.**	Verified by: **Dr.K.Padmavathi.**

Mapping with Programme Outcomes

Cos	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	S	M	S	M	S	S	M	M	S
CO2	S	S	S	M	M	S	S	M	S	S
CO3	S	S	S	M	S	S	M	M	S	S
CO4	S	M	S	S	S	M	M	M	S	M
CO5	S	S	M	S	S	M	S	S	S	S
CO6	S	M	M	S	S	M	M	S	S	M

*__S__-Strong; __M__-Medium; __L__-Low

Course code	ELECTIVE PAPER II	L	T	P	C
Core/Elective/ Supportive	A : BIOTECHNOLOGY - CONCEPTS AND TECHNIQUES	75	-	-	4
Pre-requisite	Basic knowledge on structure and application of DNA, recombinant DNA technology and plant tissue culture techniques gained during Class XII.	Syllabus Version		2021-2022	

Course Objectives:

The main objectives of this course are to:

1. Deals with Biotechnology's definition, history and importance of Biotechnology and also Plant Tissue Culture Techniques.
2. Learn about Anther culture, Cybrids,Synthetic seeds and In vitro establishment of Mycorrhizae.
3. Understand various Genetic engineering procedures.
4. Study about rDNA technology..
5. Know about the principles and uses of Molecular diagonostic tools and their applications.

Expected Course Outcomes:

On the successful completion of the course, students are able to:

1	Study about the development of Biotechnology and Plant tissue culture techniques.	K 1
2	Understand Anther culture, Androgenic haploids, Protoplast culture, Somatic hybridization, Cybrids, and Mycorrhizae establishment.	K 2
3	Understand various Genetic engineering techniques.	K 3
4	Overview cloning vectors, Agrobacterium Ti – Plasmid, direct gene transfer methods.	K 4
5	Know the techniques of PCR, RFLP , DNA finger printing, blotting techniques and Electrophoresis.	K 5&K6

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

Unit:1	INTRODUCTION TO BIOTECHNOLOGY	15 Hours
Biotechnology - definition, history and importance - Plant tissue culture, concepts and techniques, constituents of MS and White's media. Sterilization techniques - Callogenesis, regeneration, micro propagation through somatic embryogenesis and suspension culture.		
Unit:2	**PLANT TISSUE CULTURE**	**15 Hours**
Anther culture, Pollen culture (Androgenic haploids), isolation and culture of protoplast, somaclonal - variations - somatic hybridization, cybrids, synthetic seeds.		
Unit:3	**GENETIC ENGINEERING**	**15 Hours**
Genetic engineering - Procedure for gene cloning, isolation of specific genes, enzymes used in gene cloning - polymerases, restriction endonucleases, ligases and reverse transcriptase. Genetically modified food plants -Bt Brinjal		
Unit:4	**GENE CLONING IN PLANTS**	**15 Hours**
Cloning vectors - Plasmids, phages, cosmids, transposons and YAC. Gene cloning in higher plants - use of CaMV and Agrobacterium Ti - Plasmid as vehicle. Methods of direct gene transfer - electroporation, micro injection and liposomes. Isolation and screening of rDNA.		
Unit:5	**MOLECULAR DIAGNOSTIC TOOLS**	**15 Hours**
Principles of PCR and RFLP, Southern blotting, Applications of DNA fingerprinting techniques, agarose gel electrophoresis.		
PRACTICAL 1. Preparation of M.S. Medium-sterilization and inoculation of explants. 2. Synthetic seed preparation. 3. Isolation of protoplast – Mechanical method 4. Spotters – Ti Plasmid, Agrobacterium mediated transformation, Agarose gel electrophoresis, PCR Reaction, Southern blotting - observation of photographs.		
	Total Lecture hours	**75 Hours**

	Text books
1	Dubey. R.C. (1996). A Text Book of Biotechnology. Rastogi Publications, Meerut.
2	Kumaresan, V.K. (2003). Biotechnology. Saras Publications, Kanyakumari
3	Ignacimuthu, S. (1996). Applied Plant Biotechnology. Tata McGraw Hill Publishing Company Ltd., New Delhi.
4	Ignacimuthu, S. (1996). Basic Biotechnology. 1996. Tata McGraw Hill Publishing Company Ltd., New Delhi.
5	Gupta, P.K. (2004). Elements of Biotechnology, 2004. Rastogi Publications, Meerut.

Reference books	
1	Ignacimuthu, S. (1997). Plant Biotechnology. Tata McGraw Hill Publishing Company Ltd., New Delhi.
2	Chhatwal. (1995). Text book of Biotechnology. Anmol Publications Pvt. Ltd., New Delhi. .
3	Parihar, P. (2014). A Textbook of Biotechnology. Argobios Publications, Jodhpur
4	Kumar, H.D. (1991). A Textbook on Biotechnology. East west press, New Delhi.
5	Bernard R Glick & Jack J Pasternak. 2001. Molecular biotechnologyprinciples and applications of recombinant DNA, (2nd Edition), ASM Press, Washington, D.C.
6	George, EF & Sherrington, PD. 1984. Plant propagation by Tissue culture, Exegetics, London.
7	Gamborg, OL & Phillips, GC. 1995. Plant cell, Tissue and Organ culture, Narosa , New Delhi.
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://swayam.gov.in/nd2_cec20_bt07/preview
2	https://www.classcentral.com/course/swayam-principles-of-biotechnology-17738
3	https://swayam.gov.in/nc_details/NPTEL
4	https://www.classcentral.com/course/swayam..
5	https://www.classcentral.com/report/list-of-mooc-based-microcredentials
6	https://nptel.ac.in/courses/102/103/102103015
7	https://swayam.gov.in/NPTEL

Course Designed By: **Dr.V.Bhuvaneswari.** Verified by: **Dr.K.Padmavathi.**

Mapping with Programme Outcomes										
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**M**	**S**
CO2	**S**	**S**	**M**	**S**	**S**	**S**	**S**	**S**	**S**	**M**
CO3	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**M**	**S**
CO4	**S**	**S**	**M**	**S**	**S**	**S**	**S**	**S**	**S**	**M**
CO5	**S**	**S**	**M**	**S**	**S**	**S**	**S**	**S**	**S**	**S**

*__S__-Strong; __M__-Medium; __L__-Low

Course code	ELECTIVE PAPER II	L	T	P	C
Core/Elective/ Supportive	B: SEED BIOLOGY	75	-	-	4
Pre-requisite	Knowledge on seeds, germination, viability and seed dormancy gained during lower classes.	Syllabus Version		2021-2022	

Course Objectives:

The main objectives of this course are to:

1. Study the morphology, structural details of economically important seeds.
2. Know about chemical composition and seed germination techniques.
3. Perform seed germination test
4. Understand seed viability, tetrazolium test and seed vigour test
5. Learn dormancy, it's various kinds and significant factors to break dormancy

Expected Course Outcomes:

On the successful completion of the course, students are able to:

1	Understand seed biology and morphology of different seeds.	K 1 & K 2
2	Learn about seed viability test (Tetrazolium test), seed vigour concepts.	K 3
3	Know about chemical composition of the above seeds, their germination, factors affecting it and treatment to quicken germination.	K 4
4	Gain knowledge on various seed germination tests. seed germination,	K 5
5	Overview what is dormancy, its kind, significance and how to break it.	K 6

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

Unit:1	INTRODUCTION TO SEED BIOLOGY	15 Hours

Morphology and structural details of seeds:

Cereals : Paddy / Wheat
Pulses : Dolichos /Glycine
Oil seeds : Castor
Fibers : Cotton
Vegetables : Cucurbita
Study on importance of seed.

Unit:2	SEED GERMINATION	15 Hours

Chemical composition of seeds mentioned above. Germination - General account. Factors affecting germination. Changes that take place during germination (physical and chemical) Treatments given to quicken germination.

Unit:3	SEED GERMINATION TEST AND EVALUATION	15 Hours

Seed germination test under laboratory conditions. Using paper (BP & TP) sand and soil. The environmental test conditions also are discussed. Evaluation of germination test.

Unit:4	SEED VIABILITY	15 Hours

Seed viability; Topographical Tetrazolium Test. Preparation of solution and methods of application & evaluation. Seed vigour: Concept, Direct and Indirect vigour tests.

Unit:5	SEED DORMANCY	15 Hours

Dormancy – Primary and secondary dormancies. Significance, factors involved, methods used to break dormancy.

PRACTICAL

1. Seed germination test.
2. Evaluation of seedlings: Qualitative test for carbohydrates, proteins and lipids.
3. Seed viability test: Tetrazolium test.

	Total Lecture hours	75 Hours

Text Books

1	Germination of seeds – Mayer A. M & Poljakoff Mayer – 1975
2	Seed physiology -Bryant J . A 1985 –Edward Arnold , London .
3	Agarwal R. L. (1982). Seed Technology -. Oxford and IBH Publishing Company, New Delhi.
4	Bewley, J.D and M. Black (1978). Seed Biology Vol. I & II Academic press, New York

	References books
1	Mayer, AM and Poljakoff-Mayber, A (1989) The Germination of Seeds 4th edn. Pergamon Press, England.
2	Baskin, CC and Baskin, JM (2001). Seeds: Ecology, Biogeography and Evolution of Dormancy and Germination, Academic Press, San Diego.
3	Bedell, PE. (1998) Seed Science and Technology: Indian Forestry Species.Allied Publishers Limited, New Delhi.
4	Bewley, JD and Black M (1994) Seeds: Physiology of Development and Germination. 2nd edn. Plenum Press, New York.
5	Khan, A.A. (Latest Edition) (Ed.). The Physiology and Biochemistry of seed Dormancy and germination. North-Holland Publishing Company: AmsterdamNew York- Oxford.
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://swayam.gov.in/nc_details/NPTEL
2	https://swayam.gov.in/NPTEL
3	https://swayam.gov.in/explorer
4	https://www.classcentral.com/course/swayam-principles-of-seed-technology-17741
5	https://www.classcentral.com/course/swayam-plant-groups-19787
6	https://www.kanchiuniv.ac.in/assets/SWAYAM-BOOKLET.pdf
7	https://www.hindiyojana.in/swayam-free-online-course-registration/
8	https://www.aicte-india.org/sites/default/files/SWAYAM_1.pdf
9	https://www.swayamprabha.gov.in/

Course Designed By: **Dr.V.Bhuvaneswari.** Verified by: **Dr.K.Padmavathi.**

Mapping with Programme Outcomes										
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**M**	**S**
CO2	**S**	**S**	**M**	**S**	**S**	**S**	**S**	**S**	**S**	**M**
CO3	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**M**	**S**
CO4	**S**	**S**	**M**	**S**	**S**	**S**	**S**	**S**	**S**	**M**
CO5	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**M**	**S**

*__S__-Strong; **M**-Medium; **L**-Low

Course code	ELECTIVE II	L	T	P	C
Core/Elective/ Supportive	C: POMOLOGY	75	-	-	4
Pre-requisite	Basic knowledge on fruit cultivation, harvesting and disease management gained during Class XII.	Syllabus Version		2021-2022	

Course Objectives:

The main objectives of this course are to:

1. Understand pomology, tropical fruit cultivation, its status, fruit growing regions of India and in Tamil Nadu
2. Find out the overall strategies and techniques to grow different commercial fruits.
3. Impart knowledge on cultivation methods of some prominent fruit varieties.
4. Learn about the cultivation methods of subtropical and tropical fruits.
5. Study about temperate fruits and their propagation methods.

Expected Course Outcomes:

On the successful completion of the course, students are able to:

1	Gain information about cultivation of Indian fruits	K 1
2	Understand pomology, tropical fruit cultivation of India.	K 2
3	Identify methods for producing subtropical humid zone fruits	K 3& K4
4	Get a thorough knowledge about classification and production methods of temperate fruits.	K 5
5	Learn about the production of export varieties of fruits.	K 5&K6

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

Unit:1	INTRODUCTION TO TROPICAL FRUITS	15 Hours
Tropical fruits cultivation - Past and present status of tropical fruits in India. General appraisal of fruit growing regions / Zones in India and Tamil Nadu.		
Unit:2	**TROPICAL FRUIT CULTIVATION**	**15 Hours**
Production, productivity, varieties- exportable varieties. Climate and soil requirements - propagation techniques - planting. Nutrition-nutrient deficiency and management – flowering, fruit set, bearing problems - special horticultural technique. Harvesting techniques – post harvest handling & post-harvest treatments - ripening of fruits - storage and processing of Mango, Banana.		
Unit:3	**EDAPHIC FACTOR FOR FRUIT CULTIVATION**	**15 Hours**
Climate and Soil environments- varieties- Propagation-Planting requirements, manures and manuring of Papaya, Guava, Sapota, Lemon, Sweet orange, Jack fruit and Pine apple.		
Unit:4	**MANAGEMENT OF FRUIT CROPS**	**15 Hours**
Subtropical and humid zones of India and Tamil Nadu – importance and scope of fruit crops in these zones – varieties, propagation and planting and aftercare, – management of nutrient – water needs – weed management – Training and pruning method – physiology of flowering, use of plant growth regulators – harvesting procedures – post harvest aspects of the following crops: Mandarin, Avocado, Litchi, Carambola.		
Unit:5	**PRODUCTION AND POST HARVEST MANAGEMENT OF FRUIT CROPS**	**15 Hours**
Classification of temperate fruits – detailed study of area, production, varieties, climate and soil requirements – propagation – planting density – cropping systems– training and pruning –use of growth regulators – nutrient and weed management – harvesting – post harvest handling and storage in the following crops: Apple, Pear, Plum, Strawberry, Cherries.		
PRACTICAL		
Identify the fruits and their products mentioned in the syllabus with binomial, family and uses.		
	Total Lecture hours	**75 Hours**

Text books	
1	Bose, T. K. S. K. Mitra, and D. S. Rathore. 1998. Temperate Fruits – Nayaprakash, Calcutta.
2	Bose, T. K. 1996. Fruits of India – Tropical and sub – tropical. Nayaprakash, Calcutta.
3	Bose T.K. S. K. Mitra and M. K. Sadhu. 1988 Mineral Nutrition of Fruit Crops. Naya Prokash, Calcutta.
4	Bose, T. K., S. K. Mitra and D. Sanyal, 2001. Fruits: Tropical and subtropical volume I. Naya Udyog, Calcutta.
5	Chattopadhyay, T. K. 1994. A text book of Pomology (Vol 1-3), Kalyani Publishers, New Delhi.
6	Dr. Rajaneesh Singh and Dr.Bijendrakumar Singh, 2020 Basic Horticulture and Fruit Production Technology, New India Publishing Agency, New Delhi.
7	Fruit culture in India (1967) Singh, S., Krishnamoorthy. S., and Katyal, S. L. ICAR, New Delhi.

	Reference books
1	Fruits: Tropical and subtropical (1990) T. K. Bose & S. K. Mitra, Nayaprakash, 206 Bidhan Saram, Calcutta – 700 116, India.
2	Temperate fruits (1990) – S. K. Mithra, T. K. Bose and D. S. Rathore. Horticulture and Allied Publisher.
3	Anil Kumar Shukla , et.,al 2020, Fuit Breeding, New India Publishing Agency, New Delhi.
4	Pal, J.S. 1997. Fruit Growing, Kalyani Publishers, New Delhi.
5	Shanmugavelu, K. G. 1987. Production technology of fruit crops SBA Publications, Calcutta.
6	Singh, S. S. Krishanmurthi and S. L Katyal 1967. Fruit culture in India, ICAR, New Delhi.
7	Singh, S. P. 1995. Commercial Fruits, Kalyan Publishers, Ludhiyana.
8	Veeraraghavathatham, D., M. Jawaharlal, S. Jeeva and S. Rabindran 1996. Scientific Fruit culture, Suri Associates, Coimbatore.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://swayam.gov.in/nc details/NPTEL
2	https://swayam.gov.in/NPTEL
3	https://swayam.gov.in/
4	https://nptel.ac.in/
5	https://www.hindiyojana.in/swayam-free-online-course-registration/
6	http://www.openculture.com/free certificate courses
7	http://ugcmoocs.inflibnet.ac.in/ugcmoocs/moocs_courses.php
8	https://www.indiacustomercare.com/swayam-online-education-toll-free-number-18001219025
9	https://www.britannica.com/science/pomology
10	https://www.thefreedictionary.com/pomology

Course Designed By: **Dr.V.Bhuvaneswari.** Verified by: **Dr.K.Padmavathi.**

Mapping with Programme Outcomes										
Cos	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**M**	**S**
CO2	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**M**
CO3	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**M**	**S**
CO4	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**M**
CO5	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**M**	**S**

*__S__-Strong; __M__-Medium; __L__-Low

Course code	ELECTIVE III	L	T	P	C
Core/Elective/ Supportive	A : BIOTECHNOLOGY - APPLIED BIOTECHNOLOGY	75	-	-	4
Pre-requisite	Basic knowledge on Transgenic plants, hormones, vaccines, Antibiotics, Monoclonal antibodies, SCP, VAM, Bio-energy gained during Class XII.	Syllabus Version		2021-2022	

Course Objectives:

The main objectives of this course are to:

1. Understand food Biotechnology, mass cultivation of SCP, mushrooms.
2. Learn to produce Biofertilizers and its mass cultivation techniques.
3. Study about application of genetic engineering in various fields.
4. Able to understand biocontrol methods of pathogens and weeds.
5. Understand the various Biofuels and its applications.

Expected Course Outcomes:

On the successful completion of the course, students are able to:

1	Gain knowledge about Applied Biotechnology..	K 1
2	Understand biofules, microbial production of hydrogen, biogas, petrochemical plants and biodiesel plants.	K 2
3	Gain knowledge about mass cultivation of rhizobium, Azosprillum, BGA, phosphobacteria and VAM.	K 3
4	Overview transgenic plants- special importance in agriculture, production of insulin, hormones, vaccines, antibiotics, monoclonal antibodies and hybridoma techniques.	K 4
5	Create biocides to control pathogens , weeds, production of secondary metabolites and enzymes engineering.	K 5&K6

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

Unit:1	FOOD TECHNOLOGY	15 Hours
Food Technology - SCP as microbial food for future - mass cultivation and nutritional value or Spirulina, Scenedesmus, Yeast and Methylophilus. Mushroom Technology - Cultivation techniques and nutritional value of Pleurotus sajor and Agaricus bisporus.		
Unit:2	**BIOFERTILIZERS**	**15 Hours**
Biofertilizers - Advantages mass cultivation and application technique of Rhizobium, Azosprillum, Blue Green Algae (nitrogen fixers), Phosphobacteria, and VAM.		
Unit:3	**APPLICATION OF GENETIC ENGINEERING**	**15 Hours**
Application of genetic engineering: Agriculture-Bt cotton; medicine: Insulin-Stevia, Phyto Hormones-Gibberellin, Vaccines-Hepatitis B, Antibiotics-Streptomycin, Monoclonal Antibodies-Structure and function, Hybridoma techniques.		
Unit:4	**BIOLOGICAL CONTROL OF PATHOGENS AND WEEDS**	**15 Hours**
Biological control of pathogens and weeds through engineered microbes - Bacillus thuringiensis, mycoherbicides and insects, production of secondary metabolites. Bacterial toxins and penicillin. Enzymes engineering and its uses.		
Unit:5	**BIOFUEL**	**15 Hours**
Biofuel. Biomass and bio-energy, production of hydrogen. Biogas. Petrochemical plants Calotropis/ Heavia. Biodiesel- Jatropa- source of alternate fuel.		
PRACTICAL		
1. Cultivation of Pleurotus sajor. 2. Culture of Yeast, Spirulina, Nostoc and Azolla. 3. Demonstration of biofertilizers – Azospirillum; Agrobacterium; antibiotics - specimens or slides or photographs. 4. Petrochemical and biodiesel Plants - specimens.		
	Total Lecture hours	**75 Hours**

Text books

1	Dubey. R.C. (1996). A Text Book of Biotechnology. Rastogi Publications, Meerut.
2	Kumaresan, V.K. (2003). Biotechnology. Saras Publications, Kanyakumari
3	Ignacimuthu, S. (1997). Plant Biotechnology. Tata McGraw Hill Publishing Company Ltd., New Delhi.
4	Gupta, P.K. (2004). Elements of Biotechnology, 2004. Rastogi Publications, Meerut

	References books
1	Parihar, P. (2014). A Textbook of Biotechnology. Argobios Publications, Jodhpur
2	Kumar, H.D. (1991). A Textbook on Biotechnology. East west press, New Delhi.
3	Ignacimuthu, S. (1996). Applied Plant Biotechnology. Tata McGraw Hill Publishing Company Ltd., New Delhi.
4	Ignacimuthu, S. (1996). Basic Biotechnology. 1996. Tata McGraw Hill Publishing Company Ltd., New Delhi.
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://swayam.gov.in/explorer
2	https://swayam.gov.in/nd1_noc19_bt15/preview
3	https://swayam.gov.in/nd1_noc19_bt20/preview
4	https://nptel.ac.in/AICTE_FDP/
5	https://www.classcentral.com/report/swayam-moocs-course-list/
6	https://iubmb.onlinelibrary.wiley.com/journal/14708744
7	https://www.springer.com/journal/253
Course Designed By: **Dr.V.Bhuvaneswari.**	Verified by: **Dr.K.Padmavathi.**

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**M**	**S**
CO2	**S**	**S**	**M**	**S**	**S**	**S**	**S**	**S**	**S**	**M**
CO3	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**M**	**S**
CO4	**S**	**S**	**M**	**S**	**S**	**S**	**S**	**S**	**S**	**M**
CO5	**S**	**S**	**M**	**S**	**S**	**S**	**S**	**S**	**S**	**S**

*__S__-Strong; __M__-Medium; __L__-Low

Course code	ELECTIVE III	L	T	P	C
Core/Elective/ Supportive	B : ETHNOBOTANY	75	--	-	4
Pre-requisite	Basic knowledge on interrelations between humans and plants. Indigenous knowledge of plants and classification, cultivation and their uses gained during H.Sc level.	Syllabus Version		2021-2022	

Course Objectives:

The main objectives of this course are to:

1. Learn about concepts, scope and objectives of Ethnobotany and ethnic groups.
2. Study the methodology of Ethnobotany and plants used by Tribes.
3. Appreciate Tribal medicines and its role in modern medicine.
4. Analyse role of Ethnic group in conservation.
5. Inculcate Ethnobotany as a source of drugs.

Expected Course Outcomes:

On the successful completion of the course, students are able to:

1	Overview multidisciplinary aspects of Ethnobotany and have an idea about Ethnic groups.	K 1
2	Understand significance of various Tribal medicines.	K 2
3	Impart methodology of Ethnobotany and plants used by tribes.	K 3
4	Know the responsibility of conservation of plant Genetic resources by Tribes.	K 4
5	Imbibe Ethnobotany as a definite source of drug.	K 5&K6

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

Unit:1	INTRODUCTION	15 Hours
Ethnobotany: Introduction, concept, scope and objectives. Ethnobotany as an interdisciplinary science. The relevance of ethnobotany in the present context. Major ethnic groups in Tamilnadu. (Any five)		
Unit:2	**ETHNOBOTANICAL STUDIES**	**15 Hours**
Methodology of Ethnobotanical studies. a) Field work b) Herbarium c) Ancient Literature d) Temples and sacred places. Plants used by the tribals: a) Food plants b) intoxicants and beverages c) Resins and oils and miscellaneous uses.		
Unit:3	**PLANTS AND TRIBAL MEDICINE**	**15 Hours**
Plants and Tribal medicine: Significance of the following plants in ethno botanical practices (along with their habitat and morphology) *a) Azadiractha indica* b) *Ocimum sanctum* c) *Vitex negundo.* d) *Gloriosa superba* e) *Tribulus terrestris* f) *Pongamia pinnata* g) *Cassia auriculata* h) *Indigofera tinctoria*. Role of ethnobotany in modern medicine with special example *Rauwolfia sepentina., Trichopus zeylanicus.*		
Unit:4	**ROLE OF ETHNOBOTANY**	**15 Hours**
Role of ethnic groups in conservation of plant genetic resources. Participatory forest management. Sharing of wealth concept with few examples from India.		
Unit:5	**ETHNOBOTANY AND DRUG DEVELOPMENT**	**15 Hours**
Ethnobotany as a source of drug. a) Reserpine b) Artemisin c) Gulipid d) Cocaine e) Strychnine.		
PRACTICAL		
Identify the plants and plant products mentioned in the syllabus with common name, binomial, family with ethnobotanical significance.		
	Total Lecture hours	**75 Hours**

Text books

1	S.K. Jain, Manual of Ethnobotany, Scientific Publishers, Jodhpur-1995.
2	S.K. Jain (ed.) Glimpses of Indian. Ethnobotany, Oxford and I B H, New Delhi – 1981
3	S.K. Jain (ed.) 1989. Methods and approaches in ethnobotany. Society of ethnobotanists, Lucknow
4	S.K. Jain 1990. Contributions of Indian ethnobotny. Scientific publishers, Jodhpur, India.

	Reference books
1	Cotton C.M. 1997. Ethnobotany – Principles and applications. John Wiley and sons – Chichester
2	Rajiv K. Sinha – Ethnobotany The Renaissance of Traditional Herbal Medicine – INA – SHREE Publishers, Jaipur-1996.
3	Faulks, P.J. 1958. An introduction to Ethnobotany, Moredale pub. Ltd. London.
4	Gary J Martin, 2008. Ethnobotany A Methods manual, Earth scan, London.
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	www.herbs.org/links/linksethno.htm
2	http://naeb.brit.org/
3	https://www.starlink.com
4	https://www.websiteplanet.com/webtools/sharelink
5	https://phytochem.nal.usda.gov/phytochem
6	https://www.fs.fed.us/wildflowers/ethnobotany/index.shtml
7	https://link.springer.com/book/10.1007/978-1-4615-2496-0
8	https://swayam.gov.in
9	https://www.classcentral.com/report/mooc-providers-list

Course Designed By: **Dr.V.Bhuvaneswari.** Verified by: **Dr.K.Padmavathi.**

Mapping with Programme Outcomes										
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	S	M	S	S	S	S	S	S	S
CO2	S	S	S	S	S	S	M	S	S	S
CO3	S	S	M	S	S	S	S	S	S	S
CO4	S	S	S	S	S	S	M	S	S	S
CO5	S	S	S	S	S	S	S	S	S	S

*__S__-Strong; **M**-Medium; **L**-Low

Course code	ELECTIVE III	L	T	P	C
Core/Elective/ Supportive	C : BIOINFORMATICS	75	-	-	4
Pre-requisite	Basic knowledge on Database, Proteomics and Genomics gained during Class XII.	Syllabus Version		2021-2022	

Course Objectives:

The main objectives of this course are to:

1. Study about Bioinformatics and its role in Biology and sequences used in Bioinformatics.
2. Impart knowledge on Biological Database and its types.
3. Learn about various Database of Bioinformatics.
4. Know about Proteomics and Genomics.
5. Understand gene finding, protein prediction, phylogenetic analysis and drug designing.

Expected Course Outcomes:

On the successful completion of the course, student are able to:

1	Know about basics of Bioinformatics and Information technology and their relationship with biology.	K 1
2	Gain knowledge about nucleotide sequence database.	K 2
3	Understand the usage of various biological Databases.	K 3
4	Insist Biological Databases.	K 4
5	Corelate the gene prediction, , Biomolecular visualization, phylogenetic analysis and drug designing in future studies.	K 5&K6

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

Unit:1	INTRODUCTION TO BIOINFORMATICS	15 Hours

Introduction to Bioinformatics, Knowledge Base in Biology, Information Technology in Biology, Types of Sequences used in Bioinformatics- DNA Sequences, RNA Sequences, Protein Sequences, application of Bioinformatics, fields related to Bioinformatics

Unit:2	BIOLOGICAL DATABASES	15 Hours

Biological databases and its significance - objectives, properties and classification of Biological databases, Hard – link relationships between databases, Symbols used in databases

Unit:3	GENOMICS	15 Hours
Nucleotide Sequence Databases, Nomenclature of DNA Sequences, Structure of Nucleotide Sequence Databases, GenBank format, Gene expression Databases.		
Unit:4	**PROTEOMICS AND GENEMICS.**	**15 Hours**
Proteomics - Classification based on shape, composition function; Nomenclature of Protein Sequences ; Genomics- Comparative Genomic Databases, organism specific Genomic databases.		
Unit:5	**DRUG DESIGNING**	**15 Hours**
Gene finding, protein prediction, biomolecular visualization, phylogenetic analysis &Drug designing.		

PRACTICAL

1. Familiarizing with the different biological data bases mentioned in the syllabus.
2. Retrieval of nucleotide and aminoacid sequence, Blast search of nucleotide sequence.
3. Retrieval of 3D structure of protein, Molecular visualization using Rasmol.

Total Lecture hours	**75 Hours**

Text books

1	Arthur, M.L. (2005). Introduction to Bioinformatics (Ed:2). Oxford University Press, New York.
2	Attwood, T.K. and Parrysmith, D.J. (2001). Introduction to Bioinformatics. Pearson Education, New Delhi.
3	Mani, Kand N. Vijayaraj. 2002. Bioinformatics for beginners. Kalaikathir Achakam, Coimabtore.
4	David W. Mount. 2001.Bioinformatics sequence and Genome analysis, Cold spring Harber Laboratory press

Reference books

1	A.D.Baxevanis and B.J.Francis(Eds) “Bio-informatics”- A practical guide to the analyzing of gene protein”-john wiley and sons(1998).
2	Missener and A.S.Krawetg,”Bio-informatics to bio-informatics” Addison Wesley Longman Ltd (1999).
3	A.D. Baxevains and B.J. Franchis (Eds.). 1998. Bioinformatics- A practical guide to the analyzing of gene protein. Joha Wiley and Sons.
4	Bioinformatics- A biologists guide to bio-computing and the internet 2000.Stuart M.Brown.
5	Bioinformatics”Sequence and Genome analysis.2001.David W.Mount.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	http://www.ii.uib.no/~inge/list.html
2	https://www.researchgate.net/
3	https://academic.oup.com/nar/article/33/suppl_2/W3/2505760
4	https://www.bioinformatics.org/
5	http://bioinfbook.com/bioinformatics/bioinf14_mainbioinf.htm
6	https://www.ebi.ac.uk/
7	https://en.wikipedia.org/wiki/Bioinformatics
8	https://www.classcentral.com/course/swayam-bio-informatics-algorithms-and-applications-12890
9	https://swayam.gov.in/nd1_noc20_bt10/preview
10	http://www.dypatil.edu/schools/biotech-and-bioinformatics/swayam-nptel-local-chapter/

Course Designed By: **Dr.V.Bhuvaneswari.** Verified by: **Dr.K.Padmavathi.**

Mapping with Programme Outcomes

COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	S	S	S	S	S	M	S	S	S
CO2	S	S	S	S	S	M	M	S	S	S
CO3	S	S	S	S	S	S	M	S	S	S
CO4	S	S	S	S	S	M	M	S	S	S
CO5	S	S	S	S	S	S	M	S	S	S

*__S__-Strong; **M**-Medium; **L**-Low

CORE PRACTICAL-I (Papers I & II)

Course code			L	T	P	C
Core/Elective/Supportive		**Core practical – I (paper I & II)** Plant Diversity I (Algae, Fungi, Lichens, Plant Pathology); Plant Diversity II (Bryophytes, Pteridophytes, Gymnosperms and Palaeobotany)			**60**	**4**
Pre-requisite		**Basic knowledge about the type specimen's studied in core paper I and core paper II and using of microscopes.**	**Syllabus Version**		**2021-2022**	

Course Objectives:

The main objectives of this course are to

1. Get knowledge on general characters of Algae, Fungi and Bryophytes.
2. Understand the structure and reproduction of Pteridophytes and Gymnosperms.
3. Acquire knowledge on types and structure of Lichens.
4. Learn the different pathogenic organisms of plants causing various diseases.
5. Obtain knowledge on different types of fossils.

Expected Course Outcomes:

On the successful completion of the course, students are able to:

1	Understand the thallus organization and reproduction of Thallophytes and Bryophytes.	K2
2	Gain knowledge on Pteridophytes and Gymnosperms.	K1
3	Overview the different types of Lichens and their mode of reproduction.	K3
4	Implement knowledge on management of plant diseases to increase crop yield.	K4
5	Differentiate different types of fossil plants.	K3

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

Time: 3 Hrs		Max. Marks: 50
1.	Make suitable micro preparations of A & B. Draw labeled sketches. Identify, give reasons and submit the slides for valuation	2x6 = 12
2.	Identify any TWO algal members from the algal mixture C. Draw labelled sketches and give reasons.	2x4 = 8
3.	Identify, draw diagrams and write notes on D, E, F, G, and I	5x4 = 20
	Practical =	40
	Record =	10
	Total Marks =	**50**

CORE PRACTICAL-I (Papers I & II)

Plant Diversity I (Algae, Fungi, Lichens, Plant Pathology); Plant Diversity II (Bryophytes, Pteridophytes , Gymnosperms and Palaeobotany)

Key

1	A- Algae/ Fungi/ Bryophyte B- Pteriodopytes/ Gymnosperms (Identification-1, slide-2, Sketch -2 and Reasons -1)	2x6= 12
2.	C- Algal Mixture (Identification-1, Sketch-1 & Notes-2)	2x4= 08
3.	D- Fungi E- Lichen/ Plant pathology F- Bryophytes G- Pteridophytes H- Gymnosperms / Palaeobotany (Identification-1, Sketch-2,Notes-1)	5x4 = 20
	Practical =	40
	Record =	10
	Total Marks =	50

Course Designed By: **Dr.R.Kannan.** Verified by: **Dr.K.Padmavathi.**

Mapping with Programme Outcomes										
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	M	M	M	S	S	S	M	M	M
CO2	S	M	M	M	S	S	S	M	M	M
CO3	S	M	S	M	S	S	S	S	M	S
CO4	S	S	M	S	S	S	S	M	M	S
CO5	S	M	S	M	S	S	S	M	S	S

*__S__-Strong; __M__-Medium; __L__-Low

Course code			L	T	P	C
Core/Elective/Supportive		**Core practical –II (paper III & IV)** [Cell Biology and Lab techniques; Anatomy and Embryology]			45	3
Pre-requisite		**Basic knowledge, lab instruments, anatomical structures of plants and embryology of plants.**	Syllabus Version		2021-2022	

Course Objectives:

The main objectives of this course are to

1. Training students to prepare micro preparation and showing the stages of mitosis (Onion root tips) and showing permanent slides/photographs.
2. Elucidate the plant parts based on anatomical features.
3. Learn the developmental stages of dicot embryo.
4. Gain knowledge on structure and function of cell organelles.
5. Equip the students with skills related to working procedures of instruments used in biological laboratory.

Expected Course Outcomes:

On the successful completion of the course, students are able to:

1	Distinguish the different stages of cell division.	K1
2	Identify the plant parts by observing anatomical features.	K3
3	Know the developmental stages of dicot embryo.	K2
4	Gain knowledge on cell organelles.	K2
5	Technically able to handle instruments used in biological studies.	K3

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

Time: 3 Hrs		Max. Marks: 45
1	Make squash of specimen A. Draw Sketches, Identify any one stage. Submit the slide for valuation.	3
2	Make suitable micro preparation of B & C. Draw labeled Sketches. Identify giving reasons & submit the slide for Valuation.	2X4= 08
3	Mount the embryo of the given specimen D and submit the slide for Valuation.	3
4	Take the peel of given leaf E and identify the stomatal type E. Draw diagram and write notes.	4
5	Identify, draw diagrams and write notes on F, G, H, & I.	4x3= 12
	Practical =	30
	Viva-voce =	5
	Record =	10
	Total Marks =	**45**

CORE PRACTICAL II (PAPERS III & IV)

[Cell biology and Lab techniques & Anatomy and Embryology]

KEY

1	A: Squash [Identification-1, Slide-1,Sketch & Notes-1]	3
2	B & C: Anatomy [Identification-1,Slide-1,Sketch-1,Notes-1]	2x4=08
3	D: Embryo Mounting [Tridax / Crotalaria] [Slide-2, Sketch & Notes-2]	3
4	E: Leaf mounting. [Identificatin-1, slide-1, sketch &Notes-2]	4
5	F: Cell biology G: Lab techniques H: Anatomy I : Embryology [Identification-1, Sketch-2, & Notes-1]	4x3= 12
	Practical =	30
	Viva-voce =	5
	Record =	10
	Total Marks =	45
Course Designed By: **Dr.V.Bhuvaneswari.**	Verified by: **Dr.K.Padmavathi.**	

Mapping with Programme Outcomes										
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	M	M	S	S	L	S	L	L	M
CO2	S	S	S	M	S	M	M	M	S	M
CO3	S	M	L	S	S	M	S	L	M	M
CO4	S	M	S	S	S	S	S	M	M	M
CO5	S	S	S	S	S	S	S	M	M	M

*__S__-Strong; __M__-Medium; __L__-Low

Course code			L	T	P	C
Core/Elective/Supportive		**Core practical –III(paper V,VI & VII)** (Taxonomy of Angiosperms and Economic Botany; Genetics, Plant Breeding, Evolution and Biostatistics; Ecology and Phytogeography)			**60**	**4**
Pre-requisite		**Basic knowledge in plant morphology, taxonomy, adaptations of plants, basic knowledge in plant communities, and campus flora. They must also know the basic principles in Genetics and Biostatistics.**	**Syllabus Version**		**2021-2022**	

The main objectives of this course are to:

1. Observe the morphological and reproductive features of angiosperms, analyze and ascertain angiosperms to their respective families with their economic importance.
2. Employ Mendelian inheritance practically.
3. Carry out methods of plant breeding techniques.
4. Employ preliminary statistical analysis and interpret plant related parameters.
5. Observe, understand and ascertain plants to their habitat and learn about the organization of plant communities.

Expected Course outcomes are:

On the successful completion of the course, students are able to:

1	Gain efficiency in understanding the taxonomic features of angiosperms and ascertain the plant members to their respective families. Recognize and appreciate the economic values of plants studied.	K3
2	Critically analyze the heredity of characters in plants. Employ simple plant breeding techniques and develop hybrid plants.	K4
3	Use simple statistical methods to understand plant/crop parameters.	K5
4	Select plants to grow successfully to the suitable ecological locations. Relate and interpret the different components of the plant communities.	K2
5	Recognize and analyse the various biotic and abiotic factors that affect the vegetational types.	K4

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

	Time: 3 Hrs	Max. Marks 50
1	Assign specimen A and B to its respective family by giving reasons	2x3=6
2	Describe specimen C in technical terms. Draw sketches of floral Parts, Construct floral diagram & write floral formula	4
3	Make micro preparations of D. Draw labeled sketches. Submit the slide for valuation. Write down its anatomical adaptations	3
4	Analyse the plant communities present in the constructed Quadrat /Line Transect/Belt transect E by Quantitative method. Present the data and give the inference	4
5	Identify the given specimen F, Write botanical name, family and vernacular name	2
6	Work out the given genetics problem G.	2
7	Work out the given biostatics Problem H.	2
8	Write the botanical name and economic uses of I	2
	Practical =	25
	Viva-voce =	5
	Herbarium =	5
	Field trip report =	5
	Record =	10
	Total Marks =	**50**

CORE PRACTICAL-III (Papers V, VI, & VII)

(Taxonomy of Angiosperms and economic botany: Genetics, Plant Breeding, Evolution and Biostatistics; Ecology and Phytogeography)

KEY

1	A&B Taxonomy (Identification -1 , Reasons -2)	2x3=06
2	C. Taxonomy (sketches-1,Floral diagram-1,Floaral Formula-1,Notes-1)	4
3	D. Hydrophyte / Xerophyte (Identification -1, Slide-1 Sketch& Notes-1)	3
4	E. Quadrat / Line transect / Belt transect- (Identification-1,Graph & Notes-3)	4
5	F. Botanical name, family, vernacular name (tree/shrub from campus flora)	2
6	G. Genetics Problem	2
7	H. Biostatistics problem	2
8	I. Economic Botany	2
	Practical =	25
	Viva-voce =	5
	Herbarium =	5
	Field trip report =	5
	Record =	10
	Total Marks =	**50**

Course Designed By: **Dr.V.Sivasankari.** Verified by: **Dr.K.Padmavathi.**

Mapping with Programme Outcomes										
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	S	S	S	M	S	S	M	S	S
CO2	S	S	S	S	M	S	M	S	S	S
CO3	S	S	M	M	S	S	S	S	S	S
CO4	S	S	S	S	S	S	S	S	S	S
CO5	S	S	M	M	S	S	S	M	S	S

*__S__-Strong; __M__-Medium; __L__-Low

Course code			L	T	P	C
Core/Elective/Supportive		**Core practical –IV (paper IX & X)** (Biophysics, Biochemistry, Plant Physiology and Horticulture)			60	3
Pre-requisite		**Basic knowledge I, Biochemistry, Physiology and vegetative propagation methods and commercial Horticulture.**	**Syllabus Version**		**2021-2022**	

The main objectives of this course are to:

1. Overview the concept of water relation and transpiration in plants.
2. Gain complete knowledge on requirements and process of photosynthesis and respiration in plants.
3. Estimate various biomolecule using quantitative methods in plant tissues.
4. Learn about types of vegetative propagation methods.
5. Get basic knowledge in commercial horticulture.

Expected Course outcomes are:

On the successful completion of the course, students are able to:

1	Gain knowledge in water relation, process and factors affecting transpiration in plants	K1
2	Know about various requirements and processes involved in photosynthesis and respiration.	K3
3	Learn the techniques in estimation of biomolecules.	K3
4	Understand the basic techniques involved in vegetative propagation in plants.	K2
5	Get entrepreneur skill in commercial Horticulture.	K4

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

Time: 3 Hrs		Max. Marks: 45
1	Write Procedure, apparatus required for the experiment A. Give the inference from the experiment and leave the setup for valuation	9
2.	Test the presence/absence of Carbohydrate/Protein, identify the given sample B and Write the procedure.	6
3	Identify, draw diagrams and write notes on C, D & E	3x5 = 15
	Practical's =	30
	Viva-voce =	5
	-Record =	10
	Total Marks =	**45**

CORE PRACTICAL – IV (Papers IX & X)

(Biophysics, Biochemistry, Plant Physiology and Horticulture)

KEY

1	Physiology A (Requirements-3, Procedure-3, Result-3	9
2.	Biochemistry B (Requirements-2, Procedure- 2, Result-2)	6
3	Horticulture C, D & E (vegetative propagation methods, garden types –photos, Commercial horticulture – any product) - (Identification – 1, sketch &Notes - 4)	3x5 = 15
	Practical's =	30
	Viva-voce =	5
	Record =	10
	Total Marks =	**45**

Course Designed By: **Dr.C.Krishnaveni.** Verified by: **Dr.K.Padmavathi.**

Mapping with Programme Outcomes										
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	S	S	M	S	S	S	M	M	M
CO2	S	S	S	M	S	S	S	M	M	M
CO3	S	S	S	M	S	S	M	L	S	S
CO4	S	S	S	L	S	S	M	M	S	S
CO5	S	S	S	M	S	S	S	M	S	S

*__S__-Strong; __M__-Medium; __L__-Low

Course code			L	T	P	C
Core/Elective/Supportive		Core practical –V (Elective papers I, II, &III)			45	3
Pre-requisite		Basic knowledge in Microbiology and Biotechnology principles and techniques	Syllabus Version		2021-2022	

Course Objectives:

The main objectives of this course are to

1. Identify the broad classes of bacteria using gram staining and motility.
2. Learn the laboratory protocols for culturing the microbes like bacteria and fungi.
3. Analyse few food items qualitatively for microbial contamination.
4. Obtain hands on training on the laboratory practice in Plant Tissue culture techniques.
5. Gain practice on production of mushroom and bio-fertilizers.

Expected Course Outcomes:

On the successful completion of the course, students are able to:

1	Identify and differentiate types of Bacteria.	K4
2	Carry out practically the laboratory procedures for growing the microbes.	K3
3	Succeed in preserving food products without microbial contamination.	K2
4	Propagate plants in vitro and conserve endangered plants.	K3
5	Produce commercially mushrooms and bio-fertilizers, and become successful entrepreneur.	K6

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

Time: 3 Hrs		Max. Marks: 45
1	Write the procedure for the Gram Staining and identify the type of bacteria present in the given sample A.	6
2.	Write down the procedure for Preparing a medium/culture/ inoculation Techniques/Hanging drop Method	3
3	Identify the apparatus given in C and D and write notes on their use	2x3 = 6
4	Identify, draw diagrams and write notes on E, F, G, H, & I	5x3 = 15
	Practical =	30
	Viva-voce =	5
	Record =	10
	Total Marks =	**45**

CORE PRACTICAL – V

CORE VIII Fundamentals of Microbiology, Elective papers I, II, &III

KEY

Time: 3 Hrs		Max. Marks: 45
1.	A- Gram staining (procedure -4, result -2)	6
2.	B- Culture methods/ inoculation techniques/ Hanging drop method	3
3	C- Apparatus used in Core VIII Fundamentals of Microbiology D-Apparatus used in Elective (example- Biotechnology- Applied Biotechnology)	2x3=6
4	E & F – spotter in Elective –I (Example Microbiology-Applied Microbiology(Pleurotus sajor, spoiled food , dairy products, culture types-Bacteria /virus/ mycoplasma / actinomycetes (photograph) G,H & I- spotter in Elective –II & III (Example Biotechnology-Concepts and Techniques and Biotechnology-Applied Biotechnology) (Synthetic seeds, shoot tip culture, callus, VAM, Nostoc, Azolla, Azosprillum, Agro bacterium, MS Medium, Transgenic Plants, Petro chemical& Biodiesel plants, SCP etc.,) -(Identification – 1, sketch &Notes - 2)	5x3=15
	Practical =	30
	Viva-voce =	5
	Record =	10
	Total Marks =	**45**
Course Designed By: **Dr. Mahalakshmi Priya**	Verified by: **Dr.K.Padmavathi.**	

Mapping with Programme Outcomes										
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	S	M	S	M	S	S	L	L	M
CO2	S	M	M	M	M	S	S	L	L	M
CO3	S	M	M	S	S	S	S	M	M	M
CO4	S	S	S	M	M	S	S	M	L	M
CO5	S	S	M	M	M	S	S	M	L	M

*__S__-Strong; **M**-Medium; **L**-Low

Course code			L	T	P	C
Core/Elective/Supportive		**SKILL BASED SUBJECT: PRACTICAL** Paper I, II & III (Plant Bio resources, Medicinal botany and human welfare and computing Skills in Industry 4.0)			45	3
Pre-requisite		**Basic knowledge about plant bioresourses, computer (hardware and software) and medicinal plants.**	**Syllabus Version**		**2021-2022**	

Course Objectives:

The main objectives of this course are to

1. Analyze the various chemical parameters of the soil for better plant growth.
2. Educate various medicinally valuable plants parts and its uses.
3. Learn to operate and apply various techniques of computer effectively.
4. Encourage research and entrepreneurship in plant bio resources.
5. Know the various uses of plant bio resources.

Expected Course Outcomes:

On the successful completion of the course, students are able to:

1	Apply various chemical parameters necessary for plant growth.	K3
2	Overview the chemical constituents and uses of native medicinal plants.	K4
3	Create documents, table, power point presentation and MS access.	K6
4	Analyze the role of various organisms in organic farming and industrial waste management.	K4
5	Understand the various commercial products of plant bio resources.	K2

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

S.no	Time: 3Hrs	Max.Marks:45
1.	Analyse the given soil sample 'A', write the procedure and give the results.	6
2.	Make suitable micro preparation of B. Identify, draw sketches and write notes.	4
3.	Identify and write notes on C.	3
4	Write down the procedure for preparing the given method of compost in D.	3
5	Identify E, F, & G, write common name, botanical name, family and their useful parts.	3x3=9
	Practical =	25
	Viva-voce =	5
	Medicinal plant parts exhibit =	5
	Record =	10
	Total Marks =	**45**

Paper I, II & III (Plant Bio resources, Medicinal botany and human welfare and computing skills in Industry 4.0)

Key

S.no	Time: 3 Hrs	Max.Marks:45
1	A. Experiments in Soil analysis (Plant Bio resources) (Requirement-2, Procedure-2, Result-2)	6
2	B- Medicinal botany – stem/leaf (identification–1, slide–1, sketch& notes-2)	4
3	C- Spotter- Computer Applications (Identification – 1, and Notes- 2)	3
4	D-VAM, Vermi compost and EMO. (Identification-1,Description – 2)	3
5	E, F & G Spotters (Common name & Botanical name-1, family & part used-1, uses-1) E & F. Plant Bio resources, G Medicinal Botany	3x3=9
	Practical =	25
	Viva-voce =	5
	Medicinal plant parts exhibit =	5
	Record =	10
	Total Marks =	**45**

Course Designed By: **Dr.J.Rose De Leema** Verified by: **Dr.K.Padmavathi.**

Mapping with Programme Outcomes										
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	S	M	S	S	S	M	M	S	M
CO2	S	S	M	S	M	S	S	M	S	M
CO3	S	S	M	S	S	M	S	M	M	M
CO4	S	S	S	S	M	S	S	M	M	M
CO5	S	S	M	S	S	S	M	M	M	M

*__S__-Strong; __M__-Medium; __L__-Low