

**KONGUNADU ARTS AND SCIENCE COLLEGE**  
**(AUTONOMOUS)**  
**COIMBATORE - 641 029**



**DEPARTMENT OF BOTANY (UG)**

**CURRICULUM AND SCHEME OF EXAMINATIONS**  
**(CBCS)**  
**(2022 - 2023 onwards)**

**KONGUNADU ARTS AND SCIENCE COLLEGE**  
**(AUTONOMOUS)**  
**COIMBATORE – 641 029**

**DEPARTMENT OF BOTANY**

**Vision:**

- Disseminate knowledge and feasible strategies for obtaining sustainable benefits from plants and their utility to the society

**Mission:**

- Designing the curriculum by frequently updating the syllabi according to the present need.
- Preparing the students with more aptitude, skill and leadership quality by educating them.
- Make the students as entrepreneurs in plant based industries.
- Identification and encouragement to turn the students into eminent Scientists/ Laurels.

**PROGRAMME OUTCOMES (PO)**

**PO1**

- ❖ Botany has immense carrier potential in areas such as Taxonomy, Genetics, Cell Biology, Biotechnology, Pharmaceuticals, Agriculture, Forestry and Environmental Science.

**PO2**

- ❖ Students get an ample opportunity to enrich scientific knowledge on botanical and ecological dimension of many plants and to study the species richness of the plant kingdom.

**PO3**

- ❖ Students were able to acquire knowledge and understand the range of plant diversity in terms of structure, function and environmental relationship from primitive to highly evolved plant groups of various life forms.

**PO4**

- ❖ Gain introductory experience on various biochemical pathways and their role in plant systems

**PO5**

- ❖ Apply contextual knowledge on the importance of ethical environmental principles, norms and consequent responsibilities relevant to biodiversity conservation practice and sustainable use of plants.

**PO6**

- ❖ Address the socioeconomic challenges related to plant sciences and to disseminate knowledge on various aspects of medicinal plants and appropriate considerations on human health problems.

**PO7**

- ❖ Knowledge on conservation of natural bio-resources and various other hotspots augment students to explore their therapeutic values economically, culturally and aesthetically.

**PO8**

- ❖ Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data and development of information to provide valid conclusions.

**PROGRAMME SPECIFIC OUTCOMES (PSO)****PSO1**

- ❖ Students can able to apply and associate the acquired knowledge from the allied subjects viz. Zoology and Chemistry, to solve and arrive at conclusions through interdisciplinary approach.

**PSO 2**

- ❖ Through taxonomy, students will be aware about the local and scientific names, economic aspect including uses and variations among different species of Angiosperms.

**PSO3**

- ❖ Plant Physiology aids the students to enhance knowledge on pathways of metabolisms, transport and translocation of water and solutes together with a better understanding of regulation of growth, development and influence of environment.

**PSO4**

- ❖ Students will be able to acquire vast intellectual knowledge on the biology of fossils and living plants along with their relationships with environment.

**PSO5**

- ❖ Study of floriculture and landscaping techniques aids the students to implement knowledge on the process of construction of gardens, lawn designs, topiary and on the frame work of their infrastructure facilities.

**UBO1**

**KONGUNADU ARTS AND SCIENCE COLLEGE (AUTONOMOUS)  
COIMBATORE – 641 029**

**Programme Name: B.Sc., Botany**

Curriculum and Scheme of Examination under CBCS

(Applicable to the students admitted during the Academic Year 2022-2023)

Semester	Part	Subject code	Title of the Paper	Instruction Hours / Cycle	Exam. Marks			Duration of Exam.(hours)	Credit	
					CIA	ESE	Total			
I	I	22TML101	<b>Part-I -Lang. -Tamil-I</b> /Hindi-I/French -I / Malayalam -I/ Sanskrit-I	6	50	50	100	3	3	
	II	22ENG101	<b>Part - II – Lang. - English – I</b>	6	50	50	100	3	3	
	III		22UBO101	<b>C.P.1-</b> Plant Diversity – I	7	50	50	100	3	5
				<b>C.Pr.1 – Plant Diversity - I</b>	2	-	-	-	-	-
			22UZO1A1	<b>Allied -1</b> Zoology – I	5	30	45	75	3	4
			<b>Allied Pr. Zoology – I</b>	2	-	-	-	-	-	
IV	22EVS101	Environmental studies**	2	-	50	50	3	2		
<b>Total</b>				<b>30</b>	<b>-</b>	<b>-</b>	<b>425</b>	<b>-</b>	<b>17</b>	
II	I	22TML202	<b>Part - I- Tamil-II</b> /Hindi-II /French-II/ Malayalam-II / Sanskrit – II	6	50	50	100	3	3	
	II	22ENG202	<b>Part- II- Lang. - English – II</b>	6	50	50	100	3	3	
	III		22UBO202	<b>C.P.2 - Plant Diversity - II</b>	7	50	50	100	3	5
			22UBO2CL	<b>C.Pr.1 –Plant Diversity –I &amp; II</b>	2	50	50	100	3	2
			22UZO2A2	<b>Allied - 2 - Zoology – II</b>	5	30	45	75	3	4
		22UZO2AL	<b>Allied. Pr. Zoology - I &amp; II</b>	2	25	25	50	3	2	
IV	22VED201	Value Education - Moral and Ethics**	2	-	50	50	3	2		
<b>Total</b>				<b>30</b>	<b>-</b>	<b>-</b>	<b>575</b>	<b>-</b>	<b>21</b>	
III	I	22TML303	<b>Part-I-Tamil-III</b> /Hindi- III / French-III / Malayalam - III / Sanskrit – III	6	50	50	100	3	3	
	II	22ENG303	<b>Part - II – Lang. - English – III</b>	6	50	50	100	3	3	
	III		22UBO303	<b>C.P. 3 – Anatomy and Embryology of Angiosperms</b>	5	50	50	100	3	4
				<b>C. Pr. 2. – Anatomy and Embryology of Angiosperms</b>	2	-	-	-	-	-
			22UCH3A3	<b>Allied - 3 - Chemistry – 1</b>	5	30	45	75	3	4
			<b>Allied - Pr. – Chemistry</b>	2	-	-	-	-	-	
IV		22UGC3S1	Skill Based Subject -I Cyber Security*	2	100	-	100	3	3	
		22TBT301/ 22TAT301/ 22UHR3N1	Basic Tamil* / Advanced Tamil**/ Non Major Elective - I**	2	-	75	75	3	2	
<b>Total</b>				<b>30</b>	<b>-</b>	<b>-</b>	<b>550</b>	<b>-</b>	<b>19</b>	
IV	I	22TML404	<b>Part-I Tamil-IV</b> / Hindi-IV / French -IV/ Malayalam - IV / Sanskrit – IV	6	50	50	100	3	3	
	II	22ENG404	<b>Part-- II Lang. - English IV</b>	6	50	50	100	3	3	

**UBO2**

	III	22UBO404	C.P.4- Cytology, Genetics and Plant Breeding	5	50	50	100	3	4
		22UBO4CM	C. Pr.2.- Anatomy, Embryology of Angiosperms, Cytology, Genetics and Plant Breeding	2	50	50	100	3	2
		22UCH4A4	Allied 4 - Chemistry – 2	5	30	45	75	3	4
		22UCH4AL	Allied Pr. Chemistry	2	25	25	50	3	2
	IV	22UGA4S2	Skill based subject - II Plant Tissue Culture – Concept and Applications	2	50	50	100	3	3
		22TBT402/ 22TAT402 22UWR4N2	Basic Tamil*/ Advanced Tamil**/ Non Major Elective-II **	2	-	75	75	3	2
<b>Total</b>				<b>30</b>	<b>-</b>	<b>-</b>	<b>700</b>	<b>-</b>	<b>23</b>
V	III	22UBO505	C.P. 5 - Fundamentals of Computer and Bioinformatics	4	50	50	100	3	4
		22UBO506	C.P. 6 - Taxonomy of Angiosperms and Economic Botany	5	50	50	100	3	5
		22UBO507	C.P.7 – Plant Ecology, Phytogeography and Resource Conservation	4	50	50	100	3	4
		22UBO508	C.P. 8 - Microbiology and Plant Pathology	4	50	50	100	3	4
		22UBO5E1	Major Elective – I	5	50	50	100	3	5
		22UBO5CN	C.Pr.3 – Fundamentals of Computer and Bioinformatics	2	50	50	100	3	2
		22UBO5CO	C. Pr. 4 - Taxonomy of Angiosperms, Economic Botany, Plant Ecology, Phytogeography, Resource Conservation, Microbiology and plant Pathology,	4	50	50	100	3	2
	IV	-	EDC - Extra Departmental course*	2	100	-	100	3	3
		22UBO5IT	Internship Training	<b>Grade****</b>					
<b>Total</b>				<b>30</b>	<b>-</b>	<b>-</b>	<b>800</b>	<b>-</b>	<b>29</b>
VI	III	22UBO609	C.P.9 – Biochemistry and Bioinstrumentation	7	50	50	100	3	5
		22UBO610	C.P.10 - Plant Physiology	6	50	50	100	3	4
		22UBO611	C.P.11- Biophysics and Biostatistics	6	50	50	100	3	4
		22UBO6E2	Major Elective- II	5	50	50	100	3	5
		22UBO6CP	C. Pr. 5 – Biochemistry, Bioinstrumentation, Plant physiology, Biophysics and Biostatistics	4	50	50	100	3	2
		22UBO6Z1	Project & Viva – Voce ***	-	50	50	100	-	5
	22UBO6S3	Skilled Based Subject III- Cultivation and Marketing of Medicinal Plants	2	50	50	100	3	3	
IV		SWAYAM - MOOC	-	-	-	-	-	2	
	-	22NCC*/NSS/ YRC/PYE/ECC/ RRC/ WEC101 #	Co curricular Activities*	-	50	-	50	-	1
<b>Total</b>				<b>30</b>	<b>-</b>	<b>-</b>	<b>750</b>	<b>-</b>	<b>31</b>
<b>Grand Total</b>				<b>-</b>	<b>-</b>	<b>-</b>	<b>3800</b>	<b>-</b>	<b>140</b>

## UBO3

Note:

- CBCS – Choice Based Credit system
- CIA – Continuous Internal Assessment
- ESE – End of Semester Examinations

§For those students who opt NCC under Co-curricular activities will be studying the prescribed syllabi of the UGC which will include Theory, Practical & Camp components. Such students who qualify the prescribed requirements will earn an additional 24 credits.

@ **Hindi/Malayalam/ French/ Sanskrit - 22HIN/MLM/FRN/SAN101 - 404**

\* - No End-of-Semester Examinations. Only Continuous Internal Assessment (CIA)

\*\* - No Continuous Internal Assessment (CIA). Only End-of-Semester Examinations (ESE)

\*\*\* - Project Report - 35 marks; Viva-voce - 15 marks; Internal - 50 marks

\*\*\*\* - The students shall undergo an Internship training/field work for a minimum period of 2 weeks at the end of the fourth semester during summer vacation and submit the report in the fifth semester. The report will be evaluated for 100 marks along with the internal viva voce by the respective Faculty. According to their marks, the grades will be awarded as given below.

Marks %	Grade
85-100	O
70-84	D
60-69	A
50-59	B
40-49	C
<40	U (Reappear)

### Major Elective Papers

(4 papers are to be chosen from the following 8 papers)

1. Forestry
2. Biotechnology
3. Food Science
4. Seed Biology
5. Pharmacognosy
6. Horticulture
7. Mushroom Cultivation Technology
8. Medicobotany

### Non-Major Elective Papers

1. Human Rights
2. Women's Rights
3. Consumer Affairs

### Sub code & Title of the Extra Departmental Course (EDC)

**22UBO5X1 - Medicinal Botany and Human Welfare**

## UBO4

### # List of Co-Curricular Activities:

1. National Cadet Corps (NCC)
2. National Service Scheme (NSS)
3. Youth Red Cross (YRC)
4. Physical Education (PYE)
5. Eco Club (ECC)
6. Red Ribbon Club (RRC)
7. Women Empowerment Cell (WEC)

**Note:** In core/allied subjects, no. of papers both theory and practical are included wherever applicable. However, the total credits and marks for core/allied subjects remain the same as stated below:

### Tally Table:

S. No.	Part	Subject	Marks	Credits
1.	I	Language - Tamil/Hindi/Malayalam/ French/ Sanskrit	400	12
2.	II	English	400	12
3.	III	Core - Theory/Practical	1600	58
		SWAYAM – MOOC	-	2
		Allied	400	20
		Elective/Project	300	15
4.	IV	Basic Tamil / Advanced Tamil (OR) Non-major electives	150	4
		Skill Based subject	300	9
		Extra Departmental Course (EDC)	100	3
		Environmental Studies	50	2
		Value Education	50	2
5.	V	Co-curricular Activities	50	1
		<b>Total</b>	<b>3800</b>	<b>140</b>

- 50 % CIA is applicable to all subjects except EDC, SBS- I and SWAYAM courses.
- UG students should complete **SWAYAM-MOOC** courses before the completion of 5<sup>th</sup> semester and the course completion certificate should be submitted through the HOD to the Controller of Examinations. Two credit points will be given to the candidates who have successfully completed the course. In case the students have completed more than one online course, the appropriate 2 extra credits shall be awarded to such candidates upon the submission of certificate through the HOD to the Controller of Examinations.
- A **Field Trip** preferably relevant to the course should be undertaken every year.



## UBO5

### Components of Continuous Internal Assessment (CIA)

Components		Marks	Total
<b>Theory</b>			
CIA I	75	(75+75) converted to 30	50
CIA II	75		
Problem based Assignment**		10	
<b>Attendance</b>		5	
<b>Others*</b>		5	
<b>Practical</b>			
CIA Practical		50 converted to 30	50
Observation Notebook		15	
Attendance		5	
<b>Project</b>			
Review		45	50
Regularity		5	

### Components of Continuous Internal Assessment (CIA-30Marks & 25 Marks)

Components		Marks	Total
<b>Theory</b>			
CIA I	45	(45+45) converted to 15	50
CIA II	45		
Problem based Assignment**		5	
<b>Attendance</b>		5	
<b>Others*</b>		5	
<b>Practical</b>			
CIA Practical		25 converted to 10	25
Observation Notebook		10	
Attendance		5	

\*Class Participation, Case Studies Presentation, Field Work, Field Survey, Group Discussion, Term Paper, Workshop/Conference Participation. Presentation of Papers in Conferences, Quiz, Report/Content writing. etc.

\*\*Two Assignments to be given. (Each 5 marks)

## UBO6

### BLOOM'S TAXONOMY BASED ASSESSMENT PATTERN

**K1** - Remembering; **K2** - Understanding; **K3** - Applying; **K4** - Analyzing; **K5** - Evaluating

#### 1. Theory Examination - Part I, II & III

##### (i) CIA I & II and ESE: 75 Marks

Knowledge Level	Section	Marks	Description	Total
K1 – K2 Q1 to 20	A (Answer all)	20 x 1 = 20	MCQ-10/Fill ups-5/One word-5	75**
K2 – K5 Q21 to 28	B (5 out of 8)	5 x 5 = 25	Short Answers	
K2 - K5 Q29 to 33	C (3 out of 5)	3 x 10 = 30	Descriptive / Detailed	

**\*\*For ESE 75 marks converted to 50 marks**

##### (ii) CIA I & II and ESE: 45 Marks

Knowledge Level	Section	Marks	Description	Total
K1 – K2 Q1 to 10	A (Answer all)	10 x 0.5 = 5	MCQ	45
K2 – K5 Q11 to 15	B (Either or type)	5 x 3 = 15	Short Answers	
K2 - K5 Q16 to 20	C (Either or type)	5 x 5 = 25	Descriptive/ Detailed	

#### 2. Practical Examination:

Knowledge Level	Section	Marks	Total
K3	Experiments & Record Work	45	50
K4		05	
K5			

Knowledge Level	Section	Marks	Total
K3	Experiments & Record Work	20	25
K4		05	
K5			

## UBO7

### 3. Project Viva Voce:

<b>Knowledge Level</b>	<b>Section</b>	<b>Marks</b>	<b>Total</b>
K3	Project Report & Viva voce	35	50
K4		15	
K5			

<b>Programme Code: 05</b>		<b>B.Sc., BOTANY</b>		
<b>Core Paper 1: PLANT DIVERSITY – I</b>				
<b>Batch</b> 2022-2023	<b>Semester</b> I	<b>Hours / Week</b> 7	<b>Total Hours</b> 105	<b>Credits</b> 5

### COURSE OBJECTIVES

- To acquire knowledge on evolution of Thallophytes and to know about the diversity patterns of lower life forms on earth.
- To understand the distribution, structure, reproduction and life cycle patterns of lower life forms like algae, fungi and lichens.
- To know the economic value aspect of lower organisms.

### COURSE OUTCOMES

On successful completion of the course, the students will be able to

K1 ↑ ↓ K5	CO1	Know about the distribution and mode of nutrition of algal and fungal species
	CO2	Differentiate, identify and classify the algal species using algal pigments and to study the structure, reproduction and life cycle patterns of algae.
	CO3	Gain thorough knowledge on the symbiotic nature of fungi associated with tree species and improve soil fertility
	CO4	Apply knowledge on the involvement and beneficial aspects of fungi to mankind.
	CO5	Apply their knowledge on the involvement of lichens as the indicators of pollution

### SYLLABUS

#### UNIT I

(21 HOURS)

Algae: Introduction and general characters; detailed study of habits, habitats and distribution of algae, algal components, Outline classification of Algae by Fritsch, 1945. Detailed study of occurrence, thallus structure, reproduction and life cycle of Cyanophyceae – *Nostoc*, Chlorophyceae – *Volvox*, *Caulerpa*.

#### UNIT II

(21 HOURS)

Occurrence, thallus structure, reproduction and life cycle of Bacillariophyceae – *Diatoms*; Phaeophyceae – *Saragassum*; Rhodophyceae – *Polysiphonia*.  
\*Economic importance of algae.

#### UNIT III

(21 HOURS)

**Fungi** -General characters of fungi. Structure and reproduction of fungi. Outline classification of fungi by Alexopoulos and Mims (1979) Detailed study of occurrence, structure, reproduction and life cycle of Oomycetes - *Albugo*, Zygomycetes – *Pilobolous*.

## UBO9

22UBO101

### UNIT IV

(21 HOURS)

Occurrence, thallus structure, reproduction and life cycle of Ascomycetes – *Saccharomyces*, Basidiomycetes – *Puccinia*, Deuteromycetes – *Cercospora*. Economic importance of Fungi. Mycorrhizae and their significance.

### UNIT V

(21 HOURS)

Lichens: Habits and habitats, role of Phycobionts and Mycobionts. Outline classification of lichens by Alexopoulos and Mims (1979). Thallus anatomy and reproduction of Ascolichen. Economic importance of Lichens\*

#### \* Self study

#### Teaching Methods

Smart Class Room/Powerpoint presentation/Seminar/Quiz/Discussion

#### TEXTBOOKS

1. Gangulee, Das & Kar. 2001. College Botany Vol. II. New central Book agency Pvt. Ltd., Calcutta.
2. O.P. Sharma.(2002).Text book of Fungi. Tata McGraw-Hill Publications, New Delhi.
3. B.R. Vashishta, (1998). Fungi. S. Chanda & Company, New Delhi
4. B.R. Vashishta, (1998). The Algae. S. Chanda & Company, New Delhi
5. C.L. Chopra, (1982). Algae. S. Chanda & Company, New Delhi

#### REFERENCES

1. G.M.Smith, (1955). Cryptogamic Botany. Alage and Fungi Vol. I M. Vadamalai media Pvt. Ltd. Bangalore
2. F.E. Fritsch, (1972). The structure and reproduction of Algae Vol. I & II.
3. Watson.1974. Structure and life cycle of Bryophytes. B.I. Publications, New Delhi.
4. O.P.Sharma, (1986). Text book of Algae. Tata Mc Graw – Hill Publications, New Delhi
5. E.A. Bessey, (1971). Morphology and Taxonomy of Fungi. Hafner Publication Company, New York.
6. C.J. Alexopoulos and C.W. Mims. (1952). Introductory Mycology. East Wiley Ltd. New Delhi.
7. K.S. Bilgrams, and R.N. Verma, (1978). Physiology of Fungi. Vikas Publishing House.
8. B.R. Vashista, Dr. A.K.Sinha and V.P. Singh, (2013). Botany- Algae, S. Chand and Company Ltd, New Delhi

#### MAPPING

CO \ PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	L	H	S	M
CO2	H	M	S	H	S
CO3	H	H	M	S	H
CO4	S	M	H	S	M
CO5	S	H	M	S	H

S - Strong

H - High

M - Medium

L - Low

<b>Programme Code: 05</b>	<b>B.Sc., BOTANY</b>			
	<b>PART IV – ENVIRONMENTAL STUDIES</b>			
<b>Batch 2022-2023</b>	<b>Semester I</b>	<b>Hours / Week 2</b>	<b>Total Hours 30</b>	<b>Credits 2</b>

**COURSE OBJECTIVES**

- The course will provide students with an understanding and appreciation of the complex interactions of man, health and the environment. It will expose students to the multi-disciplinary nature of environmental health sciences
- To inculcate knowledge and create awareness about ecological and environmental concepts, issues and solutions to environmental problems.
- To shape students into good “Ecocitizens” thereby catering to global environmental needs.
- This course is designed to study about the types of pollutants including gases, chemicals petroleum, noise, light, global warming and radiation as well as pollutant flow and recycling and principles of environmental pollution such as air, water and soil
- The course will address environmental stress and pollution, their sources in natural and workplace environments, their modes of transport and transformation, their ecological and public health effects, and existing methods for environmental disease prevention and remediation.

**COURSE OUTCOMES**

On successful completion of the course, the students will be able to

K1 ↑          ↓ K5	CO 1	Understand how interactions between organisms and their environments drive the dynamics of individuals, populations, communities and ecosystems
	CO2	Develop an in depth knowledge on the interdisciplinary relationship of cultural, ethical and social aspects of global environmental issues
	CO3	Acquiring values and attitudes towards complex environmental socio-economic challenges and providing participatory role in solving current environmental problems and preventing the future ones
	CO4	To gain inherent knowledge on basic concepts of biodiversity in an ecological context and about the current threats of biodiversity
	CO5	To appraise the major concepts and terminology in the field of environmental pollutants, its interconnections and direct damage to the wildlife, in addition to human communities and ecosystems

**SYLLABUS**

**UNIT I MULTIDISCIPLINARY NATURE OF ENVIRONMENT (6 HOURS)**

Definition : scope and importance – Need for public awareness - Natural resources – Types of resources – Forest Resources – Water Resources – Mineral Resources – Food Resources – Energy Resources – Land Resources.

**UNIT II ECOSYSTEMS**

**(6 HOURS)**

Concept of an ecosystem – Structure and functions of an ecosystem – Procedures, consumers and decomposers – Energy flow in the ecosystem – Ecological succession – Food chains, food web and ecological pyramids – Structure and function of the following ecosystem – Forest Ecosystem – Grassland Ecosystem – Desert Ecosystem – Aquatic Ecosystem.

**UNIT III BIODIVERSITY AND ITS CONSERVATION**

**(6 HOURS)**

Introduction – Definition – Genetic – Species and ecosystem diversity- Bio geographical classification of India – Value of biodiversity – Biodiversity at global, national and local levels – India as a mega - diversity Nation - Hot spot of biodiversity – Threats to biodiversity - Endangered and endemic species of India – Conservation of Biodiversity – *In situ* Conservation of Biodiversity – *Ex situ* Conservation of Biodiversity

**UNIT IV ENVIRONMENTAL POLLUTION**

**(6 HOURS)**

Definition - Causes, effects and control measures of : Air Pollution – Water Pollution – Soil Pollution – Marine Pollution – Noise Pollution – Thermal Pollution – Nuclear Pollution – Solid Waste Management: Causes, effects, control measures of urban and industrial wastes – Role of individual in prevention of pollution – Pollution case studies – domestic waste water, effluent from paper mill and dyeing, cement pollution – Disaster Management – Food, Drought, Earthquake, Tsunami, Cyclone and Landslide.

**UNIT V SOCIAL ISSUES AND THE ENVIRONMENT**

**(6 HOURS)**

Sustainable Development – Smart City, Urban planning, Town Planning , Urban problems related to energy – Water Conservation: Rain Water Harvesting and Watershed Management – Resettlement and rehabilitation of people, its problems and concerns, case studies Narmatha Valley Project – Environmental ethics, issues and possible solutions – Climate change, global warming, ozone layer depletion, acid rain, nuclear accidents and holocaust, case studies – Hiroshima and Nagasaki, Chernobyl – Consumerism and waste products – Environmental Protection Act – Air Pollution Act (Prevention and Control) – Water Pollution Act (Prevention and control) – Wild Life Protection Act – Forest Conservation Act – Issues involved in enforcement of environmental legislation – Public awareness – Human Population and the environment – Population Growth and Distribution – Population Explosion – Family Welfare Programme – Environment and Human Health – Human Rights – Value Education – HIV/ AIDS – Women and Child Welfare – Role of Information Technology in Environment and Human Health.

**Teaching Methods**

- Smart Class Room/Powerpoint presentation/Seminar/Quiz/Discussion

**Text Book**

1. P.Arul, A Text Book of Environmental Studies, Environmental Agency, No 27, Nattar street, Velacherry main road, Velacheery, Chennai – 42, First Edition, Nov.2004.

**References**

1. Purohit Shammi Agarwal, A text Book of Environmental Sciences, Publisher Mrs.Saraswati Prohit, Student Education , Behind Naswan Cinema Chopansi Road, Jodhpur.
  2. Dr.Suresh and K.Dhameja, Environmental Sciences and Engineering , Publisher S.K.Kataria & Sons, 424/6, Guru Nanak Street, Vaisarak, Delhi -110 006.
  3. J.Glynn Henry and Gary W Heinke, Environmental Science and Engineering, Prentice Hall of India Private Ltd., New Delhi – 110 001
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**Question Paper Pattern**

**(External only)**

Duration: 3 hours

Total Marks: 50

Answer all Questions ( $5 \times 10 = 50$  Marks)

Essay type, either or type questions from each unit.



Programme Code: 05		B.Sc., BOTANY		
Core Paper: 2 - PLANT DIVERSITY – II				
Batch 2022-2023	Semester II	Hours / Week 7	Total Hours 105	Credits 5

### COURSE OBJECTIVES

- To know about the diversity of Cryptogams and Phanerogams.
- To understand the life cycle patterns of Bryophytes, Pteridophytes and Gymnosperms.
- To study the fossil remains of plants belonging to various eras of Palaeobotany.

### COURSE OUTCOMES

On successful completion of the course, the students will be able to

K1 ↑ ↓ K5	CO1	Acquire knowledge on diversity among Bryophytes, Pteridophytes and Gymnosperms.
	CO2	Understand the internal structure and reproduction of Cryptogams and Phanerogams
	CO3	Apply the medicinal and economic aspect of Bryophytes, Pteridophytes and Gymnosperms for the benefit of human welfare.
	CO4	Implement knowledge on the structural organization and life cycle patterns of Gymnosperms
	CO5	Compare and evaluate the Cryptogamic and Phanerogamic characters along with fossil forms and their past evidences for the identification and determination of their age through radiocarbon dating.

### SYLLABUS

#### UNIT I

(21 HOURS)

**Bryophytes:** Introduction and general characters of Bryophytes. Classification of Bryophytes (K.R. Sporne, 1935). Occurrence, structure, reproduction and life cycle of *Marchantia*<sup>#</sup>, *Anthoceros*<sup>#</sup> and *Funaria*<sup>#</sup>. Economic importance of Bryophytes.

#### UNIT II

(21 HOURS)

**Pteridophytes:** Introduction and general characters of Pteridophytes. Classification of Pteridophytes (Riemer, 1954). Occurrence, structure, reproduction and life cycle of *Lycopodium*<sup>#</sup>, *Selaginella*<sup>#</sup> and *Equisetum*<sup>#</sup>.

#### UNIT III

(21 HOURS)

Occurrence, structure, reproduction and life cycle of *Ophioglossum*<sup>#</sup> and *Adiantum*<sup>#</sup>. Vascular organization and Stejar evolution in Pteridophytes. Heterospory and Seed habit, Apogamy and Apospory. Economic importance of Pteridophytes\*.

#### UNIT IV

(21 HOURS)

**Gymnosperms:** Introduction and general characters of Gymnosperms. Classification of Gymnosperms (Coulter & Chamberlain 1956). Detailed study of the structure and reproduction of *Cycas*<sup>#</sup> and *Gnetum*<sup>#</sup>. Economic importance of Gymnosperms.

**UNIT V**

**(21 HOURS)**

**Palaeobotany:** Geological time scale, fossilization and types. Radiocarbon dating. Study of the following fossils – *Rhynia*, *Lepidodendron*, *Lepidocarpon* and *Williamsonia*.

# (Developmental studies are excluded)

\* Self study

**Teaching Methods**

- Smart Class Room/PowerPoint presentation/Seminar/Quiz/Discussion

**TEXT BOOKS**

1. Gangulee, Das & Kar. (2001). College Botany Vol II. New central Book agency Pvt. Ltd. Calcutta.
2. P.C Vashista, (1992). Pteridophyta. Chand & Co., New Delhi.
3. B.P. Pandey, (1981). Gymnosperms. Chand & Co., New Delhi.
4. P.C., Vashista, Sinha and Anil Kumar. (2008). Text book of Bryophytes. Chand & Co., New Delhi.
5. Shukla and Mishra. (1982). Essentials of Paleobotany. Vikas Publishing House, Pvt Ltd., New Delhi.

**REFERENCES**

1. B.P. Pandey, (1994). A Text book of Botany - Pteridophyta. Chand & Co. New Delhi.
2. Rashid, (1995). An introduction to Pteridophytes. Vikas Publishing House, Pvt. Ltd., New Delhi.
3. K.R. Sporne (1980). Morphology of Petridophytes -B.I. Publications, New Delhi
4. G.M. Smith, (1955). Cryptogamic Botany Vol. II. Tata McGraw Hill Publications, New Delhi.
5. M.A., F.R.A. Seward (1991). Fossil Plants. Today and Tomorrows Printer and Published, New Delhi
6. K.R. Surange (1996). Botanical Monogrrpph no-4 Indian Fossil Pteridophytes, Council of Scientific and Industrial Research, New Delhi
7. V. Verma, (2010). Botany, Ane Book Pvt. Ltd., New Delhi.
8. A.C. Dutta, (2007). Botany, Oxford University Press, New Delhi

**MAPPING**

CO \ PSO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	H	S	H	S	M
CO2	S	M	H	H	M
CO3	H	L	S	M	H
CO4	S	H	M	H	M
CO5	S	M	H	S	M

S - Strong

H - High

M - Medium

L – Low

Programme Code: 05		B.Sc., BOTANY		
<b>Core Practical 1: PLANT DIVERSITY – I &amp; II</b>				
<b>Batch</b> 2022-2023	<b>Semester</b> II	<b>Hours / Week</b> 2	<b>Total Hours</b> 30	<b>Credits</b> 2

### COURSE OBJECTIVES

- To enable students to know about the diversity of lower organisms.
- To understand the life cycle pattern of Bacteria, Virus, Algae, Fungi, Lichens, Bryophytes, Pteridophytes, Gymnosperms and Palaeobotany.
- To study the fossil remains of plants in the division of Palaeobotany.

### COURSE OUTCOMES

On successful completion of the course, the students will be able to

K3 ↑ ↓ K5	CO1	Understand the primitive and advanced nature of Thallophytes
	CO2	Appraisal of the morphological features of lower life form habitats
	CO3	Examine variations in structural organization and reproduction of Cryptogams
	CO4	Examine the internal structural organization of Cryptogams and Phanerogams
	CO5	Demonstrate the nature of occurrence and reproduction patterns of Lichens

### I. PLANT DIVERSITY I

1. **Algae:** Internal and reproductive structures of the following:-

*Nostoc*  
*Volvox*  
*Caulerpa*  
*Diatoms*  
*Sargassum*  
*Polysiphonia.*

2. **Fungi:** Structure and reproduction of the following:-

*Albugo*  
*Pilobolous*  
*Saccharomyces*  
*Puccinia*  
*Cersospora*

3. **Examination of Mycorrhizal colonization in roots**

4. **Lichen:** Structure and reproduction of *Usnea*.

**II. PLANT DIVERSITY - II**

Structure and reproductive characters of the following:-

**Bryophytes**

*Marchantia*

*Anthoceros*

*Funaria*

**Pteridophytes**

*Lycopodium*

*Selaginella*

*Equisetum*

*Ophioglossum*

*Adiantum*

**Gymnosperms**

*Cycas*

*Gnetum*

**Palaeobotany**

*Rhynia*

*Lepidodendron*

*Lepidocarpon*

*Williamsonia*

**MAPPING**

<b>CO \ PSO</b>	<b>PSO1</b>	<b>PSO 2</b>	<b>PSO 3</b>	<b>PSO 4</b>	<b>PSO 5</b>
<b>CO1</b>	S	H	M	S	H
<b>CO2</b>	H	S	H	H	M
<b>CO3</b>	S	H	M	S	S
<b>CO4</b>	S	H	S	S	M
<b>CO5</b>	S	S	M	H	M

**S** - Strong

**H** - High

**M** - Medium

**L** - Low

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**KONGUNADU ARTS AND SCIENCE COLLEGE (Autonomous)  
COIMBATORE - 641 029**

**UG MODEL QUESTION PAPER (PRACTICALS)**

**End of semester Examination Question Paper Pattern**

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

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**Time: 3 Hours**

**Max. Marks: 50 Marks**

**BREAK UP OF MARKS**

**Core Practical: 2 - BIODIVERSITY I & PLANT DIVERSITY II**

<b>I</b>	Micro-preparation	25 Marks
<b>II</b>	Identify the given specimen to its class and Specify their general characters	03 Marks
<b>III</b>	Plant systematic position Spotters	03 Marks
<b>IV</b>	Spotters (7 × 2)	14 Marks
	<b>Record</b>	<b><u>05 Marks</u></b>
	<b>Total</b>	<b><u>50 Marks</u></b>

<b>Programme Code: 05</b>	<b>B.Sc., BOTANY</b>		
	<b>VALUE EDUCATION - MORAL AND ETHICS</b>		
<b>Batch</b> 2022-2023	<b>Hours / Week</b> 2	<b>Total Hours</b> 30	<b>Credits</b> 2

### COURSE OBJECTIVES

- To impart Value Education in every walk of life.
- To help the students to reach excellence and reap success.
- To impart the right attitude by practicing self introspection.
- To portray the life and messages of Great Leaders.
- To insist the need for universal brotherhood, patience and tolerance.
- To help the students to keep them fit.
- To educate the importance of Yoga and Meditation.

### COURSE OUTCOMES

After completing the course the students:

K1 ↑ ↓ K5	CO1	will be able to recognize Moral values, Ethics, contribution of leaders, Yoga and its practice
	CO2	will be able to differentiate and relate the day to day applications of Yoga and Ethics in real life situations
	CO3	can emulate the principled life of great warriors and take it forward as a message to self and the society
	CO4	will be able to Analyse the Practical outcome of practicing Moral values in real life situation
	CO5	could Evaluate and Rank the outcome of the pragmatic approach to further develop the skills

### SYLLABUS

#### UNIT I

(4 HOURS)

**Moral and Ethics:** Introduction – Meaning of Moral and Ethics – Social Ethics – Ethics and Culture – Aim of Education.

#### UNIT II

(6 HOURS)

**Life and Teachings of Swami Vivekananda:** Birth and Childhood days of Swami Vivekananda – At the Parliament of Religions – Teachings of Swami Vivekananda

#### UNIT III

(4 HOURS)

**Warriors of our Nation:** Subhas Chandra Bose – Sardhar Vallabhbhai Patel – Udham Singh – V. O. Chidambaram Pillai – Bhagat Singh – Tiruppur Kumaran – Dheeran Chinnamalai – Thillaiyadi Valliammai – Velu Nachiyar – Vanchinathan

#### UNIT IV:

(8 HOURS)

**Physical Fitness and Mental Harmony:** Simplified Physical Exercise – Hand Exercises Leg Exercises – Neuro Muscular Breathing Exercises – Eye Exercises – Kabalabathi Maharasana A & B – Massage - Acupressure – Relaxation – Kayakalpa Yogam LifeForce – Aim & Objectives – Principle – Methods. Introspection – Analysis of Thoughts – Moralization of Desires – Neutralization of Anger – Eradication of Worries

**UNIT V**

**(8 HOURS)**

**Yoga and Meditation – The Asset of India:** Yogasanam – Rules & Regulations – Surya Namaskar – Asanas –Sitting – Stanging – Prone - Supine - Pranayama – Naadi Sudhi – Ujjayi – Seethali – Sithkari - Benefits. Meditation – Thanduvassudhi - Agna – Shanthi – Thuriyam – Benefits.

**TEXT BOOKS:**

1. Value Based Education – Moral and Ethics – Published by Kongunadu Arts and Science College (Autonomous), First Edition (2020).

**REFERENCE BOOKS:**

1. Swami Vivekananda – A Biography, Swami Nikhilananda, Advaita Ashrama, India, 24<sup>th</sup> Reprint Edition (2010).
2. Gandhi, Nehru, Tagore and other eminent personalities of Modern India, Kalpana Rajaram, Spectrum Books Pvt. Ltd., revised and enlarged edition(2004).
3. Freedom Fighters of India, Lion M.G. Agrawal, Isha Books Publisher, First Edition (2008).
4. Easy steps to Yoga by Swami Vivekananda, A Divine Life Society Publication(2000).
5. Yoga Practices - 1 – The World Community Service Centre – Vethathiri Publications, Sixth Edition (2017),Erode.
6. Yoga Practices - 2 – The World Community Service Centre – Vethathiri Publications – Eighth Edition (2017),Erode.

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**Question paper pattern**

**(External only)**

**Duration: 3 hrs**

**Total Marks: 50**

Answer all Questions (5 x 10 = 50 Marks)

Essay type, either or type questions from each unit.

Programme Code : 05		B.Sc., BOTANY		
<b>Core Paper 3: ANATOMY AND EMBRYOLOGY OF ANGIOSPERMS</b>				
<b>Batch</b> 2022-2023	<b>Semester</b> III	<b>Hours/Week</b> 5	<b>Total Hours</b> 75	<b>Credits</b> 4

### COURSE OBJECTIVES

- To inculcate knowledge on tissues and anatomical features of plants
- To differentiate the primary and secondary anatomical structure of dicot and monocot plants
- To understand the key aspects of reproductive systems of flowering plants

### COURSE OUTCOME

On successful completion of the course, the students will be able to

K1 ↑ ↓ K5	CO1	Know about the various developmental aspects of Angiospermic plants.
	CO2	Compare and identify the structural differences existing among the vascular plants.
	CO3	Acquire knowledge on secondary growth of Angiosperms.
	CO4	Imply the embryological and anatomical knowledge to differentiate the plant taxa.
	CO5	Recognize the evolutionary studies of dicot and monocot embryo

### SYLLABUS

#### UNIT I

(15 HOURS)

Scope and significance of plant anatomy; Apical organization: Origin and structure of primary meristem (Angiosperm). Theories of apical organization, Structure and function of simple tissues and complex tissues

#### UNIT II

(15 HOURS)

Epidermal tissue system : Stomata - types and functions; Trichomes - Types and functions, structure and functions of secretory trichomes in *Drosera* and *Nepenthes*, salt gland, collectors, floral and extrafloral nectaries, resin duct, oil glands and laticiferous (articulated and non-articulated). Primary structure of dicot and monocot root, stem and leaf

#### UNIT III

(15 HOURS)

Vascular cambium and cork cambium: Structure and function. Secondary xylem and phloem: Structure and functions. Anomalous secondary growth: Dicotyledons – *Bougainvillea*, *Achyranthes* and *Nyctanthes*, Monocotyledons - *Dracena*. Wood: Porous, non-porous, patterns and distribution, physical, chemical and mechanical properties. Plant fibres - Distribution, structure and commercial importance of coir, jute and cotton.

#### UNIT IV

(15 HOURS)

Angiosperm life cycle\*. Microsporangium: Structure and development of anther, wall of microsporangium, Tapetum - structure, types and functions, Pollen morphology – NPC formula, pollen wall features, pollen kit. Megasporangium: Structure, types of ovule, ultrastructure of mature embryosac (*Polygonum*).



**UNIT V**

**(15 HOURS)**

Fertilization: Double fertilization. Endosperm: Nuclear, Cellular, Helobial and Ruminant types, haustorial behavior of endosperm and function. Embryogeny: Types, Embryogeny in Dicotyledons (*Capsella bursapastoris*) and Monocotyledons (*Najas lacerata*). Polyembryony & Parthenocarpy: Classification, types and applications. Apomixis: types and significance.

**\* Self study**

**TEACHING METHODS**

- Smart Class Room/PowerPoint presentation/Seminar/Quiz/Discussion

**TEXT BOOKS**

1. A. Fahn, (1982). Plant Anatomy. (3rd edition). Pergamon Press, Oxford.
2. B.P.Pandey, (1978). Plant Anatomy. Chand and Co, New Delhi.
3. K.Esau, (1985) - Anatomy of Seed Plants -John Willey
4. Singh, Pandey and Jain, (2007). Anatomy of Seed plants, Rastogi Publications. New Delhi.
5. S. S. Bhojwani, S. P. Bhatnagar, (1985). Embryology of Angiosperms, Vikas Publishing House, Noida.
6. P. Maheswari, (1950). Introduction to the embryology of Angiosperms. Vikas Publishing House, New Delhi.

**REFERENCES**

1. De Roberties. (1989). Cell and Molecular Biology. Mc Graw Hill, New Delhi.
2. Annie Regland. (2000). Developmental Botany -Saras Publication, Kanyakumari
3. A. Fahn, (1985). Plant Anatomy. Pergamon Press, Great Britain.
4. K. Esau,(1991). Plant Anatomy. Wiley Eastern Ltd. New Delhi. 7<sup>th</sup> Edition
5. B.P .Pandey, (1985). Embryology of Angiosperms. S. Chanda and Company Ltd., New Delhi.
6. V. Raghavan, (1997). Molecular Embryology of Flowering Plants. Cambridge University Press, Cambridge.
7. B.M. Johri, (2011). Embryology of Angiosperms. Berlin Heidelberg, New York.
8. Annie Regland. Plant Anatomy and Microtechniques. Saras Publication, Kanayakumari

**MAPPING**

<b>CO \ PSO</b>	<b>PSO1</b>	<b>PSO 2</b>	<b>PSO 3</b>	<b>PSO 4</b>	<b>PSO 5</b>
<b>CO1</b>	S	H	H	M	H
<b>CO2</b>	H	H	M	S	M
<b>CO3</b>	S	H	S	H	H
<b>CO4</b>	H	S	H	M	M
<b>CO5</b>	M	H	S	H	H

**S** - Strong

**H** - High

**M** - Medium

**L** - Low

<b>Programme Code : 05</b>		<b>B.Sc., BOTANY</b>		
<b>SKILL BASED SUBJECT 1 – CYBER SECURITY</b>				
<b>Batch</b> 2022-2023	<b>Semester</b> III	<b>Hours/Week</b> 2	<b>Total Hours</b> 30	<b>Credits</b> 3

**COURSE OBJECTIVES**

- The course introduces the basic concepts of Cyber Security
- To develop an ability to understand about various modes of Cyber Crimes and Preventive measures
- To understand about the Cyber Legal laws and Punishments

**COURSE OUTCOME**

On successful completion of the course, the students will be able to

K1 ↑ ↓ K5	CO1	To Understand the Concepts of Cybercrime and Cyber Frauds
	CO2	To Know about Cyber Terrorism and its preventive measures
	CO3	To Analyze about the Internet, Mobile Phone and E-commerce security issues
	CO4	To Understand about E-mail and Social Media Issues
	CO5	To Describe about various legal responses to Cybercrime

**SYLLABUS**

**UNIT I (6 HOURS)**

Introduction to Cyber Security: Definition of Cyber Security- Why is Cyber Security important? Layers of Cyber Security- Evolution of Cyber Security. Cyber hacking - Cyber fraud: Definition- Different modes of cyber fraud - Cyber fraud in India. Cyber pornography

**UNIT II (6 HOURS)**

Cyber Terrorism: Modes of cyber terrorism. Cybercrime: What is Cybercrime? Cybercrime preventive methods - Preventive steps for individuals & organizations - Kinds of cybercrime - Malware and its types – Cyber attacks

**UNIT III (5 HOURS)**

Internet Mobile Phone and E-commerce Security issues: Data theft - Punishment of data theft- Theft of internet hours - Internet safety tips for children & parents. Mobile phone privacy-E-Commerce security issues.

**UNIT IV (6 HOURS)**

Email and Social media issues: Aspects of Social Media - The Vicious Cycle of unhealthy social media use- Modifying social media use to improve mental health. Computer Virus - Antivirus – Firewalls.

**UNIT V**

**(7 HOURS)**

Cyber Forensics and Digital Evidence: What does Digital Footprint Mean? - Web Browsing and Digital Footprints- Digital Footprint examples – How to Protect Your Digital Footprints? - How to erase your Footprints? - Browser Extensions and Search Engine Deletion - Cyber Crime and Cyber Laws - Common Cyber Crimes and Applicable Legal Provisions: A Snapshot - Cyber Law (IT Law) in India – The Information Technology Act of India 2000 - Cyber Law and Punishments in India - Cyber Crime Prevention guide to users – Regulatory Authorities

**TEACHING METHODS**

- Chalk and Talk, Presentation, Seminar, Quiz, Discussion & Assignment

**TEXT BOOKS**

1. **“Cyber Security”, Text Book** prepared by “Kongunadu Arts and Science College”, Coimbatore -29, 2022

**REFERENCES**

1. Mayank Bhushan, Rajkumar Singh Rathore, Aatif Jamshed, **“Fundamental of Cyber Security”**, BPB Publications, 1<sup>st</sup> Edition, 2017.
2. Anand Shinde, **“Introduction to Cyber Security-Guide to the world of Cyber Security”**,Notion Press,2021.
3. Paul Grishman, **“Cyber Terrorism- The use of the Internet for Terrorist Purpose”**,Axis Publication,1<sup>st</sup> Edition 2010.
4. Shilpa Bhatnagar, **“Encyclopaedia of Cyber and Computer Hacking”**, Anmol Publications, 1<sup>st</sup> Edition 2009.

**Web References:**

1. <http://deity.gov.in/> - Department of Electronics and Information Technology,
2. Govt. of India
3. <http://cybercellmumbai.gov.in/> - Cybercrime investigation cell
4. <http://ncrb.gov.in/> - National Crime Records Bureau
5. <http://catindia.gov.in/Default.aspx> - Cyber Appellate Tribunal
6. <http://www.cert-in.org.in/> - Indian Computer Emergency Response Team
7. <http://cca.gov.in/rw/pages/index.en.do> - Controller of Certifying Authorities
8. [www.safescrypt.com](http://www.safescrypt.com) - Safescrypt
9. [www.nic.in](http://www.nic.in) – National Informatics Centre
10. <https://www.kaspersky.com/resource-center/definitions/what-is-a-digital-footprint>
11. <https://geekflare.com/digital-footprint/>

<b>Programme Code: 05</b>		<b>B.Sc., BOTANY</b>		
<b>Core Paper 4: CYTOLOGY, GENETICS AND PLANT BREEDING</b>				
<b>Batch 2022-2023</b>	<b>Semester IV</b>	<b>Hours / Week 5</b>	<b>Total Hours 75</b>	<b>Credits 4</b>

**COURSE OBJECTIVES**

- To learn the cellular details, cell organelles and their functions
- To acquire knowledge on genes and their interactions
- To gain knowledge on plant breeding methods and crop improvement programmes

**COURSE OUTCOMES**

On successful completion of the course, the students will be able to

K1 ↑ ↓ K5	CO1	Understand the structural organizations of cells and their cellular mechanisms
	CO2	Understand and explain scientific principles behind nature and function of genes and their process of inheritance.
	CO3	Apply the acquired knowledge on character exchanges among the individuals due to crossing over.
	CO4	Understand the role of genetic mechanisms during evolution
	CO5	Study the techniques behind the production of superior crop varieties

**SYLLABUS**

**UNIT I**

**(15 HOURS)**

Microscopic Techniques for study of cells, cell Wall- Structure, function, biogenesis and growth, cell differentiation, Plasma Membrane - Membrane architecture, Plasmodesmata - Structure role in movement of molecules and macromolecules, comparison with gap junction, Cell Organelles - Mitochondria, Endoplasmic reticulum, Golgi apparatus, Chloroplast, Ribosome, Nucleus and Chromosomes.

**UNIT II**

**(15 HOURS)**

DNA as a genetic material, structure, properties, replication of DNA (Conservative, semi- conservative and dispersive methods) and functions. RNA - types and functions. Cell division - Cell cycle, Amitosis, Mitosis & Meiosis and their significances.

**UNIT III**

**(15 HOURS)**

Genetics - field of genetics, Mendels experiments, Mendels laws of inheritance, monohybrid and dihybrid cross. Gene Interaction - Incomplete dominance, Codominance, Collaborator genes, Epistasis, Complementary genes, Duplicate genes and Lethal genes.

**UNIT IV**

**(15 HOURS)**

Multiple alleles – Blood groups in Man, Rh factor, Linkage - Complete and incomplete, Crossing over - mechanism, kinds & controlling factors, Cytoplasmic inheritance in plants - male sterility in maize.

**UNIT V**

**(15 HOURS)**

Introduction and Objectives of Plant breeding, breeding methods - pureline selection, mass selection and clonal selection, Hybridization, Heterosis, National and international organizations for crop improvement, Achievements in crop improvement - Sugarcane and Cotton.

**\*Self study**

**Teaching Methods**

- Smart Class Room/PowerPoint Presentation/Seminar/Quiz/Discussion

**TEXT BOOKS**

1. Veerbala Rastogi. (1994). Text book of Genetics. National Press, Meerut.
2. P.S. Verma, & V.K. Agarwal (1983). Cytology. Chand & Co. New Delhi.
3. P.K. Gupta & M.S. Swaminathan. (2000). Cytology, Genetics and Evolution. Rastogi Publication, Meerut.
4. D.N. Arumugam, (1999). Cell Biology. Saras Publication, Nagarcoil.
5. B.D. Singh, (2000). Plant Breeding-Principles and Methods. Kalyani Publishers, New Delhi.

**REFERENCES**

1. De Roberties. (1989). Cell Biology. McGraw Hill Publication, New Delhi.
2. H.K. Chaudhari, (2005). Elementary principles of plant breeding (25<sup>th</sup> Ed.). Oxford & IBH Publishing Co. (P) Ltd., New Delhi.
3. Allard. (1960). Principles of plant breeding. John Wiley & Sons, New York.
4. E.J., P. Gardner, Snustad & D. Dobzzonsky, (1995). Principles of Genetics.TATA Mc Graw Hill Company Ltd. New Delhi.
5. W. Edmund, L.C. Sinnott, Dunn and T. Dobzhansky. 1900. Principles of Genetics, 5<sup>th</sup> Edition, Tata McGraw Hill Publishing Company Ltd., New Delhi
6. Benjamin A. Pierce (2012). Genetics – A conceptual approach, W.H. Freeman and Company, New York, England
7. Eldon J. Gardner, (2004). Principle of Genetics, John Wiley and Sons, New York
8. S. Sundara Rajan. 2003. Introduction to Cell Biology, Vikas Publishing House Pvt. Ltd., New Delhi

**MAPPING**

PSO CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	H	M	S	H
CO2	H	S	S	H	S
CO3	S	H	H	M	H
CO4	H	M	H	S	H
CO5	S	H	H	S	H

S - Strong

H - High

M - Medium

L - Low

Programme Code : 05		B.Sc., Botany		
Core Practical 2: ANATOMY, EMBRYOLOGY OF ANGIOSPERMS, CYTOLOGY, GENETICS AND PLANT BREEDING				
Batch 2022 – 2023	Semester IV	Hours/Week 2	Total Hours 30	Credits 2

### COURSE OBJECTIVES

- To learn about the special structures associated with plants
- To obtain knowledge on primary, secondary and anomalous structures of plants
- To understand and solve the biological related problems
- 

### COURSE OUTCOME

K3 ↑ ↓ K5	CO1	Analyze various internal and external structures of the plants
	CO2	Dissect and examine different stages of embryos of <i>Tridax</i> plant
	CO3	Analyze the progress of cell division and their significance
	CO4	Understand basic principles of gene inheritance
	CO5	Demonstrate methods used in plant breeding

### I. PLANT ANATOMY

1. To study the stomatal index and different types of stomata
2. Localization of laticiferous cells of any Apocynaceae and Asclepiadaceae members
3. Primary structure of dicot and monocot root stem and leaf
4. Plant fibres - Cotton
5. Anomalous secondary thickening - Dicot – *Bougainvillea*, *Nyctanthus*, *Achyranthes*.  
Monocot - *Dracaena*

### II. EMBRYOLOGY OF ANGIOSPERMS

1. Structure of pollen grains using whole mount (*Hibiscus*, *Catharanthus* & *Crinum* species)
2. Calculate the percentage of germinated pollen grain by Hanging Drop Method (*Catharanthus*)
3. Demonstration of mounting of endosperm from a developing seed of *Cucumis sativus*
4. Dissection and display of any two stages of embryo in *Tridax*
5. Identification using permanent slides
  - i. T.S. of anther
  - ii. Morphology of pollen grains
  - iii. Types of ovules
  - iv. Ultrastructure of embryosa
  - v. Endosperm types
  - vi. Types of embryos
  - vii. Polyembryony

**III. CYTOLOGY, GENETICS & PLANT BREEDING**

1. Study of cell wall structure and cell organelles (plasma membrane, mitochondria, ER, golgi apparatus, chloroplast, ribosomes, nucleus and chromosomes) through slides and photographs
2. Study of mitosis using onion root tip
3. Study of meiosis using *Rheo* flower buds
4. Simple problems in genetics (Monohybrid and Dihybrid cross, Incomplete dominance, Codominance, Collaborator genes, Epistasis, Complementary genes, Duplicate genes and Lethal genes)
5. Selection, mass selection and clonal propagation methods.
6. Emasculation technique

**MAPPING**

<b>PSO</b> <b>CO</b>	<b>PSO1</b>	<b>PSO 2</b>	<b>PSO 3</b>	<b>PSO 4</b>	<b>PSO 5</b>
<b>CO1</b>	S	H	M	H	H
<b>CO2</b>	H	M	H	S	M
<b>CO3</b>	S	H	M	H	H
<b>CO4</b>	S	H	M	H	S
<b>CO5</b>	S	H	S	S	M

S - Strong

H - High

M - Medium

L - Low

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**KONGUNADU ARTS AND SCIENCE COLLEGE (Autonomous)  
COIMBATORE - 641 029**

**UG MODEL QUESTION PAPER (PRACTICALS)**

**End of Semester Examination Question Paper Pattern**

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

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**Time: 3 Hours**

**Max. Marks: 50 Marks**

**BREAK UP OF MARKS**

**CORE PRACTICAL: 2 – ANATOMY, EMBRYOLOGY OF ANGIOSPERMS,  
CYTOLOGY, GENETICS AND PLANT BREEDING**

I. Anatomy section (A & B)	- 12 Marks
II. Pollen germination Test (C)	- 04 Marks
III. Embryo dissection (D)	- 04 Marks
IV. Any two stages of Mitosis/Meiosis (E)	- 05 Marks
V. Genetics problem (F& G)	-10 Marks
IV. Spotters (H,I, J, K & L)	- 10 Marks
Record	- 05 Marks
<b>TOTAL</b>	<b>50 Marks</b>

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<b>Programme Code: 05</b>		<b>B.Sc., BOTANY</b>		
<b>SKILL BASED SUBJECT II: PLANT TISSUE CULTURE CONCEPT AND APPLICATIONS</b>				
<b>Batch</b> 2022-2023	<b>Semester</b> IV	<b>Hours / Week</b> 2	<b>Total Hours</b> 30	<b>Credits</b> 3

### COURSE OBJECTIVES

- To gain the basic knowledge on plant tissue culture and organization of tissue culture laboratory
- To acquire fundamental knowledge on tissue culture media and preparation
- To reproduce the rare endemic & endangered plants from tissue culture techniques
- To gain the theoretical knowledge on transgenic plants and their applications

### COURSE OUTCOMES (CO)

On successful completion of the course, the students will be able to

K1 ↑ ↓ K5	CO1	Know about plant tissue culture laboratory organization
	CO2	Gain knowledge on various tissue culture media composition and preparation
	CO3	Learn about the direct regeneration techniques
	CO4	Study various tissue culture techniques and their applications
	CO5	Understand <i>in vitro</i> regenerated variants

### SYLLABUS

#### UNIT I

(6 HOURS)

Plant tissue culture - history, organization of tissue culture laboratory, glass goods and instruments, preparation of stock solution.

#### UNIT II

(6 HOURS)

Medium preparation- MS, B5 and Nitsch medium. Collection of explants, surface sterilization, inoculation, incubation. Callus culture and sub culture

#### UNIT III

(6 HOURS)

Micropropagation- nodal and shoot tip culture, anther and pollen culture, Cell culture: single cell and cell suspension culture

#### UNIT IV

(6 HOURS)

Embryo and ovule culture, somatic embryogenesis and artificial seed production, Protoplast isolation, culture and fusion

#### UNIT V

(6 HOURS)

Somaclonal variation: Definition, mechanism, isolation of somaclonal variation- phenotypic character, cytological study, DNA content, disease and herbicide resistance. Application of somaclonal variation\*.

## UBO30

### \*Self study

### Teaching Methods

Smart Class Room/PowerPoint Presentation/Seminar/Quiz/Discussion

### TEXT BOOK

1. P.K. Gupta (1996). Elements of Biotechnology. Rastogi Publications, Meerat.
2. V.K. Kumaresan (2003). Biotechnology. Saras Publications, Kanyakumari.
3. M.K. Razdon (2003). Plant Tissue Culture. Oxford and IBH Publishing Co.Private Ltd., New Delhi.
4. Kalyan Kumar De (2008). An introduction ot plant tissue culture.New Central Book Agency. Kolkata.

### REFERENCE BOOKS

1. S.S. Bhojwani and M.K. Razdan (1996). Plant Tissue Culture: Theory and Practice. 1<sup>st</sup> Edition, Elsevier Publications.
2. H.S. Chawla (1998). Biotechnology in crop improvement. International Book Distributors, Dehradun.
3. H.S. Chawla (2002). Introduction to Plant Biotechnology. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
4. H.K. Choudhri (2005). Elementary principles of Plant Breeding. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
5. T.B. Jha and Biswajit Ghosh (2005). Plant Tissue Culture: Basic and Applied. Universities Press.
6. E.F. George, M.A. Hall, G.D. Klerk (2008). Plant Propagation by Tissue Culture. Springer Publications.
7. Robert Trigiano and Dennis Gray (2011). Plant Tissue Culture, Development, and Biotechnology. 1<sup>st</sup> Edition, CRC Press.
8. S.S. Bhojwani and P.K. Dantu (2013).Plant Tissue Culture: An Introductory Text. Springer Publications.

### MAPPING

PSO CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	S	H	S	S
CO2	S	M	S	H	M
CO3	H	S	H	S	H
CO4	S	S	S	S	M
CO5	S	H	H	S	H

S - Strong

H - High

M - Medium

L - Low


<b>Programme Code: 05</b>		<b>B.Sc., BOTANY</b>		
<b>Core Paper: 5 - FUNDAMENTALS OF COMPUTER AND BIOINFORMATICS</b>				
<b>Batch</b>	<b>Semester</b>	<b>Hours / Week</b>	<b>Total Hours</b>	<b>Credits</b>
<b>2022-2023</b>	<b>V</b>	<b>4</b>	<b>60</b>	<b>4</b>

### COURSE OBJECTIVES

- To acquire basic knowledge about computers
- To know how to create databases
- To impart knowledge on biological information's available in the databases

### COURSE OUTCOMES

On successful completion of the course, the students will be able to

	K1	CO1	Inherit computer knowledge and internet usage.
		CO2	Understand the components of computers and usage of biological databases.
		CO3	Applying technical skills to know the sequences of nucleic acids and amino acids in genes and protein molecules.
		CO4	Identify the structure of various biomolecules using biomolecular visualization techniques.
K5	CO5	Evaluate evolutionary relationships using sequence alignments.	

### SYLLABUS

#### UNIT I

(12 HOURS)

Introduction to computer - applications, types, generations, capabilities - components of computer - hardware - CPU, input and output devices, memory units, auxiliary storage devices.

#### UNIT II

(12 HOURS)

Computer architecture, number system, Software - classification of software. Language machine language - high level language - compilers, translators. Operating systems / DOS / windows. Internet - www, E-mail, browser and search engines\*.

#### UNIT III

(12 HOURS)

Windows- 2010 an overview. MS-Excel- preparation of workbook and charts, MS-Power Point - features and slide presentation. MS-ACCESS- Creating and querying a database. Database languages, database independence and database administrator. Data warehousing and data mining. Basic concept of Photoshop.

#### UNIT IV

(12 HOURS)

Introduction to Bioinformatics. Regulation of gene expression in Prokaryotes and Eukaryotes. Protein Structure - Primary, secondary, tertiary and quaternary structure (Outline only). Biological databases, importance and classification (Outline only). Gene finding methods.

**UNIT V**

**(12 HOURS)**

Sequence alignment, evolutionary basis of sequence alignment, global vs local alignment, searching for similarities using scoring matrices and gap penalty. Biomolecular visualization, phylogenetic analysis and computer aided drug designing.

**\*Self study**

**Teaching Methods**

- Smart Class Room/PowerPoint presentation/Seminar/Quiz/Discussion

**TEXT BOOKS**

1. Mani, K and N. Vijayaraj. (2002). Bioinformatics for beginners. Kalaikathir Achakam, Coimbatore.
2. David W. Mount. (2001). Bioinformatics -Sequence and Genome analysis. Cold Spring Harbor Laboratory Press.
3. V. Rajaraman, (2004). Fundamentals of computer. Prentice Hall of India Pvt Ltd.
4. Reema Thareja (2019). Fundamentals of Computers. Second Edition, Oxford University Press, Oxford, UK
5. Vinay Sharma, Ashok Munjal and Asheesh Shanker (2008). A Text Book of Bioinformatics, Rastogi Publications, Meerut, U.P. India
6. S. Harisha. (2013). Fundamentals of Bioinformatics. R.K. International Pvt. Ltd., New Delhi, India

**REFERENCES**

1. A.D. Baxevanis and B.J.Francis (Eds.). (1998). Bio-informatics - A practical guide to the analyzing of gene protein. John Wiley and sons.
2. Stuart M. Brown. (2000). Bioinformatics- A biologists guide to bio computing and the internet. Eaton Publishing Co.
3. Arthor M. Lesk. (2002). Introduction to Bioinformatics. Oxford University Press, UK.T.K. Attwood and Parry-Smith (2007).
4. Teresa k Attwood, David J. Parry-Smith and Samiron Phukan (2007). Dorging Kindersley (India) Pvt. Ltd., Nodia, India
5. D.R.Westhead,J.H. Parish and R.M.Wyman. (2003). Instant Notes in Bioinformatics. BIOS Scientific Publishers, Milton Park, England
6. Pradeep k. Sinha and Priti Sinha (2004). BPB Publications, New Delhi

**MAPPING**

<b>CO \ PSO</b>	<b>PSO1</b>	<b>PSO 2</b>	<b>PSO 3</b>	<b>PSO 4</b>	<b>PSO 5</b>
<b>CO1</b>	S	H	M	S	H
<b>CO2</b>	S	S	S	H	M
<b>CO3</b>	H	H	S	M	S
<b>CO4</b>	S	H	H	S	M
<b>CO5</b>	H	S	L	M	H

**S - Strong**

**H - High**

**M - Medium**

**L - Low**

<b>Programme Code: 05</b>		<b>B.Sc., BOTANY</b>		
<b>Core Paper 6: TAXONOMY OF ANGIOSPERMS AND ECONOMIC BOTANY</b>				
<b>Batch</b> 2022-2023	<b>Semester</b> V	<b>Hours / Week</b> 5	<b>Total Hours</b> 75	<b>Credits</b> 5

**COURSE OBJECTIVES**

- To study morphology of Angiospermic plants
- To learn the technical terms / descriptors to know the morphological features
- To recognize plant families of major flowering plants and their diagnostic features.
- To acquire basic knowledge on the principles of phylogeny and biosystematics.
- To familiarize knowledge on plants with immense economic values.

**COURSE OUTCOMES**

On successful completion of the course, the students will be able to

K1 ↑ ↓ K5	CO1	Understanding the systems of classification of Angiosperms, plant morphological terminologies and identifying morphological peculiarities
	CO2	Understand nomenclature principles of flowering plants and gain hands on experience on herbarium preparation techniques
	CO3	Recognize members of major Angiospermic families by identifying their diagnostic features
	CO4	Analyzing the comparative account among the families of Angiosperms
	CO5	Evaluate the economic and beneficial aspects of plants to human mankind

**SYLLABUS**

**UNIT I**

**(15 HOURS)**

Aims and objectives of taxonomy. Natural System of Classification (Bentham and Hooker, 1862- 1983), its merits and demerits. Parts of Angiospermic plants – Root and Stem: Characteristics, types and modifications; Leaf: parts, stipules, types, phyllotaxy, venation and modifications

**UNIT II**

**(15 HOURS)**

Inflorescence: Racemose, Cymose and Specia; Flower: structure and symmetry; Fruit and Seed: parts and classification, seed dispersal. Herbarium techniques and uses. Botanical Survey of India; National herbarium - CNH - Regional herbarium - MH. Nomenclature - ICN, Binomial - principles. Typification, Author citations, Effective and valid publication. Retention and rejection of names.

**UNIT III**

**(15 HOURS)**

Detailed study of the following families with reference to Morphology, Taxonomy and their economic importance. Annonaceae, Nymphaeaceae, Capparidaceae, Rutaceae, Anacardiaceae, Caesalpiniaceae, Mimosaceae, Myrtaceae, Curcubitaceae, Apiaceae, Rubiaceae, Asteraceae, Sapotaceae and Apocynaceae.

**UNIT IV**

**(15 HOURS)**

Detailed study of the following families with reference to Morphology, Taxonomy and their economic importance. Solanaceae, Acanthaceae, Verbenaceae, Lamiaceae, Amaranthaceae, Euphorbiaceae, Orchidaceae, Zingiberaceae, Liliaceae, Amaryllidaceae, Arecaceae and Poaceae.

**UNIT V**

**(15 HOURS)**

Economic Botany- study of botany, cultivation and utilization of the following: Fiber yielding plants (*Gossypium hirsutum*), sugar yielding plant (*Saccharum officinarum*) and food crops - (cereals - paddy and pulses - soybean). Spices and condiments (*Piper nigrum* and *Curcuma longa*)\*.

**\* Self Study**

**TEACHING METHODS**

- Smart Class Room/PowerPoint presentation/Seminar/Quiz/Discussion

**TEXT BOOKS**

1. A.V.S.S. Sambamoorthy. (2005). Taxonomy of Angiosperms. Dreamtech Press, New Delhi.
2. V. Verma,(2006). A textbook of Economic Botany. Emky Publication, New Delhi.
3. B.K. Verma, (2010). Introduction to Taxonomy of Angiosperms, Prentice-Hall of India Pvt. Ltd., Delhi
4. O.P. Sharma, (2017). Plant Taxonomy. Mc Graw Hill Education, New York.
5. N.B. Saxena and Shamindra Saxena (2019). Plant Taxonomy. Pragati Prakashan, Meerut

**REFERENCES**

1. V. Singh and D.K. Jain. (1997). Taxonomy of Angiosperms. Rastogi Publications, New Delhi.
2. B.P.Pandey, (1997). Taxonomy of Angiosperms. Chand & Co., New Delhi.
3. S.K. Jain and R.R. Rao. (1977). A. Handbook of Field and Herbarium methods. Today and Tomorrow Publishers, New Delhi.
4. A.N. Henry and Chandrabose. (1982). An aid to the international code of botanical nomenclature. BSI Calcutta.
5. Gurucharan Singh (2004). Plant systematic-theory and practices. Oxford and IBH publishers, New Delhi.
6. V. Singh and D.K. Jain. (2015). Taxonomy of Angiosperms. Rastogi Publications, New Delhi.
7. Dixit, M.O. Siddiqui and A. Pathak. (2016). Taxonomy of Angiosperms: Basic Concepts, Molecular Aspects and Future Prospect. Studera Press, New Delhi.
8. Pullaiah T and Karuppusamy S (2018). Taxonomy of Angiosperms. Regency Publication, New Delhi

**MAPPING**

CO \ PSO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	H	S	M	H
CO2	S	M	H	S	S
CO3	H	H	M	H	S
CO4	S	H	S	M	H
CO5	H	S	M	S	H

S - Strong

H - High

M - Medium

L - Low

<b>Programme Code: 05</b>		<b>B.Sc., BOTANY</b>		
<b>CORE PAPER 7: PLANT ECOLOGY, PHYTOGEOGRAPHY AND RESOURCE CONSERVATION</b>				
<b>Batch</b> 2022-2023	<b>Semester</b> V	<b>Hours / Week</b> 4	<b>Total Hours</b> 60	<b>Credits</b> 4

**COURSE OBJECTIVES**

- To understand the principles of ecosystem.
- To acquire basic knowledge about community succession
- To ensure knowledge on resource conservation and related environmental acts

**COURSE OUTCOMES**

On successful completion of the course, the students will be able to

↑ K1    ↓ K5	CO1	Pertain knowledge on principle factors controlling the environment.
	CO2	Understand the pattern of distribution of plant species in various communities and their adaptive features.
	CO3	Assess the structure and functions of various ecosystems.
	CO4	Explore knowledge on the pattern of distribution of natural resources.
	CO5	Evaluation of management practices for the sustainable utilization of natural resources.

**SYLLABUS**

**UNIT I**

**(12 HOURS)**

Principles of Ecology. Climatic factors - role and importance of light, temperature, wind and rainfall on the growth of plants. Edaphic factors, Biotic factors - Characters of community and methods of studying plant communities (quadrat and transect methods alone).

**UNIT II**

**(12 HOURS)**

Community succession - Kinds and causes. Structural and functional changes in communities (Hydrosere and Xerosere - Lithosere). Climax concept. Morphological and anatomical adaptations of Hydrophytes, Xerophytes, Halophytes and Epiphytes.

**UNIT III**

**(12 HOURS)**

Ecosystem - Basic structure and functions: Major Ecosystems of India, Distribution and Climatic patterns of Plants in tropical and temperate regions. Invasive and Alien Plants, Plants - indicator of pollution. Disaster Management.

**UNIT IV**

**(12 HOURS)**

Phytogeographical realms of the world. Origin of cultivated plants. Botanical regions of India. Continental drift. Age and area hypothesis, theory of Island biogeography, endemism, plant distribution, migration and barriers.

**UNIT V**

**(12 HOURS)**

Resource conservation - types of resources, conservation of soil, water, agriculture resources, range, forest and freshwater bodies. World Biodiversity Hotspots-Criteria, Biodiversity Hotspots in India, CITES, Important Environmental acts in India, Case study\* - Project Tiger and Biosphere reserves - Nilgiri Biosphere Reserve (NBR).

**\*Self study**

**Teaching Methods**

- Smart Class Room/PowerPoint presentation/Seminar/Quiz/Discussion

**TEXT BOOKS**

1. P.D. Sharma, (2000). Ecology and Environment. Rastogi Publications, New Delhi
2. R.S. Shukla and P. S. Chandal. (2000). Plant Ecology and soil science. Chand & Co. Ltd., New Delhi.
3. P.C. Vasishta, (1993). Plant Ecology. II Edition. Vishal Publications.
4. Verma and Agarwal. (1998). Principles of Ecology, Chand & Co. Ltd., New Delhi.
5. H.D. Kumar, (1994), General Ecology, Vikas Publishing Co. New Delhi

**REFERENCES**

1. R.S. Ambasht, (1992). Text book of Plant Ecology, Students and Friends & Co. Varanashi.
2. A.F. Schimper, (1960). Plant geography. Lubrecht & Cramer Ltd., New York.
3. S.Richard, Ostfeld and William H. Schlesinger. (2011). The year in Ecology and conservation Biology, Willey - Blackwell Publications.
4. E.P. Odum, ( 1971) Fundamentals of Ecology, N.B.Saundes Co. Ltd. Philadelphia
5. K.C. Misra, (1980). Manual of Plant Ecology. Oxford and IBH Publishing Co, New Delhi
6. Krebs (1985). Ecology. C.J.Hapes an Rao, Newyork
7. Weaver ND Clements (1929). Plant Ecology. Tata McGraw Hill publishing Co. NewDelhi
8. C.K.Varshney, (1989). Water pollution and Management. S.P. Printers. Noida

**MAPPING**

<b>CO \ PSO</b>	<b>PSO1</b>	<b>PSO 2</b>	<b>PSO 3</b>	<b>PSO 4</b>	<b>PSO 5</b>
<b>CO1</b>	S	H	M	H	S
<b>CO2</b>	H	H	S	M	H
<b>CO3</b>	S	M	H	H	M
<b>CO4</b>	H	H	H	M	S
<b>CO5</b>	S	H	S	M	S

**S - Strong**

**H - High**

**M - Medium**

**L – Low**



Programme Code: 05		B.Sc., BOTANY		
<b>Core Paper 8: MICROBIOLOGY AND PLANT PATHOLOGY</b>				
Batch 2022-2023	Semester V	Hours / Week 4	Total Hours 60	Credits 4

**COURSE OBJECTIVES**

- To attain knowledge on major groups of microbes.
- To understand the exploitation of microbes in industries.
- To learn the different pathogenic organisms of plants causing various diseases

**COURSE OUTCOMES**

On successful completion of the course, the students will be able to

K1 ↑ ↓ K5	CO1	Recognize evolutionary relationships of microorganisms through various classifications
	CO2	Understand the use of microbes in industries for the welfare of mankind.
	CO3	Apply knowledge on microbial technology for the production of antibiotics.
	CO4	Knowledge on plant pathogen interactions on disease development
	CO5	Implement the plant disease management techniques under field level

**SYLLABUS**

**UNIT I**

**(12 HOURS)**

Introduction to microbiology - Historical account, Scope of microbiology, major groups, and classification - five kingdom concept. Eukaryotic organisms. Bacterial morphology, classification (Bergey's manual of Bacteriology) ultrastructure, reproduction - conjugation, transformation and transduction.

**UNIT II**

**(12 HOURS)**

General characters of viruses, classification of plant viruses. Viral replication - Lytic and lysogenic cycles. Morphology of Bacteriophage (T<sub>2</sub> and T<sub>4</sub>). Fermentation - Aerobic and anaerobic fermentation (outline). Industrial production and applications of ethanol - penicillin - vinegar.

**UNIT III**

**(12 HOURS)**

Food microbiology - Milk and milk products (yoghurt and cheese): physical and chemical composition – pasteurization - microbial flora of fresh food - microbial examination of poisoning (Botulism) - Single Cell Protein (*Spirulina* and *Chlorella*).

**UNIT IV**

**(12 HOURS)**

Introduction and milestones in phytopathology - classification of diseases - organisms and causal factors responsible for plant diseases - dissemination of diseases - Koch's postulates - Defense mechanism in plants: structural and biochemical - Integrated disease management.

**UNIT V****(12 HOURS)**

Symptoms, causative organisms, life cycle and control measures. Virus - Tobacco Mosaic disease\* and Cucumber Mosaic disease; Bacteria - Citrus canker, Rice bacterial blight disease; Fungi - Tikka disease of ground nut and Red rot of sugarcane.

**\*Self study****Teaching Methods**

- Smart Class Room/PowerPoint presentation/Seminar/Quiz/Discussion

**TEXT BOOKS**

1. R.S. Mehrota and Ashok Aggarwal. (2003). Plant Pathology, Second Edition, Tata Mc. Graw Hill Publishing Co. Ltd., New Delhi.
2. George N. Agrios. (2004). Plant Pathology. 5th Edition. Elsevier Academic Press. Amsterdam, Netherlands.
3. R.C. Dubey and D.K. Maheshari (2005). A Text Book of Microbiology' S. Chand and Company Limited, New Delhi.
4. Michael J. Pelczar, E.C.S. Chan and Noel R. Krieg (2008). 'Microbiology' 5th edition, Tata McGraw-Hill Publishing Company Ltd, New Delhi.
5. P.C. Trivedi, Sonali Pandey, Seema Bhadauria. (2010). Text Book of Micobiology. Aavishkar Publications, Distributors. Jaipur, India.
6. K.R.Aneja, Pranay Jain and Raman Aneja. (2018). A text Book of Basic and Applied Microbiology. New Age International Publishers, New Delhi.

**REFERENCES**

1. G. Rangaswamy, (1972). Diseases of crop plants in India. Prentice Hall of India. Pvt., Ltd., New Jersey.
2. K.H. Steindrans, (1983). Hand Books of Indigenous fermented food parcel. Edition Inc, New York.
3. R.S. Singh, (1990). Plant diseases (6th ed.) Oxford and IBH, New Delhi.
4. H.B. Schiesel, (1993). General microbiology, 6th Edition, Cambridge University Press.
5. Alexander N. Glazer and Hiroshi Nikaido. (2007). Microbial Biotechnology, Second Edition. Cambridge University Press, Cambridge, UK.
6. Sanjai Saxena. (2015). Applied Microbiology. Springer, New Delhi.
7. S.B. Sullia, and S. Shantharam, (2017). General Microbiology, Second Edition, Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.

# UBO39

## MAPPING

<b>CO \ PSO</b>	<b>PSO1</b>	<b>PSO 2</b>	<b>PSO 3</b>	<b>PSO 4</b>	<b>PSO 5</b>
<b>CO1</b>	H	S	H	M	H
<b>CO2</b>	S	H	H	H	M
<b>CO3</b>	H	S	M	S	H
<b>CO4</b>	S	H	H	H	M
<b>CO5</b>	S	H	H	M	S

**S** - Strong

**H** - High

**M** - Medium

**L** - Low

<b>Programme Code: 05</b>		<b>B.Sc., BOTANY</b>		
<b>Core Practical 3 - FUNDAMENTALS OF COMPUTER AND BIOINFORMATICS</b>				
<b>Batch</b> 2022-2023	<b>Semester</b> V	<b>Hours/Week</b> 2	<b>Total Hours</b> 30	<b>Credits</b> 2

**COURSE OBJECTIVES**

- To insist basic knowledge on the components of computer.
- To create a document, table, chart and database using MS Office.
- To learn sequence and structure of genes and protein molecules.

**COURSE OUTCOMES**

On successful completion of the course, the students will be able to

K3 ↑ ↓ K5	CO1	Apply knowledge to create biological databases.
	CO2	Apply knowledge on preparation and presentation of data base
	CO3	Analyze secondary structure predictions of any protein molecules using appropriate biological software.
	CO4	Examine macromolecular structures through visualization tools.
	CO5	Evaluate pattern of phylogenetic interrelation ship among plants

**I. FUNDAMENTALS OF COMPUTER**

1. Creating, editing and printing a document using MS-Word
2. Creating, editing and printing a table using MS-word
3. Data entry and chart preparation using MS-Excel
4. Creating a presentation using MS-PowerPoint
5. Creating and querying the database using MS-ACCESS

**II. BIOINFORMATICS**

1. Similarity search using BLASTS (nBLAST and pBLAST)
2. Protein structure prediction using GOR-IV
3. Protein structure prediction using SOPMA
4. Phylogenetic analysis using Clustal-X
5. Bio-Molecular Visualization using RASMOL
6. Multiple sequence alignment using Clustal sigma

**MAPPING**

CO \ PSO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	H	S	H	M	H
CO2	S	M	S	M	H
CO3	H	S	S	H	M
CO4	H	S	H	M	H
CO5	S	H	S	H	M

S - Strong

H - High

M - Medium

L - Low

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**KONGUNADU ARTS AND SCIENCE COLLEGE (Autonomous)**

**COIMBATORE - 641 029**

**UG MODEL QUESTION PAPER (PRACTICALS)**

**End of Semester Examination Question Paper Pattern**

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

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**Time: 3 Hours**

**Max. Marks: 50 Marks**

**BREAK UP OF MARKS**

**Core Practical: 3 - FUNDAMENTALS OF COMPUTER AND BIOINFORMATICS**

I. Write Algorithms for A, B & C (10 + 10 + 08)	<b>- 28 Marks</b>
II. Results for A, B & C (04 + 04 + 04)	<b>- 09 Marks</b>
III. Viva-voce for A, B & C (04 + 04 + 02)	<b>- 08 Marks</b>
Record	<b>- 05 Marks</b>
<b>TOTAL</b>	<b>- 50 Marks</b>

<b>Programme Code: 05</b>		<b>B.Sc., BOTANY</b>		
<b>Core practical 4: TAXONOMY OF ANGIOSPERMS, ECONOMIC BOTANY, PLANT ECOLOGY, PHYTOGEOGRAPHY, RESOURCE CONSERVATION, MICROBIOLOGY AND PLANT PATHOLOGY</b>				
<b>Batch 2022-2023</b>	<b>Semester V</b>	<b>Hours/Week 4</b>	<b>Total Hours 60</b>	<b>Credits 2</b>

**COURSE OBJECTIVES**

- To learn the morphological, taxonomical and economic values of plants
- To impart knowledge on the determination of types of vegetation's using quantitative ecological characters
- To study the different types of ecosystem
- To study the cellular details, genetic constitution and plant breeding techniques.

**COURSE OUTCOMES**

K3 ↑	CO1	Provide lab based training in writing short species descriptions and illustrations
	CO2	Apply knowledge on identification of plants and assigning their families based on diagnostic features
	CO3	Determine the distribution of vegetation's in a given habitat using various quadrat methods.
	CO4	Apply knowledge on the pattern of distribution of plants in any ecological niche
↓ K5	CO5	Enhancement of microbial culture

**I. TAXONOMY OF ANGIOSPERMS & ECONOMIC BOTANY**

1. Identification of plant specimens with reference to their families prescribed in the syllabus following Bentham & Hookers system of classification
2. Identification of economically important products with reference to their plant name and family
3. Technical description of plant parts, including floral parts (L.S. of flower, floral diagram and floral formula) with reference to the families mentioned in the theory
4. Field visit to nearby floristic regions for the study of flora
5. Submission of 25 herbarium sheets (relevant to syllabi) with field notes for internal and external valuation

**II. PLANT ECOLOGY, PHYTOGEOGRAPHY & RESOURCE CONSERVATION**

1. Quadrat - determination of frequency and density of vegetation in the surrounding areas of college premises.
2. Line transects - frequency determination of vegetation in the surrounding areas of college premises
3. Belt transects - frequency determination of vegetation in the surrounding areas of college premises
4. Observation of adaptive morphological and anatomical features of xerophytes

## UBO43

- hydrophytes, halophytes and epiphytes
5. Ecosystems (pond, forest and grasslands)
  6. Community succession patterns - hydrosere and lithosere
  7. Global Positioning System (GPS)
  8. Locate major Phytogeographical zones of India using photographs

### III. MICROBIOLOGY AND PLANT PATHOLOGY

1. Preparation of culture media for bacteria and fungi.
2. Isolation of microbes from soil by pour plate and spread plate techniques.
3. Pure culture technique - spread plate.
4. Differential staining of bacteria using Gram stain.
5. Methylene blue reductase test for milk.
6. Antimicrobial assay - disc - diffusion / agar well method
7. Preparation and quantification of ethanol content in wine.
8. Plant Pathology – Virus - Tobacco Mosaic disease & Cucumber Mosaic disease.  
Bacteria - Citrus canker & Rice bacterial blight disease.  
Fungi - Tikka disease of ground nut & Red rot of sugarcane.

### MAPPING

<b>CO \ PSO</b>	<b>PSO1</b>	<b>PSO 2</b>	<b>PSO 3</b>	<b>PSO 4</b>	<b>PSO 5</b>
<b>CO1</b>	S	M	S	H	S
<b>CO2</b>	H	H	H	M	H
<b>CO3</b>	S	M	H	S	M
<b>CO4</b>	S	H	M	S	H
<b>CO5</b>	H	S	M	H	M

**S** - Strong

**H** - High

**M** - Medium

**L** - Low

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**KONGUNADU ARTS AND SCIENCE COLLEGE (Autonomous)**

**COIMBATORE - 641 029**

**UG MODEL QUESTION PAPER (PRACTICALS)**

**End of Semester Examination Question Paper Pattern**

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

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**Time: 3 Hours**

**Max. Marks: 50 Marks**

**BREAK UP OF MARKS**

**CORE PRACTICAL 4: TAXONOMY OF ANGIOSPERMS, ECONOMIC BOTANY,  
PLANT ECOLOGY, PLANT PHYTOGEOGRAPHY, RESOURCE  
CONSERVATION, MICROBIOLOGY AND PLANT PATHOLOGY**

I. Family description	- 05 Marks
II. Identification of Family	- 03 Marks
III. Economic Botany	- 03 Marks
IV. Ecology experiment	- 08 Marks
V. Phytogeography	- 03 Marks
V. Microbiology experiment	- 08 Marks
VII. Spotters	- 10 Marks
VIII. Herbarium	- 05 Marks
Record	- 05 Marks

	<hr style="border: 0.5px solid black;"/> <b>TOTAL</b>
	50 Marks

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Programme Code: 05		B.Sc., BOTANY		
<b>Core Paper 9 – BIOCHEMISTRY AND BIOINSTRUMENTATION</b>				
<b>Batch</b> 2022-2023	<b>Semester</b> VI	<b>Hours / Week</b> 7	<b>Total Hours</b> 105	<b>Credits</b> 5

### COURSE OBJECTIVES

- To study the structure of atom and chemical bonds
- To learn the metabolism of chemical reactions in a cell
- To seed the basic knowledge about instruments
- To make students understand the applications of instruments and to train the students handle and maintain instruments.

### COURSE OUTCOMES

On successful completion of the course, the students will be able to

K1 ↑ ↓ K5	CO1	Gain knowledge on chemical bonds, atoms and molecules.
	CO2	Understand the chemical structure of macro molecules.
	CO3	Assess the structural organization of biomolecules
	CO4	Analyze the working principles and mechanisms of instruments
	CO5	Evaluate the direct applications and benefits of instruments used for biological experiments

### SYLLABUS

#### UNIT I (21 Hours)

Basic concepts of atoms and molecules, types of bonding: primary chemical bonds-covalent, hydrogen bonds, isotopes and isomerism. Acids, bases, solutions, colloids, pH and buffer systems, Introduction to phytoconstituents

#### UNIT II (21 Hours)

**Carbohydrates** - classification, Monosaccharides-structure (glucose), open chain and cyclic (or) ring structure. Biological functions. Oligosaccharides (sucrose) - glycosidic linkages and biological functions. Polysaccharides (cellulose). **Lipids**-classification, structure, properties and functions. Fatty acids - saturated and unsaturated.

#### UNIT III (21 Hours)

**Amino acids** : Structure, classification, properties and biosynthesis. **Proteins** - classification, structure - primary, secondary, tertiary and quaternary structures. **Enzymes**: definition, structure, properties, mode of action and factors affecting enzyme activity.

#### UNIT IV (21 Hours)

Principle, working mechanism, types and applications: pH meter, Microscopy - light and electron, Centrifugation, Autoclave and Laminar air flow chamber. Photometry: Colorimetry and UV-visible spectrophotometry. PCR and Gel Electrophoresis (AGE and PAGE).

**UNIT V**

Principle, working mechanism and applications: Paper chromatography\*, Thin layer chromatography (TLC), Column chromatography, Ion exchange chromatography, Ion exchange chromatography, affinity chromatography and Lyophilization.

**\*Self study**

**Teaching Methods**

- Smart Class Room/PowerPoint presentation/Seminar/Quiz/Discussion

**TEXT BOOKS**

1. H. S. Srivastava, (1993). Elements of Biochemistry. Rastogi Publications, Meerut.
2. J.L. Jain, (2002). Fundamentals of Biochemistry. S. Chand & Co. New Delhi
3. L.M.Narayanan, Dulsy Fathima, K.Nallasingam, R.P. Meyyan Pillai, N.Arumugam, S.Prasanna Kumar. (2010). Biochemistry. Saras Publication
4. L. Veerakumari, L (2009). Bioinstrumentation. MJP Publishers, New Delhi, India
5. B.K. Sharma, (2005). Instrumental Methods of Chemical analysis. 24th Revised Edition, Goel Publishing House, Meerut.
6. Richard Notmahn (1988). Principles of Bioinstrumentation, Wiley Publishers

**REFERENCES**

1. J.H. Weel, (1990). General Biochemistry. Wiley Eastern Ltd.
2. Skoog and Leary. (1992). Principles of Instrumental analysis, 4th Edition. Saunder's College Publishing, New York
3. Holme and Peck. (1998). Analytical Biochemistry, 3rd Edition, Pearson Education Ltd, Essex, England
4. K. Wilson, and J. Walker,(2000). Principles and Techniques of Practical Biochemistry, 5th edition, Cambridge University Press, Cambridge.
5. Albert L. Lehninger. (2002). Principles of Biochemistry. ICAR, Delhi.
6. V. Satyanarayana, (2005). Essentials of Biochemistry. Arunabha Sen & Allied Pvt., Ltd
7. Jeremy M. Berg, John, Tymoczko, Gregory J. Gatto and Lubertstryer (2015). Biochemistry, Macmillan, Publishers, New York.

**MAPPING**

CO \ PSO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	H	S	H	M	H
CO2	S	H	M	L	S
CO3	H	H	S	M	H
CO4	S	M	H	H	M
CO5	S	S	H	M	M

S - Strong

H - High

M - Medium

L - Low

Programme Code: 05		B.Sc., BOTANY		
<b>Core Paper 10: PLANT PHYSIOLOGY</b>				
<b>Batch</b> 2022-2023	<b>Semester</b> VI	<b>Hours/Week</b> 6	<b>Total Hours</b> 90	<b>Credits</b> 4

### COURSE OBJECTIVES

- To study about water potential and its components
- To understand the mechanism of various metabolic process in plants
- To acquire inherent knowledge on mineral nutrients, growth and development in plants

### COURSE OUTCOME

On successful completion of the course, the students will be able to

K1 ↑ ↓ K5	CO1	Gain knowledge on the relationship of complementary metabolic process in energy acquisition and understand the water potential and its effects on cellular functions
	CO2	Learn about the movement of sap and absorption of water in plant body
	CO3	Assess the process of photosynthesis and respiration in higher plants with particular emphasis on aerobic and anaerobic respiration
	CO4	Analyze the physiological effects of growth regulators in plants
	CO5	Validate the biosynthetic pathways of plant growth regulators

### SYLLABUS

#### UNIT I

**(18 HOURS)**

Plant - water relationship - structure, properties and biological significance of water, water potential and its components, physical forces involved in absorption of water - diffusion, osmosis, imbibition. Absorption of water - mechanism and affecting factors. Absorption of minerals - mechanism (Active and Passive).

#### UNIT II

**(18 HOURS)**

Ascent of sap - path and mechanism; Translocation of organic solutes - directions, path, mechanism, assimilates partitioning and controlling factors. Transpiration - kinds, mechanism of stomatal transpiration, significance and factors affecting stomatal movement and Guttation.

#### UNIT III

**(18 HOURS)**

Photosynthesis – pigment types, pigment system (PS-I & II), Mechanism - Light reaction, Dark reaction - Calvin cycle, Hatch and Slack pathway and CAM pathway, Photorespiration and Factors controlling photosynthesis. Respiration- Glycolysis, (preparatory and pay-off phases), Fermentation. Kreb's cycle, Electron Transport Chain, oxidative phosphorylation, chemiosmotic hypothesis, balance sheet of ATP yield, Respiratory quotient, respiratory inhibitors. Growth and maintenance of respiration.

**UNIT IV****(18 HOURS)**

Nitrogen metabolism - Nitrogen cycle, Biological Nitrogen Fixation - Symbiotic and Non- Symbiotic. Formation of root nodules in leguminous plants, Structure and function of nitrogenase, hydrogenase and leg-hemoglobin, biochemical regulation of nitrogen fixation process. Nitrogen metabolism, inorganic nitrogen species ( $\text{NO}_2$ ,  $\text{NO}_3$ , and  $\text{NH}_4$ ) and their reduction to amino acids. Factors controlling biological nitrogen fixation

**UNIT V****(18 HOURS)**

Definition and classification of plant growth regulators: Phytohormones, endogenous -Discovery, site of synthesis, biosynthetic pathways, Specific signaling pathways Specific Physiological effects of Auxins, Gibberellins, Cytokinins, Abscisic acid, Ethylene, Brassinosteroids and Methyl Jasmonate. Physiology of flowering: Photoperiodism - Phytochrome, Vernalization. Seed dormancy\*.

**\*Self study****TEACHING METHODS**

Smart Class Room/PowerPoint presentation/Seminar/Quiz/Discussion

**TEXT BOOKS**

1. V.K. Jain, (1993). Fundamentals of plant physiology. S. Chand & Co. New Delhi
2. Chopra. (1995). A text book of Plant Physiology. EMKAY Publications, New Delhi.
3. S.K. Verma, (1999). A textbook of Plant physiology. S. Chand & Co. New Delhi
4. Annie Ragland, Rajkumar, Rajaatnam and Jayakumar. (2007). Plant Physiology. Saras Publications, Nagarcoil.
5. S.N. Pandey and B.K.Sinha, (2009). Plant Physiology, 4<sup>th</sup> Edition, Vikas Publishing Company, Noide, UP

**REFERENCES**

1. Noggle and Fritz. (1992). Introductory plant physiology. Prentice Hall of India. Pvt. Ltd. New Delhi.
2. Malik. (2002). Plant physiology. Kalyani Publishers, New Delhi.
3. Devlin, (1986). Plant physiology. CBS Publishers and distributors, New Delhi.
4. S.K. Sinha, (2004). Modern Plant Physiology. Narosa Publishing House, New Delhi
5. John Charles Walker (1997). Plant Physiology, McGraw Hill Book Company, New York.
6. L. Taiz and E. Zeiger, (2002). Plant Physiology. III Edition, Sinauer Association
7. Devlin and Witham (1996). Plant Physiology. CBS Publishers and Distributors, Delhi
8. F.B. Salisbury and C.W. Ross, (1993). Plant Physiology. IV Edition Wadsworth Publishing Company, California

# UBO49

## MAPPING

<b>CO \ PSO</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>	<b>PSO4</b>	<b>PSO5</b>
<b>CO1</b>	<b>S</b>	<b>H</b>	<b>M</b>	<b>H</b>	<b>M</b>
<b>CO2</b>	<b>H</b>	<b>H</b>	<b>S</b>	<b>M</b>	<b>H</b>
<b>CO3</b>	<b>S</b>	<b>M</b>	<b>H</b>	<b>H</b>	<b>S</b>
<b>CO4</b>	<b>H</b>	<b>S</b>	<b>S</b>	<b>M</b>	<b>H</b>
<b>CO5</b>	<b>S</b>	<b>H</b>	<b>H</b>	<b>S</b>	<b>H</b>

**S** - Strong

**H** - High

**M** - Medium

**L** - Low

<b>Programme Code: 05</b>		<b>B.Sc., BOTANY</b>		
<b>Core paper 11: BIOPHYSICS AND BIOSTATISTICS</b>				
<b>Batch</b> 2022-2023	<b>Semester</b> VI	<b>Hours / Week</b> 6	<b>Total Hours</b> 90	<b>Credits</b> 4

**COURSE OBJECTIVES**

- To understand the nature, pathways and applications of light energy.
- To learn the basic principles of biostatistics.
- To impart knowledge to solve biological problems.

**COURSE OUTCOMES**

On successful completion of the course, the students will be able to

K1 ↑ ↓ K5	CO1	Recognize the dual nature of light and its reactions with reference to plants.
	CO2	Understand basic concepts of radioactivity and the methods of detection.
	CO3	Impart knowledge on the tools of biostatistics.
	CO4	Analyze and solve the biological related problems using biostatistical formulae.
	CO5	Evaluate scientific findings through various statistical tools.

**SYLLABUS**

**UNIT I (18 HOURS)**

**Biophysics:** Introduction, scope and importance. Electromagnetic radiation and absorption. Excitation and de-excitation. Absorption of light in photosynthesis, Efficiency of photosynthesis. Thermodynamic laws (enthalpy, entropy, free energy).

**UNIT II (18 HOURS)**

**Radioactivity and Biological traces:** Alpha, beta and gamma radiations. Radioactive isotopes and half-life period. Ionization and detection - biological effects of ionizing radiation - uses of biological traces in metabolic studies. Autoradiography, Geiger-Muller and Scintillation counter.

**UNIT III (18 HOURS)**

**Biostatistics:** - Definition, steps in statistics, data collection methods - sampling - census and sampling method, law of statistical regularities, law of inertia of large numbers. Essential of sampling and methods of sampling - probability of sampling - simple, random sampling, stratified random sampling, cluster sampling, non-probability sampling - judgment sampling, quota sampling and convenient sampling (theory only). Primary and secondary data.

**UNIT IV (18 HOURS)**

Classification of data and Frequency distribution-Simple, Discrete and Continuous series. Tabulation, graphical representation-Time series graph, Histogram and diagrammatic representation of data - Line, Bar and Pie diagram. Cartogram and Pictogram\*.

**UNIT V**

Measures of central tendency - Mean [Arithmetic only] median and mode. Rounding off figures. Precision, accuracy and error. Dispersion or deviation- range, average deviation, variance, standard deviation and standard error. Test of significance- Chi-square test and t- test.

**\* Self study**

**Teaching Methods**

Smart Class Room/Powerpoint presentation/Seminar/Quiz/Discussion

**TEXT BOOKS**

1. S. Palanichamy, (1986). Principles of Biophysics. Paramount Publication, Palani.
2. S. Palanichamy and M. Manoharan. (1994). Statistical Methods for Biologists. Paramount Publication, Palani.
3. N. Arumugam, (2003). Basic Concepts of Biostatistics. Saras Publications, Nagarcoil.
4. S.P. Gupta, (2001). Statistical Methods. Sultan Chand & Sons, Educational Publishers, New Delhi.
5. S. Thiraviyaraj,(2009). Biophysics. Saras Publications, Nagarcoil, Tamil Nadu.

**REFERENCES**

1. Salil Bose. (1981). Elementary biophysics - Part 1. Vija Printers, Madurai.
2. I.D. Khan and A. Khanum. (1994). Fundamentals of Biostatistics. Mc Graw Hill, New Delhi.
3. Vasantha Pattabhi and N. Gautham. (2004). Biostatistics. Narosa Publishing House, Chennai.
4. R.S.Chandel, (1975). A Hand Book of Agricultural Statistics, Achal Prakashan Mandir
5. K.A. Gomez, and A.A. Gomez, (1984). Statistical Procedures for Agricultural Research. John Wiley and Sons
6. M. Daniel, (1989). Basic Biophysics for Biologists, Agro-Botanical Publisher, Bikaner, India
7. P. Narayanan, (2007). Essentials of Biophysics. Second New Age International Publishers
8. P.N. Arora and P.K. Malhan (1996). Biostatistics, Himalaya Publishing House, Delhi.

**MAPPING**

CO \ PSO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	H	S	S	H	M
CO2	S	H	M	H	H
CO3	H	S	H	M	S
CO4	S	H	M	H	M
CO5	S	H	M	H	H

S - Strong

H - High

M - Medium

L - Low

<b>Programme Code: 05</b>		<b>B.Sc., BOTANY</b>		
<b>Core practical 5: BIOCHEMISTRY, BIOINSTRUMENTATION, PLANT PHYSIOLOGY, BIOPHYSICS AND BIOSTATISTICS</b>				
<b>Batch</b> 2022-2023	<b>Semester</b> VI	<b>Hours/Week</b> 4	<b>Total Hours</b> 60	<b>Credits</b> 2

**COURSE OBJECTIVES**

- To acquire skills on handling of the instruments
- To learn principles and applications of instruments
- To provide hands-on techniques on instruments
- To learn metabolic process of the plants

**COURSE OUTCOMES**

On successful completion of the course, the students will be able to

K3 ↑ ↓ K5	CO1	Able to quantify the amount of macromolecules in a given sample
	CO2	Able to apply the principles in any biological experiments
	CO3	Apply indepth knowledge on instrumentation techniques and knowledge on handling and troubleshooting of instruments in any biological experiments
	CO4	Acquire basic knowledge on mechanism of various metabolic processes in plants
	CO5	Apply problem solving skills using statistical tools

**I. BIOCHEMISTRY**

1. Estimation of Carbohydrate by Anthrone method
2. Estimations of aminoacids by Ninhydrin method.
3. Estimation of protein by Lowry’s method.
4. Estimation of Vitamin C
5. Preparation of Phosphate Buffers.

**II. BIOINSTRUMENTATION**

1. Analyze the pH of samples (soil, water and plant extract)
2. Colorimetry
3. Soxhlet apparatus
4. Clevenger apparatus
5. Column Chromatography
6. Centrifugation
7. PCR and Agarose Gel Eletrophoresis



**III. PLANT PHYSIOLOGY**

1. Determination of osmotic pressure of cell sap of onion/*Rheo* leaf.
2. Separation of plant pigments by paper chromatography.
3. Measurement of oxygen evolution using different light intensities using Wilmott's bubbler.
4. Determination of photosynthetic rate in water plants under different CO<sub>2</sub> concentration.
5. Measurement of rate of respiration using flower buds/ germinated seeds with simple Respiroscope.
6. Estimation of leghemoglobin in Root nodules of legumes
7. Extraction and colorimetric estimation of IAA from plant tissues
8. Effect of light intensity on transpiration using Ganong's photometer.
9. Determination of absorption and transpiration ratio in plants.
10. Effect of Auxins and Gibberellins on seedling growth
11. Arc auxanometer

**IV. BIOPHYSICS**

1. Nature of Electromagnetic Radiation (EMR) and Spectrum.
2. Diagrams of Fluorescence, Phosphorescence, Delayed light emission, Autoradiography, Geiger-Muller counter and Scintillation counter

**V. BIOSTATISTICS**

Simple problems in biostatistics:

1. Mean
2. Median
3. Mode
4. Standard Deviation
5. Standard Error
6. Chi-Square Test
7. t- test

**MAPPING**

CO \ PSO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	H	M	S	H
CO2	S	S	S	H	M
CO3	H	H	M	H	S
CO4	S	H	H	M	S
CO5	S	H	S	S	M

S - Strong

H - High

M - Medium

L - Low

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**KONGUNADU ARTS AND SCIENCE COLLEGE (Autonomous)  
COIMBATORE - 641 029**

**UG MODEL QUESTION PAPER (PRACTICALS)**

**End of Semester Examination Question Paper Pattern**

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

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**Time: 3 Hours**

**Max. Marks: 50 Marks**

**BREAK UP OF MARKS**

**CORE PRACTICAL: 5 – BIOCHEMISTRY, BIOINSTRUMENTATION, PLANT  
PHYSIOLOGY, BIOPHYSICS AND BIOSTATISTICS**

I. Biochemistry	- 09 Marks
II. Bioinstrumentation	- 09 Marks
III. Physiology Experiment	- 09 Marks
IV. Biostatistics (2 × 4)	- 08 Marks
V. Spotters (5 × 2)	- 10 Marks
Record	- 05 Marks

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**TOTAL**                      **50 Marks**

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Programme Code: 05		B.Sc., BOTANY		
SKILL BASED SUBJECT III: CULTIVATION AND MARKETING OF MEDICINAL PLANTS				
Batch 2022-2023	Semester VI	Hours / Week 2	Total Hours 30	Credits 3

### COURSE OBJECTIVES

- To gain knowledge on scope, importance and conservation strategies of medicinal plants
- To understand the medicinal values of various parts of medicinal plants
- To understand the present scenario on marketing of medicinal plants
- To obtain basic knowledge on Intellectual property rights (IPR).

### COURSE OUTCOMES

On successful completion of the course, the students will be able to

K1 ↑ ↓ K5	CO1	To know about <i>in situ</i> and <i>ex situ</i> conservation strategies for various medicinal plants.
	CO2	To gain knowledge on sustainable utilization of various herbal medicines for home remedies.
	CO3	Learn about the medicinal aspects of selected plant species
	CO4	Examine quality management, marketing and trade of medicinal plants
	CO5	Apply the principles and concepts of IPR and their applications

### SYLLABUS

#### UNIT I

(6 HOURS)

Scope, importance and present scenario of medicinal plants in India. *In situ* and *ex situ* conservation strategies. National Medicinal Plants Board (NMPB)

#### UNIT II

(6 HOURS)

A general account on the methodology of cultivation, therapeutic uses of plants. Rhizome - *Curcuma longa*, Root tubers - *Asparagus racemosus*, Twigs - *Adathoda vasica*

#### UNIT III

(6 HOURS)

Cultivation of medicinal plants: Leaf- *Andrographis paniculata*. Bark - *Cinchona officinalis*, Flower bud- *Syzygium caryophyllatum* - Fruit- *Phyllanthus emblica*, Seed – *Withania somnifera* and Tuber - *Gloriosa superba*

#### UNIT IV

(6 HOURS)

Marketing Scenario of medicinal plants - Agricultural and Processed Food Products Export Development Authority (APEDA), Domestic market, Global market, Export: Standard and Quality control (Constraints). Future perspectives for medicinal plants\*

#### UNIT V

(6 HOURS)

**Intellectual property rights (IPR):** Definition, Origin, Classification and application of different forms, Patents: Concepts and principles – Patent act in India, Procedure for obtaining patent–Rights of patent.

## UBO56

### \*Self study

#### Teaching Methods

- Smart Class Room/Powerpoint presentation/Seminar/Quiz/Discussion

#### TEXT BOOKS

1. S.S. Purohit and S.P. Vyas (2005). Medicinal Plant Cultivation. A Scientific Approach. Agrobios Publishers, Jodhpur, India.
2. G. E. Treases and W. G. Evans. (1983). Pharmocognosy Bailliare, Tindall Esaibolarna.
3. Barrett and Margreth. Intellectual Property, (2009) 3rd, New York Aspen publishers.
4. Nard and Craig Allen. Law of Intellectual Property, (2008) 2nd, New York Aspen publishers

#### REFERENCES

1. D.N. Guha Bakshi, P. Sensarma, DC pal, (2001). A lexicon of medicinal plants in India. Vol. II. Naya Prakash, Calcutta.
2. S. Thirugnanam (2003). Mooligai maruthuvam, Selvi Pathipagam, Trichy.
3. R.S. Satoskar, S.D. Bhanalarkar, S.S. Ainapure. (2002) Pharmacology, Pharmacotherapy - popular Prakasham, Mumbai.
4. Anil K. Dhiman, (2003). Sacred plants and their medicinal uses - Daya Publishing House, New Delhi.
5. H. Panda, (2001). Essential oils- hand book, national Institute of Industrial Research, New Delhi.
6. H. Panda, (2001) Hand book of herbal medicines. Asia Pacific Business Press, New Delhi.
7. International Encyclopedia of Laws: Intellectual Property (Kluwer Law International, 1997) (loose leaf). I, MON K 1401. I5828 (1997) vols. 1-5
8. K. Ahuja, Law relating to Intellectual Property rights, 2nd Edition, (2013) LexisNexis

#### MAPPING

CO \ PSO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	H	H	M	S
CO2	H	S	H	M	S
CO3	H	H	M	S	H
CO4	S	M	S	M	H
CO5	S	M	S	S	H

S - Strong

H - High

M - Medium

L - Low

<b>Programme Code: 05</b>		<b>B.Sc., BOTANY</b>		
<b>PROJECT &amp; VIVA – VOCE</b>				
<b>Batch 2022-2023</b>	<b>Semester VI</b>	<b>Hours / Week -</b>	<b>Total Hours -</b>	<b>Credits 5</b>

**COURSE OBJECTIVES**

- To know the practical problems in various fields of Botany
- To understand and collect related data in the selected fields
- To apply suitable skills and solve selected problems through proper execution

**COURSE OUTCOME**

On successful completion of the project work, the students will be able to

K3 ↑ ↓ K5	CO1	Applying theoretical skill sets in lab oriented experiments
	CO2	Analyzing the importance of project work while collecting necessary data
	CO3	Evaluating variations between theories and experiments.
	CO4	Apply principles and concepts in research components
	CO5	Executing standard operating procedures and interpretation of appropriate results.

Group project work will be allotted to a group of students under the supervision and guidance of the Faculty members during VI Semester. Project works will be given based on the various fields of specialization of the supervisors under whom the students are allotted. They are allotted based on the lot system. The fields of specialization are Systematic Botany, Microbiology and Plant Pathology, Medicobotany, Ecology and Conservation Biology. The students shall do their projects under their supervisor and submit their dissertation at the end of VI Semester. Both the Internal and External Examiners shall jointly evaluate the project report submitted by the students and marks will be awarded on the basis as mentioned below.

**Guidelines for the Distribution of Marks:**

<b>CIA</b>	Project Review	45	<b>50</b>
	Regularity	5	
<b>ESE</b>	Project Report Present	35	<b>50</b>
	Viva – Voce	15	
<b>Grand Total</b>			<b>100</b>

**MAPPING**

<b>PSO</b> <b>CO</b>	<b>PSO1</b>	<b>PSO 2</b>	<b>PSO 3</b>	<b>PSO 4</b>	<b>PSO 5</b>
<b>CO1</b>	H	H	S	M	S
<b>CO2</b>	S	S	H	S	H
<b>CO3</b>	S	H	S	H	S
<b>CO4</b>	S	H	M	S	M
<b>CO5</b>	H	M	S	M	L

**S - Strong                      H - High                      M - Medium                      L - Low**

UBO58

# **ELECTIVE PAPERS**

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## UBO59

Programme Code: 05	B.Sc., BOTANY		
	Major Elective: 1 - FORESTRY		
Batch 2022-2023	Hours / Week 5	Total Hours 75	Credits 5

### COURSE OBJECTIVES

- To understand the basic concepts of forest and their distribution types
- To acquire knowledge on forest resources and their utilization
- To gain knowledge on laws of conservation of forest

### COURSE OUTCOMES

On successful completion of the course, the students will be able to

K1 ↑ ↓ K5	CO1	Recognize the importance of forest produce to mankind.
	CO2	Understand the economic aspects of forest and their importance to the society.
	CO3	Reclamation of wastelands with suitable tree species.
	CO4	Implement the socio - economic benefits of trees in day to day life
	CO5	Evaluate the plants used as source of food

### SYLLABUS

#### UNIT I

(15 Hours)

Introduction to Forests: General introduction to forests, Natural, man-made forest. Classification of forest (Champion and Seth, 1968). Tropical, subtropical, temperate, evergreen, semi-ever green and deciduous forests. Mangrove forests-species

#### UNIT II

(15 Hours)

Silviculture - concept, scope; clear felling, uniform shelter, wood selection, coppice. Conservation systems – *Ex situ* and *In situ*. Silviculture of some of the economically important species in India- *Casuarina*, *Dalbergia sisso* and *Tectona grandis*.

#### UNIT III

(15 Hours)

Social and Agro forestry. Selection of species and role of multipurpose trees. food, fodder, energy and avenue plantation. Sacred grooves - definition and importance. Significance of sacred trees - *Terminalia arjuna*, *Aegle marmelos* and *Ficus religiosa*

#### UNIT IV

(15 Hours)

Introduction to forest laws: Forest laws, necessity, General principles, Indian forest act, 1927, Forest conservation act (1980), Indian forest law (1988), Wild life protection act (1972) and their amendments, Endangered species act (1982).

#### UNIT V

(15 Hours)

Plants as sources for food, fodder, fibres, spices, beverages, drugs, narcotics, insecticides, timber, gums, resins and dyes. Ethnobotany in human welfare\*, Major Botanical garden - Kew.

## UBO60

### \*Self study

### Teaching Methods

- Smart Class Room/PowerPoint presentation/Seminar/Quiz/Discussion

### TEXT BOOKS

1. K.P. Sagreiya, (1994). Forests and Forestry (Revised by S.S. Negi). National book trust. New Delhi.
2. Tribhawan Mehta, (1981). A handbook of forest utilization. Periodical Expert Book Agency, New Delhi.

### REFERENCES

1. Kollmann and Cote (1988). Wood Science and Technology. Vol.I & II Springer verlag.
2. P.D. Sharma, (2004). Ecology and Environment. Rastogi Publications, Meerut
3. M.P. Singh and Vinita Vishwakarma. (1997). Forest Environment and Biodiversity. Daya Publishing House, New Delhi
4. K.M. Tiwari, (1983). Social forestry in India.
5. Gray L. Rolfe, Johan, M. Edgington, I. Irving Holland and Gayle C. Fortenberry. (2005). Forests and Forestry. International book distributing Co., Lucknow.
6. B.S.Chundawat & S.K. Gautams. (1996). Textbook of Agroforestry. Oxford and IBH Publishnig Co., Pvt. Ltd., Kolkatta
7. Anil Kumar Dhiman. (2003). Sacred Plants and their medicinal uses. Daya publishing house, New Delhi.
8. P.E. Bedell, (1998). Seed Science & Technology. Allied Publishers Ltd.

### MAPPING

CO \ PSO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	H	M	H	S
CO2	H	H	S	M	S
CO3	S	M	H	H	H
CO4	H	S	H	H	M
CO5	S	M	H	H	H

S - Strong

H - High

M - Medium

L – Low



## UBO61

<b>Programme Code: 05</b>	<b>B.Sc., BOTANY</b>		
	<b>Major Elective: 2 - BIOTECHNOLOGY</b>		
<b>Batch 2022-2023</b>	<b>Hours / Week 5</b>	<b>Total Hours 75</b>	<b>Credits 5</b>

### COURSE OBJECTIVES

- To familiarize the fundamental principles of biotechnology and various tools
- To obtain knowledge on various developments and potential applications of gene cloning technology and genetic transformation and their application in plants
- To know the basic principles, knowledge and applications of bio-fertilizers, waste water treatment and biomass and bioenergy production
- To acquire inherent knowledge on the basic principles and applications of bioethics and biosafety

### COURSE OUTCOMES

On successful completion of the course, the students will be able to

K1 ↑ ↓ K5	CO1	Gain the basic concepts of biotechnology and various tools
	CO2	Understand and gain knowledge on gene cloning techniques, methods of gene transfer in plants and various applications and tools in molecular biology
	CO3	Acquire knowledge and applications of microbes used for biofertilizer preparation, waste water treatments, biomass and energy production
	CO4	Analyze the principles of biosafety assessment procedures of food related products
	CO5	Evaluate the acquired biotechnological knowledge in their practical life

### SYLLABUS

#### UNIT I

(15 HOURS)

**Genetic Engineering**—Definition and importance, Enzymes used in gene cloning - Polymerases, Restriction endonucleases, Ligases, Vectors for gene cloning- General properties of a vector, Plasmid and Cosmid, Gene cloning procedure. Tools and Techniques for Molecular Biology-Agarose gel electrophoresis, PCR-working principles, procedure and applications

#### UNIT II

(15 HOURS)

Methods of gene transfer in plants - Mechanism of T-DNA transfer- *Agrobacterium* mediated (Ti and Ri plasmids) and Gene gun (Particle bombardment) method, Blotting techniques to detect the transgene in transgenic plants - Southern, Northern and Western. Applications of genetic engineering- Golden rice, Flavr Savr, Bt cotton, and herbicide resistance (EPSPs).

#### UNIT III

(15 HOURS)

Microbial Biotechnology: Scope and importance, Biofertilizers –Definition and types, advantages, mass cultivation and application techniques of *Rhizobium*, *Azospirillum*, *Azolla* and VAM.

#### UNIT IV

(15 HOURS)

Environmental Biotechnology: Definition, concept, scope and application, wastewater treatment. Treatment of paper and distillery effluents - oxidation ponds. Source of

## UBO62

alternate fuel - biomass and bioenergy production of biogas and its advantage.  
Vermitechnology - definition, scope, importance and advantages.

### UNIT V

(15 HOURS)

**Bioethics:** Principles, Scope and importance. **Biosafety:** Definition of Biosafety. Requirements, Biosafety for human health and environment, use of genetically modified organisms and their release into the environment, Biosafety assessment procedures for biotech foods & related products.

#### \*Self study

#### Teaching Methods

Smart Class Room/PowerPoint presentation/Seminar/Quiz/Discussion

#### TEXT BOOKS

1. S. Ignacimuthu, (1996). Applied Plant Biotechnology. Tata McGraw Hill Publishing Company Ltd., New Delhi.
2. S. Ignacimuthu, (1997). Plant Biotechnology. Tata McGraw Hill Publishing Company Ltd., New Delhi.
3. S. Shantharam and Jane F. Montgomery, (1999), Biotechnology Biosafety, and Biodiversity, Scientific and Ethical Issues for Sustainable Development, CC Now Science Publishers.
4. R.C. Dubey, (2014). A Text Book of Biotechnology. S Chand & Company P. Ltd, New Delhi.
5. V.K. Kumaresan,(2015). Biotechnology. Saras Publications, Nagercoil, Tamil Nadu.

#### REFERENCES

1. Chhatwal, (1995). Text book of Biotechnology. Anmol Publications Pvt. Ltd., New Delhi.
2. P.K. Gupta, (2004). Elements of Biotechnology, Rastogi Publications, Meerut.
3. S.B. Primrose and R.Twyman, (2006). Principles of Gene Manipulation and Genomics. 7<sup>th</sup> Edition, Blackwell Publishing, Malden, MA, USA.
4. Colin Ratledge and Bjorn Kristiansen. (2006). Basic Biotechnology. 3<sup>rd</sup> Edition, Cambridge University Press.
5. P.K. Moapatra,(2006). Textbook of Environmental Biotechnology. IK International Publishers.
6. Slater, Scott and Fowler, (2008). Plant Biotechnology, 2<sup>nd</sup> Edition, Oxford University Press
7. U. Sathyanarayanan, (2018). Biotechnology, Generic Publisher
8. Kalyan Kumar De (2020). Plant tissue culture. New Central Book Agency (NCBA), Kolkata, West Bengal.

#### MAPPING

PSO CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	H	M	L	M
CO2	S	M	H	S	H
CO3	H	S	H	M	S
CO4	H	H	M	H	M
CO5	S	S	H	H	H

S - Strong

H - High

M - Medium

L – Low

## UBO63

<b>Programme Code: 05</b>	<b>B.Sc., BOTANY</b>		
	<b>Major Elective: 3 - FOOD SCIENCE</b>		
<b>Batch 2022-2023</b>	<b>Hours / Week 5</b>	<b>Total Hours 75</b>	<b>Credits 5</b>

### COURSE OBJECTIVES

- To know about the food groups and preparations
- To understand food processing technology and preservation methods
- To analyze and disseminate knowledge on food related issues

### COURSE OUTCOMES

On successful completion of the course, the students will be able to

K1 ↑ ↓ K5	CO1	Acquire knowledge on manufacturing processes and technologies used in the production of food products
	CO2	Understand the nutritive value, process of food product development and their environmental considerations.
	CO3	Explain the functional properties of food in human nutrition.
	CO4	Develop skills in researching, analyzing and communicating food related issues.
	CO5	Assess the chemical and physiological changes during food processing techniques.

### SYLLABUS

#### UNIT I

(15 Hours)

**Food groups:** Basic groups- basic four, five and seven, food in relation to health. Preliminary preparation of food- cleaning, peeling, stinging, cutting and grating, soaking, marinating, sprouting, fermenting, grinding, drying and filtering - their advantages and disadvantages.

#### UNIT II

(15 Hours)

Cereals and cereal products - structure, composition and nutritive value - Wheat and wheat products; fermented and unfermented products.

#### UNIT III

(15 Hours)

Biotechnology in food - biofortification, nutraceuticals, space food. Fruits and vegetables - classification, composition and nutritive value. Milk and milk products\* - processing, clarification, pasteurization and homogenization. Tea processing and marketing.

#### UNIT IV

(15 Hours)

Food preservation by high and low temperatures- outline. Preservation by high osmotic pressure, high concentration of sugar, jam and jelly preparation. High concentration of salts. Principles and preparation of pickles- preservation by dehydration. Principles and methods of drying - freeze drying, sun drying, mechanical driers - spray drying and foam mat drying and by smoking.

## UBO64

### UNIT V

(15 Hours)

Packing of food- classification of package, materials used for packing, active food packing, packing of fruits and vegetables. Nutrition labeling - principles, codex guidelines. Recent development on the food labeling front in India.

#### \*Self study

#### Teaching Methods

Smart Class Room/PowerPoint presentation/Seminar/Quiz/Discussion

#### TEXT BOOKS

1. RaheenaBegum (1989). A Text Book of Foods Nutrition and Dietetics. Sterling Publisher, New Delhi
2. James M. Jay. (1987). Modern Food Microbiology. CBS, Mylapore, Chennai.
3. D. Manley, (2000). Tech of Biscuits, Creckers and Cookes. 2nd Cec Press
4. B. Srilakshmi, (2003). Food science. New Age International Pvt. Ltd., New Delhi
5. B. Srilakshmi, (2016). Food Science. New Age International Pvt. Ltd., New Delhi.

#### REFERENCES

1. Lal G. Siddapa and G.L. Tandon. 1986. Preservations of Fruits and Vegetables'. ICAR
2. H.D. Belttz,(1999). Food Chemistry. Springer Vellag, DeManJM
3. D. Janet, Ward and T. Larry. (2002). Principles of Food Science. Good Heart, Wilcox, Illinois.
4. S.C. Dubey, (2002). Basic Baking. The society of India Bakers, New Delhi
5. R. Coles, D. McDowell and M.J. Krwan, (2003). Food Packaging Tech. CRC, Press
6. G. Subbulakeshmi, (2003). Food processing and preservation. New Age International Pvt. Ltd.
7. B. Srilakshmi, (2005). Food and Health. National Institute of Nutrition, ICMR, Hyderabad.
8. P.J. Fellows, (2005). Food Processing Technology: Principle and Practice, 2<sup>nd</sup> Edition, CRC.

#### MAPPING

CO \ PSO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	H	H	M	S
CO2	S	S	H	S	M
CO3	H	M	H	M	H
CO4	H	H	M	H	M
CO5	S	S	M	S	H

S - Strong

H - High

M - Medium

L - Low

## UBO65

<b>Programme Code: 05</b>	<b>B.Sc., BOTANY</b>		
	<b>Major Elective: 4 - SEED BIOLOGY</b>		
<b>Batch 2022-2023</b>	<b>Hours / Week 5</b>	<b>Total Hours 75</b>	<b>Credits 5</b>

### COURSE OBJECTIVES

- To study the structure of Angiospermic seeds
- To analyze various products produced by seeds.
- To assess and examine the germination capacity of seeds.

### COURSE OUTCOMES

On successful completion of the course, the students will be able to

K1 ↑ ↓ K5	CO1	Recognize physical and chemical properties of seeds
	CO2	Understand the factors responsible for seed germination
	CO3	Apply various methods of processing of seeds for storage
	CO4	Implement knowledge to break seed dormancy and enhance plant growth
	CO5	Compare various methods of seed treatment and trace their patterns of growth in Angiospermic seeds

### SYLLABUS

#### UNIT- I (15 Hours)

Scope of seed biology - Structure of monocot and dicot seeds / grains. Albuminous (endospermic) and ex-albuminous (non-endospermic) seeds. Chemical composition - cereals (Paddy) - Oil seed (Castor) - Fibre (Cotton) and Pulses (Bean).

#### UNIT- II (15 Hours)

Seed germination: Factors affecting germination. Methods of germination test (using paper, sand and soil) - Seed viability (Tetrazolium test), vigour (Direct and Indirect test). Concept of seed vigour.

#### UNIT- III (15 Hours)

Seed drying, Process and Equipments. Methods of moisture determination of seed. Seed cleaning and upgrading - Equipments involved. Seed testing and quality control.

#### UNIT- IV (15 Hours)

Seed dormancy: Primary and Secondary dormancy - significance - Factors involved - methods used to break dormancy\*.

#### UNIT- V (15 Hours)

Seed treatment - methods of seed treatment, seed treating formulations and equipments, seed disinfestations, identification of treated seeds; Pelleting and their significance, packaging, bagging, labeling, storage and marketing.

\*Self study

## UBO66

### Teaching Methods

- Smart Class Room/PowerPoint presentation/Seminar/Quiz/Discussion

### TEXTBOOKS

1. J.D. Bewley and M. Black (1978). Seed Biology Vol. I & II Academic press, New York
2. R.L. Agarwal, (1982). Seed Technology -. Oxford and IBH Publishing Company, New Delhi.
3. GV. Basavaraju, P. Ravishankar and S. Gowdiperu, (2014). A Text book of seed science
4. N. Rakesh Singh, C. Naveen and P. Deepti (2000). Treasure of Seed Science and Technology, Jain Brothers, New Delhi
5. S. Padmavathi, M. Prakesh, S. Ezhil kumar, G. Sathiyarayanan and A. Kamaraj (2021). A Text Book of Seed Science and Technology, New India Publishing Agency.

### REFERENCES

1. T.T. Kozlowski, (1972). Seed Biology- Importance, Development and Germination. Volume I, Academic Press, INC, New York
2. D.R. Murray (1984). (Ed.) Seed physiology. Vol. I & II Academic Press: Sydney - New York- London
3. J.D. Bewley and M. Black. (1985). (Eds.) Seeds; Physiology of development and germination Plenum Press: New York.
4. A.A. Khan (Latest Edition) (Ed.). The Physiology and Biochemistry of seed Dormancy and germination. North-Holland Publishing Company: Amsterdam- New York- Oxford.
5. A.K. Joshi and B.D Singh (2004). Seed Science and Technology, Kalyani Publishers, New Delhi
6. S.W. Adkins, S. Ashmore and S.C. Navie (2007). Seeds: Biology, Development and Ecology, CAB International, Wallingford, Oxfordshire, UK
7. Elgi and B. Dennis, (2017). Seed Biology and Yield of grain crops, 2<sup>nd</sup> Editions, CAB International, Wallingford, Oxfordshire, UK
8. Jose C. Jimenez-Lopez (2017). Advances in seed Biology. Intech. Janeza Trdine, Croatia

### MAPPING

CO \ PSO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	H	M	S	M	S
CO2	S	S	H	H	S
CO3	H	S	H	M	H
CO4	H	H	M	S	H
CO5	M	M	H	H	S

S - Strong

H - High

M - Medium

L - Low

## UBO67

<b>Programme Code: 05</b>	<b>B.Sc., BOTANY</b>		
	<b>Major Elective: 5 – PHARMACOGNOSY</b>		
<b>Batch 2022-2023</b>	<b>Hours / Week 5</b>	<b>Total Hours 75</b>	<b>Credits 5</b>

### COURSE OBJECTIVES

- To study the drug development from medicinal plants
- To understand the traditional systems of medicines like Ayurveda, Siddha & Unani
- To know the pharmacological actions of plant drugs

### COURSE OUTCOME

On successful completion of the course, the students will be able to

K1 ↑ ↓ K5	CO1	Acquire knowledge on the therapeutic uses of plant drugs.
	CO2	Understand the traditional and modern systems of medicine.
	CO3	Relates physiological action of various plant drugs.
	CO4	Recognize the nature of pharmaceutical bioactive components in plant sources.
	CO5	Predict the identification and purity of natural drug source for their efficacy and safety.

### SYLLABUS

#### UNIT I

(15 Hours)

Definition, history and scope of Pharmacognosy. Study of various system of classification of drugs. Traditional system of medicine (AYUSH - Ayurveda Siddha, Unani and Homeopathy). Glossary of medicinal plants

#### UNIT II

(15 Hours)

A general survey of biological sources, Geographical sources and cell cultures in the production of drugs. Factors involved in the production of drugs.

#### UNIT III

(15 Hours)

Pharmacological action of plant drugs - act on central nervous system- Lysergic acid Diethylomids, cannabis, Cocaine and reserpine. Action on heart muscles - Digitalis, Quinidine, Papaverine and Ergotamine.

#### UNIT IV

(15 Hours)

Drugs of plant origin - Phytochemical tests and application of plant derived phenols, resins, alkaloids, flavonoids, terpenoid, steroids, glycosides and vitamins. A general procedure for separation of the compounds by TLC technique.

#### UNIT V

(15 Hours)

Organized natural products - wood and bark - Quassia and Cinchona. Leaves and Flowers -Adhathoda and Clove Seed and fruits- Fennel, Nutmeg. Unorganized products - Acacia gum and Castor oil\*.

## UBO68

### \*Self study

### Teaching Methods

- Smart Class Room/PowerPoint presentation/Seminar/Quiz/Discussion

### TEXT BOOKS

1. G.E. Trease and W. C. Evans, (1983) Pharmacognosy, ELBS, Britain
2. Biren Shah and Avinash Seth (2013).Textbook of Pharmacognosy and Phytochemistry. Elsevier India
3. Suresh Narayana P, Varalakshmi D and Pullaiah T (2016). A Textbook of Pharmacognosy, CBS Publishers & Distributors Pvt Ltd, India.
4. Biren Shah and AK Seth. (2016). Textbook of Pharmacognosy and Phytochemistry , CBS Publishers & Distributors

### REFERENCES

1. G.M. Hocking, (1955). A dictionary of terms used in Pharmacognosy, Spring Field.
2. R.N. Chopra, R.L. Badhwa, and S. Ghosh, (1965). Poisonous plants of India Govt. of India Press.
3. M.H. Ballow, (1969). Marine Pharmacology, Williams and Wilkins.
4. C.K. Kokate, A.P. Purohit and S.B. Gokhale, (2008). Pharmacognosy, Nirali.
5. S.S. Handa and V.K.Kapoor. (2014). Pharmacognosy, Vallabh Prakashan
6. W.C. Evans,(2019), Trease and Evans of Pharmacognosy
7. Kuntal Das, (2019). Pharmacognosy and Phytochemistry – I, Nirali Prakashan
8. Neeraj Kumar Sharma, Mona Kejariwal and Md. Rageeb Md. Usman. 2021. PV Publication,Jalandhar

### MAPPING

CO \ PSO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	H	S	H	M
CO2	S	H	M	S	H
CO3	H	S	H	M	S
CO4	H	M	H	H	M
CO5	S	H	M	M	H

S - Strong

H - High

M - Medium

L - Low



## UBO69

<b>Programme Code: 05</b>	<b>B.Sc., BOTANY</b>		
	<b>Major Elective 6 - HORTICULTURE</b>		
<b>Batch 2022-2023</b>	<b>Hours / Week 5</b>	<b>Total Hours 75</b>	<b>Credits 5</b>

### COURSE OBJECTIVES

- ❖ To learn about the propagation methods of horticultural crops.
- ❖ To study the various types of gardening, landscaping and their management.
- ❖ To know about commercial floriculture and their significance.

### COURSE OUTCOMES

On successful completion of the course, the students will be able to

K1 ↑ ↓ K5	CO1	Gain inherent knowledge on various horticultural practices
	CO2	Understand in depth knowledge on gardening techniques and their organization.
	CO3	Able to provide comprehensive account on cultivation practices and techniques of horticultural crops.
	CO4	Analyze various designs and patterns of arrangement of cut flowers.
	CO5	Evaluate various post-harvest handling strategies for various fruits and vegetables

### SYLLABUS

#### UNIT I (15 HOURS)

**Introduction to Horticulture** - History, scope and divisions of Horticulture - Methods of vegetative propagation - cutting, layering, grafting and budding. Manures\*: organic- Panchakavya, and inorganic. Irrigation.

#### UNIT II (15 HOURS)

**Gardening** - Types of gardens - Japanese. Styles of garden - Formal and Informal. Garden components - shrubbery, fernery, arches and pergolas, edges and hedges, climbers and creepers, cacti and succulents. Special types of garden - rock garden and sacred groves. Lawn making, Terrarium and Bonsai techniques.

#### UNIT III (15 HOURS)

**Olericulture** - Cultivation of vegetables - Bhendi and Tomato. **Pomology** - Cultivation of fruits - Banana and Grapes. Growth regulators in horticulture. Plant protection measures for horticultural crops. Bioinsecticides and Biopesticides.

#### UNIT IV (15 HOURS)

**Floriculture** - Cultivation of flowers - Jasmine and Rose. Cut flowers and Flower arrangements. Cultivation of plantation crops - Tea and Cardamom. Basics of greenhouse design, different types of structures - glasshouse, shade net, poly tunnels - Design and development of low cost greenhouse structures.

#### UNIT IV (15 HOURS)

**Floriculture** - Cultivation of flowers - Jasmine and Rose. Cut flowers and Flower arrangements. Cultivation of plantation crops - Tea and Cardamom. Basics of greenhouse design, different types of structures - glasshouse, shade net, poly tunnels - Design and development of low cost greenhouse structures.

## UBO70

### UNIT V

(15 HOURS)

Extraction of Jasmine concrete and papain. Postharvest handling of fruits and vegetables. Preservation of fruits and vegetables. Cultivation of medicinal plants - *Gloriosa superba* and *Aloe vera*.

#### \*Self study

#### Teaching Methods

- Smart Class Room/Powerpoint presentation/Seminar/Quiz/Discussion

#### TEXT BOOKS

1. George Aquach (2002). Horticulture - Principles and Practices.. Parson Education Ltd. Delhi
2. N. Kumar (1999). An introduction to horticulture. Rajalakshmi Publication, Nagargoil.
3. S.K. Bhattacharjee, (2006). Advances in Ornamental Horticulture. Pointer Publications, Jaipur.
4. N. Kumar, (2006). Horticulture: Principles and practices. New India Publishing agency, New Delhi 88.

#### REFERENCES

1. K.L. Chaha, (2001). Handbook of horticulture. ICAR, New Delhi.
2. Edwin Biles. (2003). The complete book of gardening. Biotech book, New Delhi.
3. S.P. Singh,(1999). Advances in Horticulture and Forestry. Scientific Publishers, Jodhpur.
4. V.K. Sharma, (2004). Advances in Horticulture: Strategies, Production, Plant Protection and Value Addition - Deep and Deep Publications, New Delhi.
5. Desh Beer Singh and Poonam Wazir. (2002). Bonsai-An Art. Scientific Publishers, Jodhpur.

#### MAPPING

CO \ PSO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	H	S	S	H	M
CO2	S	H	M	H	H
CO3	H	S	H	M	S
CO4	S	H	M	H	M
CO5	S	H	M	H	H

S - Strong

H - High

M - Medium

L – Low

## UBO71

<b>Programme Code: 05</b>	<b>B.Sc., BOTANY</b>		
	<b>Major Elective 7 - MUSHROOM CULTIVATION TECHNOLOGY</b>		
<b>Batch 2022-2023</b>	<b>Hours / Week 5</b>	<b>Total Hours 75</b>	<b>Credits 5</b>

### COURSE OBJECTIVES

- To understand the importance of mushrooms
- To learn the methodology involved in mushroom cultivation
- To know the disease management in mushroom

### COURSE OUTCOMES

On successful completion of the course, the students will be able to

K1 ↑ ↓ K5	CO1	Recognize the nutritive, medicinal and food values of mushrooms.
	CO2	Determine suitable climate and cultivation techniques for mushrooms.
	CO3	Relate knowledge on designing of farming house for mushrooms.
	CO4	Apply knowledge on processing and storage of mushrooms for marketing.
	CO5	Assess the various developments in modern technologies to enhance productivity of mushrooms.

### SYLLABUS

#### UNIT I

(15 HOURS)

Introduction to Mushroom - History, importance and scope of mushroom, Identification and classification of mushroom. Habitat morphology and life cycle of mushroom. Key to differentiate edible and poisonous mushroom. Medicinal value of mushroom.

#### UNIT II

(15 HOURS)

Edible Mushrooms - Systematic position, morphology and life cycle of Edible Mushrooms - White button mushroom (*Agaricus bisporus*)- Oyster mushroom (*Pleurotus sajor- caju*). Paddy straw mushroom (*Volvariella* Sp.).

#### UNIT III

(15 HOURS)

Principles of Mushroom cultivation -Structure and construction of mushroom house. Sterilization of substrates. Spawn production - culture media preparation- production of pure culture, mother spawn, and multiplication of spawn. Composting technology, mushroom bed preparation. Spawning, spawn running and harvesting.

#### UNIT IV

(15 HOURS)

Common fungal and bacterial diseases of button, Oyster and paddy straw mushrooms and their control Measure. Problems in cultivation of mushrooms- diseases, pests, nematodes and weed moulds- management strategies during cultivation of mushrooms.

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### UNIT V

(15 HOURS)

Post harvesting techniques- Preservation of mushrooms - packaging, transport, short term and long term storage of mushrooms (canning, drying, freeze drying, sun drying and pickling), Commercial value of Mushrooms – Different Food recipes (Mushroom soup, Mushroom candy, Mushroom Pickle and Mushroom Preserve (Murabba)) and Novel Value Added Products of Mushrooms

#### \*Self study

#### Teaching Methods

Smart Class Room/Power point presentation/Seminar/Quiz/Discussion

### TEXTBOOKS

1. Reeti Singh and U.C. Singh (2005). Modern mushroom cultivation, Agrobios India, Jodhpur.
2. V. Kumaresan, (2001). Biotechnology, Saras-publication, Nagarcovil.
3. P.K. Gupta, (2004). Elements of biotechnology, Rastogi publication, Meerut.
4. D.P. Tripathi, (2005). Mushroom Cultivation. Oxford and IBH publishing Co.Pvt.Ltd.,
5. V.N. Pathak and Yadavand Maneesha Gour (2000).Mushroom production and processing Technology, Vedams E books Pvt. Ltd, New Delhi

### REFERENCES

1. B.D. Singh, (2002). Biotechnology. Kalyani Publishers, New Delhi.
2. T.N. Kaul, (2001). Biology and conservation of Mushrooms. Oxford & IBH Publishing Company Pvt. Ltd. New Delhi.
3. Giovanni Pacioni, (1985). Mushrooms and Toadstools. Mac Donald & Co. Ltd., London.
4. B.P. Pandey, (1996). A text book of fungi. Chand & Co., New Delhi.
5. Pathak and Yadav Gour (2010). Mushroom Production and Processing Technology. Agrobios
6. Kannaiyan and K. Ramasamy (1980). A Hand Book of edible Mushroom, Today and Tomorrow Printers and Publishers, New Delhi
7. N. Bahl, (1998). Hand book on Mushroom Oxford and IBH, Publication. Co.
8. T.N. Kaul, (1999).Introduction to Mushroom Science Oxford and IBH, Co, Pvt. limited

### MAPPING

CO \ PSO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	M	H	M	S
CO2	H	S	M	S	H
CO3	S	S	H	M	H
CO4	M	H	S	H	S
CO5	M	M	S	H	H

S - Strong

H - High

M - Medium

L - Low

## UBO73

<b>Programme Code: 05</b>	<b>B.Sc., BOTANY</b>		
	<b>Major Elective 8: MEDICOBOTANY</b>		
<b>Batch 2022-2023</b>	<b>Hours / Week 5</b>	<b>Total Hours 75</b>	<b>Credits 5</b>

### COURSE OBJECTIVES

- To learn about the traditional people and their knowledge in ethno-medicine.
- To understand the role of ethnic groups and government organizations in cultivation and conservation of plant genetic resources.
- To acquire basic knowledge on traditional systems of medicine in India.
- To study the potential natural products derived from medicinal plants.
- To know the conservation strategies for ET plants.

### COURSE OUTCOMES

On successful completion of the course, the students will be able to

K1 ↑  ↓ K5	CO1	Recognize about ethnobotany and its relevance in Life Sciences.
	CO2	Understand various ethnobotanical sources and its uses.
	CO3	Implement knowledge on herbal drugs and its validation.
	CO4	Apply ethnopharmacological knowledge for the development of novel drugs.
	CO5	Develop skill set as a source of employment ability in pharmaceutical/herbal industries

### SYLLABUS

#### UNIT I (15 HOURS)

Ethnobotany: Introduction, concept, scope and objectives; Ethnobotany as an interdisciplinary Science. Relevance of ethnobotany in present context. Medico-ethnobotanical sources in India. Major Tribal groups in Tamil Nadu (Irulas, Todas, Malasars and Malayalis).

#### UNIT II (15 HOURS)

Plants used by the Irular Tribes: Food plants, Beverages, Resins and oils. Sharing of wealth concept with few examples from India. Role of ethnobotany in modern medicine with special reference to *Rauvolfia serpentina*, *Trichopus zeylanicus*, *Artemisia annua* and *Withania somnifera*.

#### UNIT III (15 HOURS)

Introduction, Scope and Importance of Indigenous Medical systems. Ayurveda, Siddha, Unani and Homeopathy - History, basic principles and drug preparations.

#### UNIT IV (15 HOURS)

Natural Products - Definition, importance, systematics, characterization of alkaloids, glycosides, flavonoids, terpenoids, phenolic acids and steroids. Approaches to drug discovery from ethnobotanical leads. Ethnopharmacological validation of traditional medicines.

#### UNIT V (15 HOURS)

Organizations involved in medicinal plants conservation, Conservation of endangered and endemic medicinal plants: EET plants - Definition, Red list Criteria. *In situ*

## UBO74

conservation: Biosphere reserves, sacred groves, National Parks. *Ex situ* conservation: Botanical Gardens

### \*Self study

### Teaching Methods

Smart Class Room/Power point presentation/Seminar/Quiz/Discussion

### TEXTBOOKS:

1. Purohit and Vyas. (2005). Medicinal plant cultivation- A scientific approach, Agrobios, Jodhpur
2. A.K. Rath and S.R. Mishra, (2017). Ethnobotany, Kalyani Publishers, New Delhi
3. Biren Shah and A.K. Seth. (2019). Textbook of Pharmacognosy and Phytochemistry. CBS Publishers & Distributors Pvt. Ltd.,
4. Mohammed Ali. (2019). Textbook of Pharmacognosy. CBS Publishers & Distributors Pvt. Ltd.,
5. P. Arora and V. Arora (2019). A Textbook of Herbal Drug Technology. S.Vikas and Company

### REFERENCES

1. S.K. Jain, Manual of Ethnobotany, Scientific Publishers, Jodhpur, 1995.
2. C.M. Colton, (1997). Ethnobotany – Principles and applications. John Wiley and sons – Chichester
3. Rajiv K. Sinha. (1996). Ethnobotany The Renaissance of Traditional Herbal Medicine. INA SHREE Publishers, Jaipur.
4. Gokhale et al. (2019). Pharmacognosy and Phytochemistry. Nirali Prakashan,
5. C.S. Mandal, (2011). Herbal Drugs. New Central Book Agency,
6. P.C. Trivedi, (2008). Medicinal Plants: Traditional Knowledge. I.K. International.
7. M.C. Joshi, (2007). Handbook of Indian Medicinal Plants. Scientific Publishers,
8. R. John *et al.* (1995). Phytochemistry of Medicinal Plants. Springer Sciences & Business Media.

### MAPPING

CO \ PSO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	M	H	M	S
CO2	H	S	M	S	H
CO3	S	S	H	M	H
CO4	M	H	S	H	S
CO5	M	M	S	H	H

S - Strong

H - High

M - Medium

L - Low

UBO75

**ALLIED PAPER**

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<b>Programme Code: 05</b>		<b>For B.Sc., ZOOLOGY</b>		
<b>ALLIED-1 BOTANY: 1</b>				
<b>Batch</b> 2022-2023	<b>Semester</b> I	<b>Hours / Week</b> 5	<b>Total Hours</b> 75	<b>Credits</b> 4

### COURSE OBJECTIVES

- ❖ To study the classification of Cryptogams & Gymnosperms.
- ❖ To learn the structure and life cycle patterns of primitive to advanced life forms.
- ❖ To impart knowledge on the economic values of plants.

### COURSE OUTCOMES

On successful completion of the course, the students will be able to

↑ K1 ↓	CO1	Gain knowledge on lower life form habits, habitats and their phylogeny
	CO2	Understand structural organization and reproduction of lower life forms
	CO3	Apply impart knowledge in the identification of plant diseases and their control measures
	CO4	Explore the economic aspects of lower life forms for the betterment of mankind
K5	CO5	Evaluate the life cycle patterns of Cryptogams and Gymnosperms

### SYLLABUS

#### UNIT I

(15 HOURS)

**Phycology:** Classification by Fritsch (1945) (outline only), Structure, Reproduction and life cycle of the following Genus: *Oscillatoria*, *Caulerpa*, and *Chara*. Economic importance of algae (briefly).

#### UNIT II

(15 HOURS)

**Mycology and Plant Pathology:** Classification by Alexopoulos and Mims (1979) (outline only), Structure, Reproduction and Life cycle of the following Genus: *Albugo* and *Agaricus*. Tikka disease of ground nut and Citrus canker. Economic importance of Fungi.

#### UNIT III

(15 HOURS)

**Bryophytes:** Classification by Smith (1955) (outline only), Structure, Reproduction and Life cycle of *Marchantia* and *Funaria*. Economic importance of Bryophytes.

#### UNIT IV

(15 HOURS)

**Pteridophytes:** Classification by Riemers (1954) (outline only), Structure, Reproduction and Life cycle of *Lycopodium* and *Adiantum*. Economic importance of Pteridophytes.



**UNIT V**

**Gymnosperms:** Classification by K.R. Sporne (1962) (outline only), Structure, Reproduction and Life cycle of *Cycas* and *Gnetum*. Economic importance of Gymnosperms\*.

**\*Self study**

**Teaching Methods**

Smart Class Room/PowerPoint presentation/Seminar/Quiz/Discussion

**TEXTBOOKS**

1. B.P. Pandey. (20004). Colege Botany Volume I&II.S. Chand and company Ltd, New Delhi
2. Gangulee, Das & Kar. (2001). College Botany Vol II. New central Book agency Pvt. Ltd. Calcutta.
3. R.M. Johri, S. Latha and S. Shrama, (2004). Text book of Bryophytes, Dominant publishers and distributers, New Delhi.
4. B.P. Pandey, (1994). A Text book of Botany - Pteridophyta. Chand & Co. New Delhi.
5. P.C. Vashishta, A.K. Sinha and A. Kumar, (2006). Gymnosperms. Revised Edition S. Chand and company Ltd, New Delhi.

**REFERENCES**

1. B.R. Vashishta, (1998). The Algae. S. Chand & Co., New Delhi.
2. B.R. Vashishta,(1998). Fungi. S. Chand & Co., New Delhi.
3. P.C. Vashista, Sinha and Anil Kumar. (2008). Text book of Bryophytes. Chand & Co., New Delhi.
4. C. Pathak, (2003). Latest Proffolio of Theory and practice of Pteridophytes Dominant Publication, New Delhi
5. P.C. Vashista, (1992). Pteridophyta. Chand & Co., New Delhi.
6. K.R. Spore, (1976 Morphology of Pteridophytes, 4<sup>th</sup> edition. B.L.Publication.
7. B.P. Pandey, (1981). Gymnosperms. Chand & Co., New Delhi.
8. Gilbert M Smith (1951). Manual of Phycology.

**MAPPING**

PSO CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	M	S	H	H
CO2	S	S	H	M	S
CO3	H	H	M	S	M
CO4	S	M	S	H	H
CO5	M	H	H	S	M

S - Strong

H - High

M - Medium

L – Low

Programme Code: 05		For B.Sc., ZOOLOGY		
<b>ALLIED-2 BOTANY: 2</b>				
<b>Batch</b> 2022-2023	<b>Semester</b> II	<b>Hours / Week</b> 5	<b>Total Hours</b> 75	<b>Credits</b> 4

### COURSE OBJECTIVES

- To differentiate the anatomical and reproductive features of monocot and dicots
- To acquire knowledge on the classification and nomenclature of Angiosperms
- To understand physiological process and metabolism in plants

### COURSE OUTCOMES

On successful completion of the course, the students will be able to

K1 ↑ ↓ K5	CO1	Recognize anatomical features and morphological variations among Angiospermic taxa.
	CO2	Understand the structure and development of different types of embryos
	CO3	Apply keys and manuals for identifying any unknown plants at species level.
	CO4	Explore the nature of application of micronutrients and growth regulators for the development of plants.
K5	CO5	Determine the strategies for the conservation of natural resources

### SYLLABUS

#### UNIT I

(15 HOURS)

**Anatomy:** Scope and significance of plant anatomy. A brief account of meristems and tissues (simple and complex tissue). Primary structure of dicot and monocot stem and root.

#### UNIT II

(15 HOURS)

**Embryology:** Microsporogenesis. Development of Male gametophyte, Megasporogenesis, Development of female gametophyte (*Polygonum* type). Structure of mature embryo sac. Type of embryo sac - *Polygonum* type (8 nucleus) and *Oenothera* type (4 nucleus). Types of endosperms. Development of Dicot embryo (*Capsella* type)

#### UNIT III

(15 HOURS)

**Taxonomy of Angiosperms:** Bentham and Hooker's classification (outline only), Nomenclature – ICN, Study of the following families with their economic importance- Annonaceae, Asteraceae, Apocynaceae, Lamiaceae, Amaranthaceae, Liliaceae and Poaceae. Herbarium techniques.

#### UNIT IV

(15 HOURS)

**Physiology:** Water relationships of plants. Osmosis, absorption of water, absorption of ions. **Photosynthesis:** Photosynthetic apparatus, primary photochemical reaction, path of carbon (Calvin cycle). **Respiration:** Glycolysis and Krebs' cycle. **Phytohormones:** auxins and cytokinins.

**UNIT V**

**(15 HOURS)**

**Environmental Biology:** Scope and significance of environmental studies. Structure and functions of ecosystems. Vegetational types of southern India. Pollution - Air\*, water and noise. Soil conservation methods.

**\*Self study**

**Teaching Methods**

Smart Class Room/PowerPoint presentation/Seminar/Quiz/Discussion

**TEXTBOOKS**

1. H.C. Gangulee, K.S. Das and C.T.Dutta (1986). College Botany Vol. - I.AIU publications. New Delhi
2. Gangulee and A.K. Kar, (1986). College Botany Vol. - II. AIU Publications. New Delhi
3. O.P. Sharma (2013), Plant Taxonomy, Mc,Graw Hill Education. Pvt. Ltd. New Delhi
4. S.S. Bhojwani and S.P. Bhattnagar, S.P. (2008). The Embryology of Angiosperms
5. P.D.Sharma, (2017), Ecology and Environment – Rastogi Publication.

**REFERENCE BOOKS**

1. T. Pullaiah, (2007). Taxonomy of Angiosperms 3<sup>rd</sup> edition. Regency Publication. New Delhi.
2. B.P. Pandey, (1997). Taxonomy of Angiosperms. Chand & Co., New Delhi.
3. V.K. Jain,(1993). Fundamentals of plant physiology. S. Chand & Co. New Delhi
4. P.D. Sharma, (2013). Environmental Biology and Toxicology – Rastogi Publication Meerut.
5. Shukla. R.S. and P. S. Chandal. (2000). Plant Ecology and soil science. Chand & Co. Ltd., New Delhi.
6. Bhojwani & Bhatnager. (1977). The embryology of angiosperms. Vikas Publishing House, New Delhi
7. B.P. Pandey, (1978). Plant Anatomy. Chand and Co, New Delhi.
8. P. Maheswari , (1950). An introduction to the embryology of Angiosperms. McGraw Hill.

**MAPPING**

PSO CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	H	S	M	H	H
CO2	S	H	H	M	S
CO3	H	M	S	H	M
CO4	S	H	M	S	H
CO5	H	S	H	M	S

S - Strong

H - High

M - Medium

L - Low

Programme Code: 05		For B.Sc., ZOOLOGY		
<b>ALLIED PRACTICAL BOTANY- I &amp; II</b>				
Batch 2022 – 2023	Semester II	Hours/Week 2	Total Hours 30	Credits 2

**COURSE OBJECTIVES**

- To acquire knowledge on the morphological and anatomical features of vascular plants.
- To create basic skills on biosystematics and herbarium preparation techniques.
- To learn the basic concepts and principles of ecosystem

**COURSE OUTCOMES**

On successful completion of the course, the students will be able to

K3 ↑ ↓ K5	CO1	Apply knowledge on the identification of lower life forms.
	CO2	Analyze various diseases and their impact on crop plants.
	CO3	Dissect and determine the structural organization of lower life forms.
	CO4	Assign and identify plants to their families based on their morphological characters.
	CO5	Examine the physiological process that occur in plant life.

**LIST OF PRACTICALS**

**ALLIED PR. BOTANY - I**

1. **Phycology:** Structure and the reproduction of the following:
  - i. *Oscillatoria*
  - ii. *Caulerpa*
  - iii. *Chara*
2. **Mycology**
  - i. *Albugo*
  - ii. *Agaricus*
3. **Plant pathology:** Symptoms, causative organisms and control measures of
  - i. Tikka disease of Groundnut
  - ii. Citrus canker
4. **Bryophytes**
  - i. *Marchantia*
  - ii. *Funaria*
5. **Pteridophytes**
  - i. *Lycopodium*
  - ii. *Adiantum*
6. **Gymnosperms**
  - i. *Cycas*
  - ii. *Gnetum*

**ALLIED PR. BOTANY - II**

1. **Anatomy**
  1. Primary and secondary structure of dicot stem and root
  2. Primary structure of monocot stem and root.
2. **Embryology**
  1. T.S. of mature anther
  2. Types of the endosperm
3. **Taxonomy of Angiosperms:**
  1. Study of morphology and systematic position of plant families mentioned in theory
4. **Physiology**
  1. Osmosis
  2. Evolution of oxygen during photosynthesis
5. **Environmental Botany**
  1. Aquatic and terrestrial ecosystem.

**MAPPING**

<b>CO \ PSO</b>	<b>PSO1</b>	<b>PSO 2</b>	<b>PSO 3</b>	<b>PSO 4</b>	<b>PSO 5</b>
<b>CO1</b>	H	S	M	H	H
<b>CO2</b>	S	H	H	M	S
<b>CO3</b>	H	M	S	H	M
<b>CO4</b>	S	M	H	S	M
<b>CO5</b>	S	H	M	S	H

**S** - Strong

**H** - High

**M** - Medium

**L** - Low

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**KONGUNADU ARTS AND SCIENCE COLLEGE (Autonomous)  
COIMBATORE - 641 029**

**UG MODEL QUESTION PAPER (PRACTICALS)**

**End of Semester Examination Question Paper Pattern**

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

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**Time: 3 Hours**

**Max. Marks: 25 Marks**

**BREAK UP OF MARKS**

**ALLIED PRACTICAL BOTANY - I & II**

I. Algae and Bryophytes	<b>04 Marks</b>
II. Pteridophytes/Gymnosperms	<b>04 Marks</b>
III. Anatomy section	<b>03 Marks</b>
IV. Taxonomy	<b>03 Marks</b>
IV. Physiology setup	<b>02 Marks</b>
V. Spotters	<b>04 Marks</b>
Record	<b>05 Marks</b>
<b>TOTAL</b>	<b>25 Marks</b>

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**NON-MAJOR ELECTIVE**

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Programme Code : 05	B.Sc., BOTANY		
	PART IV - Non- Major Elective 1 – HUMAN RIGHTS		
Batch 2022-2023	Hours/Week 2	Total Hours 30	Credits 2

### COURSE OBJECTIVES

- To prepare for responsible citizenship with awareness of the relationship between human rights, democracy and development.
- To impart education on national and international regime on human rights.
- To sensitive students to human suffering and promotion of human life with dignity.
- To develop skills on human rights advocacy
- To appreciate the relationship between rights and duties
- To foster respect for tolerance and compassion for all living creature.

### COURSE OUTCOMES

K1 ↑	CO1	To understand the hidden truth of Human Rights by studying various theories.
	CO2	To acquire overall knowledge regarding Human Rights given by United Nation Commission. (UNO)
	CO3	To gain knowledge about various organs responsible for Human Rights such as National Human Rights Commission and state Human Right commission (UNHCR)
	CO4	To get habits of how to treat aged person, others and positive social responsibilities
K5 ↓	CO5	To treat and confirm, child, refugees and minorities with positive social justice.

### SYLLABUS

#### UNIT I

(6 Hours)

Definition, Meaning, Concept, Theories and Kinds of Human Rights- Evaluation and Protection of Human Rights in India- Development of Human Rights under the United Nations.

#### UNIT II

(6 Hours)

United Nations Charter and Human Rights - U.N. Commission on Human Rights- Universal Declaration of Human Rights - International Covenant on

- Civil & Political Rights
- Economic, Social and Cultural Rights

#### UNIT III

(6 Hours)

Human Rights and Fundamental Rights (Constitution) - Enactments regarding Human Rights Laws in India - National Human Rights Commission and State Human Rights Commission.



**UNIT IV**

**(6 Hours)**

Aged persons and their Human Rights - Human Rights of Persons with Disabilities  
- Tribal Human Rights in India - Three Generation Human Rights.

**UNIT V**

**(6 Hours)**

Rights of Women, Child, Refugees and Minorities - Media and Human Rights -  
NGO's in protection of Human Rights - Right to Election

**Teaching Methods**

Smart Class Room/PowerPoint presentation/Seminar/Quiz/Discussion

**TEXT BOOKS**

1. Human Rights Compiled by Dr. V. Sugantha, Kongunadu Arts and Science College, Coimbatore -29.

**REFERENCES**

1. Human Rights, Jaganathan, MA., MBA., MMM., ML., ML., Humanitarian Law and J.P.Arjun Proprietor, Usha Jaganathan Refugee Law Law series, 1<sup>st</sup> floor, Narmatha Nanthi Street, Magathma Gandhi Nagar, Madurai - 625014.
2. Promoting Women's Rights Publisher : United Nations. As Human Rights New York., 1999.

**Question Paper Pattern  
(External only)**

**Duration: 3 hrs**

**Max: 75 marks**

**Section A (5x5=25)**

**Short notes**

Either - Or/ Type - Question from each unit

**Section B (5x10=50)**

**Essay type**

Either - Or/ Type - Question from each unit

<b>Programme Code : 05</b>	<b>B.Sc., BOTANY</b>			
	<b>PART IV - NON- MAJOR ELECTIVE – II WOMEN’S RIGHTS</b>			
<b>Batch</b> 2022-2023	<b>Semester</b> IV	<b>Hours/Week</b> 2	<b>Total Hours</b> 30	<b>Credits</b> 2

**COURSE OBJECTIVES**

- To know about the laws enacted to protect Women against violence.
- To impart awareness about the hurdles faced by Women.
- To develop a knowledge about the status of all forms of Women to access to justice.
- To create awareness about Women’s rights.
- To know about laws and norms pertaining to protection of Women.
- To understand the articles which enables the Women’s rights.
- To understand the Special Women Welfare laws.
- To realize how the violence against Women puts an undue burden on healthcare services.

**COURSE OUTCOMES (CO)**

**After Completion of the Course the student will be able to**

K1 ↑ ↓ K5	CO1	Appraise the importance of Women’s Studies and incorporate Women’s Studies with other fields
	CO2	Analyze the realities of Women Empowerment, Portrayal of Women in Media, Development and Communication
	CO3	Interpret the laws pertaining to violence against Women and legal consequences
	CO4	Contribute to the study of the important elements in the Indian Constitution, Indian Laws for Protection of Women
	CO5	Spell out and implement Government Developmental schemes for women and create awareness on modernization and impact of technology on Women

**SYLLABUS**

**UNIT I**

**(6 Hours)**

**Women’s Studies:** Basic concepts of Women’s studies in Higher education, Women’s studies perspectives- Socialization- Patriarchy- Women’s studies as an academic discipline- Growth and development of Women’s studies as a discipline internationally and in India.

**UNIT II**

**(6 Hours)**

**Socio-Economic Development of Women:** Family welfare measures, role of Women in economic development, representation of Women in media, status of Women land rights, Women Entrepreneurs, National policy for the empowerment of women.

**UNIT III**

**(6 Hours)**

**Women's Rights – Access to Justice:** Crime against Women, domestic violence – physical abuse- verbal abuse – emotional abuse - economic abuse – minorities, dowry- harassment and death, code of conduct for work place, abetment of suicide.

**UNIT IV**

**(6 Hours)**

**Women Protective acts:** Protective legislation for Women in the Indian constitution- Anti dowry, SITA, PNDT, and Prevention Sexual Harassment at Workplace (Visaka case), Domestic violence (Prevention) Act.

**UNIT V**

**(6 Hours)**

**Women and Child welfare:** Safety provisions - various forms of mass media, radio, visual, internet, cyber space, texting, SMS and smart phone usage. Healing measures for the affected Women and child society by private and public sector, NGO and society.

**Teaching Methods**

- ❖ Smart Class Room / Power point Presentation / Seminar / Quiz / Discussion / Flipped Class

**TEXT BOOK**

1. **Women's Rights** (2021), Published by Kongunadu Arts & Science College, Coimbatore – 641 029.

**REFERENCE BOOKS**

1. **“Rights of Indian Women”** by Vipul Srivatsava. Publisher: Corporate Law Advisor, 2014.
2. **“Women's security and Indian law”** by Harsharam Singh. Publisher: Aabha Publishers and Distributors, 2015.
3. **“Women's Property Rights in India”** by Kalpaz publications, 2016.

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**Question Paper Pattern**

Duration :3 hrs

Max: 75 marks

**Section A (5 X 5=25 Marks)**

Short notes

Either – Or/ Type - Question from each unit.

**Section B (5 X 10=50 Marks)**

Essay type

Either – Or/ Type - Question from each unit.

## UBO88

<b>Programme Code : 05</b>	<b>B.Sc., BOTANY</b>		
	<b>PART IV - Non- Major Elective III – Consumer Affairs</b>		
<b>Batch 2022-2023</b>	<b>Hours/Week 2</b>	<b>Total Hours 30</b>	<b>Credits 2</b>

### COURSE OBJECTIVES

- To familiarize the students with their rights and responsibilities as a consumer.
- To understand the procedure of redress of consumer complaints.
- To know more about decisions on Leading Cases by Consumer Protection Act.
- To get more knowledge about Organizational set-up under the Consumer Protection Act
- To impart awareness about the Role of Industry Regulators in Consumer Protection
- To understand Contemporary Issues in Consumer Affairs

### COURSE OUTCOMES

K1 ↑ ↓ K5	CO1	Able to know the rights and responsibility of consumers.
	CO2	Understand the importance and benefits of Consumer Protection Act.
	CO3	Applying the role of different agencies in establishing product and service standards.
	CO4	Analyse to handle the business firms' interface with consumers.
	CO5	Assess Quality and Standardization of consumer affairs

### SYLLABUS

#### UNIT I

**(6 Hours)**

Conceptual Framework - Consumer and Markets: Concept of Consumer, Nature of markets: Liberalization and Globalization of markets with special reference to Indian Consumer Markets, E-Commerce with reference to Indian Market, Concept of Price in Retail and Wholesale, Maximum Retail Price (MRP), Fair Price, GST, labeling and packaging along with relevant laws, Legal Metrology. Experiencing and Voicing Dissatisfaction: Consumer buying process, Consumer Satisfaction/dissatisfaction-Grievances-complaint, Consumer Complaining Behaviour: Alternatives available to Dissatisfied Consumers; Complaint Handling Process: ISO 10000suite

#### UNIT II

**(6 Hours)**

The Consumer Protection Law in India - Objectives and Basic Concepts: Consumer rights and UN Guidelines on consumer protection, Consumer goods, defect in goods, spurious goods and services, service, deficiency in service, unfair trade practice, restrictive trade practice.

Organizational set-up under the Consumer Protection Act: Advisory Bodies: Consumer Protection Councils at the Central, State and District Levels; Adjudicatory Bodies: District Forums, State Commissions, National Commission: Their Composition, Powers, and Jurisdiction (Pecuniary and Territorial), Role of Supreme Court under the CPA with important case law.

**UNIT III**

**(6 Hours)**

Grievance Redressal Mechanism under the Indian Consumer Protection Law - Who can file a complaint? Grounds of filing a complaint; Limitation period; Procedure for filing and hearing of a complaint; Disposal of cases, Relief/Remedy available; Temporary Injunction, Enforcement of order, Appeal, frivolous and vexatious complaints; Offences and penalties.

Leading Cases decided under Consumer Protection law by Supreme Court/National Commission: Medical Negligence; Banking; Insurance; Housing & Real Estate; Electricity and Telecom Services; Education; Defective Products; Unfair Trade Practices.

**UNIT IV**

**(6 Hours)**

Role of Industry Regulators in Consumer Protection

- i. Banking: RBI and Banking Ombudsman
- ii. Insurance: IRDA and Insurance Ombudsman
- iii. Telecommunication: TRAI
- iv. Food Products: FSSAI
- v. Electricity Supply: Electricity Regulatory Commission
- vi. Real Estate Regulatory Authority

**UNIT V**

**(6 Hours)**

Contemporary Issues in Consumer Affairs - Consumer Movement in India: Evolution of Consumer Movement in India, Formation of consumer organizations and their role in consumer protection, Misleading Advertisements and sustainable consumption, National Consumer Helpline, Comparative Product testing, Sustainable consumption and energy ratings.

Quality and Standardization: Voluntary and Mandatory standards; Role of BIS, Indian Standards Mark (ISI), Ag-mark, Hallmarking, Licensing and Surveillance; Role of International Standards: ISO an Overview.

Note: Unit 2 and 3 refers to the Consumer Protection Act, 2086. Any change in law would be added appropriately after the new law is notified.

**Teaching Methods:**

- ❖ Smart Class rooms /Power Point Presentations / Seminars/Quiz /Discussion /Flipped Classrooms

**SUGGESTED READINGS:**

1. Khanna, Sri Ram, Savita Hanspal, Sheetal Kapoor, and H.K. Awasthi. (2007) Consumer Affairs, UniversitiesPress.
2. Choudhary, Ram Naresh Prasad (2005). Consumer Protection Law Provisions and Procedure, Deep and Deep Publications PvtLtd.
3. G. Ganesan and M. Sumathy. (2012). Globalisation and Consumerism: Issues and Challenges, RegalPublications
4. Suresh Misra and Sapna Chadah (2012). Consumer Protection in India: Issues and Concerns, IIPA, NewDelhi
5. Rajyalaxmi Rao (2012), Consumer is King, Universal Law Publishing Company
6. Girimaji, Pushpa (2002). Consumer Right for Everyone Penguin Books.
7. E-books :-[www.consumereducation.in](http://www.consumereducation.in)
8. Empowering Consumers e-book,[www.consumeraffairs.nic.in](http://www.consumeraffairs.nic.in)
9. ebook,[www.bis.org](http://www.bis.org)
10. The Consumer Protection Act, 2086 and its later versions.

**UBO90**

**Question paper pattern (External Only)**

Duration: 3 hrs

Max: 75 Marks

**Section A (5 x 5=25)**

Short notes

Either – or / type – question from each unit.

**Section B (5 x 10=50)**

Essay type

Either – or / type – question from each unit.

UBO91

**EXTRA DEPARTMENTAL  
COURSE (EDC) PAPER**

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<b>Programme Code: 05</b>		<b>For UG STUDENTS</b>		
<b>Extra Departmental Course (EDC) - MEDICINAL BOTANY AND HUMAN WELFARE</b>				
<b>Batch</b> 2022-2023	<b>Semester</b> V	<b>Hours / Week</b> 2	<b>Total Hours</b> 30	<b>Credits</b> 3

### COURSE OBJECTIVES

- To obtain inherent knowledge on the Indian system of traditional medicine
- To expertise pharmacognostical aspects of medicinal plants
- To familiarize cultivation technologies of medicinal plants

### COURSE OUTCOMES

On successful completion of the course, the students will be able to

K1 ↑ ↓ K5	CO1	Recognize crude drugs used in traditional system of medicine
	CO2	Understand the therapeutic potential of crude drugs
	CO3	Apply knowledge for the cultivation practices of medicinal plants
	CO4	Implement knowledge in identifying novel drug leads against allopathic medicine
	CO5	Assess the methods of cultivation and processing of medicinal plants

### SYLLABUS

- UNIT-I** **(6 Hours)**  
 Traditional medicinal Systems - Ayurveda, Unani, Siddha and Homeopathy. Classification and Evaluation of crude drugs. Drug adulterations.
- UNIT-II** **(6 Hours)**  
 Morphological and histological studies chemical constituents. Therapeutic and other pharmaceutical uses of bark - *Cinchona*, Leaves - *Adathoda* and Flower-clove.
- UNIT-III** **(6 Hours)**  
 Fruits and seeds – Noni and poppy seeds, Underground stem-ginger- Unorganized drugs. Gum - Gugul, Resin - *Ferula*, Fixed oil- Castor oil
- UNIT-IV** **(6 Hours)**  
 A brief account of the following: Drugs acting on the central nervous system (*Papaver somniferum*, *Atropa belladonna*, *Valeriana officinalis*) Drugs used in disorders of gastro-intestinal tract (*Zingiber officinale*, *Curcuma longa*, *Ulmus rubra*) and Cardio vascular drugs (*Panax ginseng*, *Taxus brevifolia*, *Digitalis purpurea*).
- UNIT-V** **(6 Hours)**  
 Botanical features, medicinal uses and cultivation of medicinal plants - *Emblica officinalis*, *Gloriosa superba* and *Rauwolfia serpentina*\*.

\*Self study

#### Teaching Methods

- ❖ Smart Class Room/PowerPoint presentation/Seminar/Quiz/Discussion



## UBO93

### TEXT BOOK

1. Trease and Evans. (1978). Pharmacognosy, Baillere Tindall London.
2. T.E.Wallis. (2005). Text book of Pharmacognosy Fifth Edition. Publishers- CBS publishers and distributions Delhi.
3. J.K. Maheshwari, (2000). Ethnobotany and Medicinal Plants of India and Subcontinent Scientific Publishers, India
4. S.K. Jain, (1981). Glimpses of Ethnobotany. Oxford and IBH, New Delhi
5. P. Vasanthkumar, (2014). Economic Botany. Sonali Publications, New Delhi.

### REFERENCES

1. S.S Handa and V.K. Kapoor. (1989). Pharmacognosy, Second Edition. Publishers- CBS Publishers and Distributors, Delhi.
2. N.C. Kumar, (1993). An introduction to Medical Botany and Pharmacognosy, Emky Publications, New Delhi.
3. B. Supriya Kumar, (2005). Hand Book of Medicinal Plants, Pointers Publishers, Jaipur.
4. C.K. Kokate, A.Purohit and S.R. Gokhale. (2002). Pharmacognosy, 13th Edition Publishers Nirali Prakashan. Pune.
5. Rai et al. (2012). Medicinal plants: Biodiversity and Drugs. CRC Press, USA
6. Hao et al (2015). Medicinal Plants: chemistry, Biology and omics. Woodhead publishers, Cambridge
7. P.C. Trivedi, (2016). Medicinal plants and Raw drugs of tribals. Pointer Publishers, India.
8. Bikarma Singh, (2019). Plants for Human survival and Medicine., New India Publishing Agency, New Delhi

### MAPPING

<b>PSO</b> <b>CO</b>	<b>PSO1</b>	<b>PSO 2</b>	<b>PSO 3</b>	<b>PSO 4</b>	<b>PSO 5</b>
<b>CO1</b>	H	H	M	S	H
<b>CO2</b>	S	M	S	H	M
<b>CO3</b>	H	S	M	H	H
<b>CO4</b>	S	H	S	H	M
<b>CO5</b>	S	H	M	H	S

S - Strong

H - High

M - Medium

L - Low