

SRI SARADA COLLEGE FOR WOMEN
(AUTONOMOUS), Salem- 636 016
Reaccredited with 'B++' Grade by NAAC
(Affiliated to Periyar University)



OUTCOME BASED SYLLABUS

DEPARTMENT OF BOTANY
(DBT STAR COLLEGE SCHEME Sponsored)
B.Sc. Botany
(For the students admitted in 2021 – 22)

Programme Title: B. Sc. Botany

Programme Outcome

- PO1: To develop skilled and efficient professionals who can effectively cater to the growing demands of plant based industries.
- PO2: To acquire diverse knowledge to earn advanced degrees for the changing needs.
- PO3: To broaden the students' horizon in research organizations, herbal product companies, biotechnology industries and related disciplines for the betterment of the society.
- PO4: To face entrance and competitive examinations to pursue their career in state and national departments as an individual or in groups.
- PO5: To favour the graduates as entrepreneurs in developing and marketing products using modern technology for human needs.

Sri Sarada College for Women (Autonomous), Salem-16

DEPARTMENT OF BOTANY (DBT Star College Scheme Sponsored)

**Programme Structure under CBCS
(For the students admitted in 2021–22)
Total Credits: 140 + Extra Credits (Maximum 28)**

SEMESTER I					
Part	Course	Course Title	Code	Hrs./week	Credits
I	Language - 1	Tamil/ Hindi/ Sanskrit – I	21ULTC1/ 21ULHC1/ 21ULSC1	6	3
II	English – I	Communicative English – I	21ULEC1	6	3
III	Core Course – I	Plant Diversity – I	21UBOC1	6	5
	Core Practical – I	Practical – I	21UBOQC1	4	2
	Allied Course – I	Chemistry – I	21UBOAC1	3	3
	Allied Practical - I	Allied Chemistry Practical	-	2	-
IV	Skill Based –I	Nursery Raising Techniques	21UBOSQC1	2	2
V	Extension Activity	Group Project based on Extension Activity	21UEXAC	1	1
TOTAL				30	19
VI	<ul style="list-style-type: none"> • Articulation and Idea Fixation skills 6 • Physical Fitness Practice – 35 hrs. per semester • Advanced Diploma in Horticulture Level 1: Certificate course - 100 Hrs. per year 				

SEMESTER II

I	Language – II	Tamil/ Hindi/ Sanskrit – II	21ULTC2/ 21ULHC2/ 21ULSC2	6	3
II	English – II	Communicative English – II	21ULEC2	6	3
III	Core Course – II	Plant Anatomy and Embryology	21UBOC2	5	5
	Core Practical – II	Practical – II	21UBOQC2	4	2
	Allied Course – I	Chemistry – II	21UBOAC2	3	3
	Allied Practical – I	Chemistry Practical	21UBOAC1	2	4
IV	Skill Based –II (Practical)	Home Gardening and Floriculture	21UBOSQC2	2	2
		Environmental Studies	21UEVSC	2	1
		Group Project based on Environmental Studies	21UEVSPC		1

				TOTAL	30	24
VI	<ul style="list-style-type: none"> • Articulation and Idea Fixation skills -1 Extra Credit • Physical Fitness Practice – 35 hrs. per semester- 1 Extra Credit • Advanced Diploma Course in Horticulture Level 1: Certificate course - 100 hrs. per year -2 Extra Credits • Certificate Course Yoga –30 hrs.- 1 Extra Credit • Extra credits are given for extra skills and courses qualified in MOOC/NPTEL 					
SEMESTER III						
Part	Course	Course Title	Code	Hrs/week	Credits	
I	Language – III	Tamil/ Hindi/ Sanskrit – III	21ULTC3 / 21ULHC3 / 21ULSC3	6	3	
II	English – III	Communicative English – III	21ULEC3	6	3	
III	Core Course – III	Plant Diversity – II	21UBOC3	5	5	
III	Core Practical – III	Practical – III	21UBOQC3	4	2	
	Allied – II	Zoology – I	21UBOAC3	3	3	
	Allied Practical	Zoology Practical	21UBOAC3	2	-	
IV	Skill Based –III	Analytical Techniques in Plant Science	21UBOSQC3	2	2	
	Non Major Elective - I			2	2	
TOTAL				30	20	
VI	Extension Activity	Group project based on Extension Activity				
	Life Skill Course	Course I : Communication Skills		2	2(Extra)	
	<ul style="list-style-type: none"> • Articulation and Idea Fixation skills • Physical Fitness Practice – 35 hrs. per semester • Advanced Diploma in Horticulture Level 2: Diploma Course - 100 Hrs. per year • Extra credits are given for extra skills and courses qualified in MOOC/NPTEL 					
Non-Major Elective – I For II BA/ B.Sc./B.Com.		Horticulture	21UBONEC1			
Allied Botany		For Zoology Students (Theory & Practical)	21UZOAC3			
SEMESTER IV						
I	Language – IV	Tamil/ Hindi/ Sanskrit – IV	21ULTC4/ 21ULHC4/ 21ULSC4	6	3	
II	English – IV	Communicative English – IV	21ULEC4	6	3	
	Core Course – IV	Microbiology	21UBOC4	4	5	

III	Elective – I	Plant Biotechnology/ Agricultural Microbiology	21UBOEC1/ 21UBOESC1	5	5
	Allied – II	Zoology – II	21UBOAC4	3	3
	Allied Practical	Allied Zoology Practical	21UBOQC2	2	2+2
	Skill Based –IV (Practical)	Laboratory Techniques in Applied Biology	21UBOSQC4	2	2
IV	Non-Major Elective – II			2	2
TOTAL				30	27
VI	Extension Activity	Group project based on Extension Activity			2(Extra)
	Life Skill Course	Course II : Professional Skills		2	2(Extra)
	<ul style="list-style-type: none"> • Articulation and Idea Fixation skills-1 Extra Credit • Physical Fitness Practice – – 35 hrs. per semester -1 Extra Credit • Advanced Diploma in Horticulture Level 2: Diploma Course - 100 Hrs. per year -2 Extra Credits • Extra credits are given for extra skills and courses qualified in MOOC/NPTEL and Societal oriented Group Projects 				
Non-Major Elective – II For II BA/ B.Sc./B.Com.		Home Gardening	21UBONEC2		
Allied Botany		For Zoology Students (Theory & Practical)	21UZOAC4/ 21UZOACQ2		
SEMESTER V					
III	Core Course – V	Cytology	21UBOC5	5	5
	Core Course - VI	Morphology and Taxonomy of Angiosperms	21UBOC6	6	5
	Core Course – VII	Biochemistry and Biophysics	21UBOC7	5	5
	Elective – II	Biostatistics and Bioinformatics / Bioinstrumentation	21UBOEC2/ 21UBOESC2	5	5
	Core Practical - IV	Practical – IV	21UBOQC4	6	2
IV	Non Major Skill Based – I			2	2
	Value Education		21UVENC	1	-
TOTAL				30	24
VI	Extension Activity	Group project based on Extension Activity			
	Life Skill Course	Course III : Leadership and Management Skills		2	2 (Extra)
	<ul style="list-style-type: none"> • Articulation and Idea Fixation skills • Physical Fitness Practice – 35 hrs. per semester • Advanced Diploma in Horticulture Level 3: Advanced Diploma Course - 100 hrs. per year • Extra credits are given for extra skills and courses qualified in MOOC/NPTEL • Internship Training - 1 Extra Credit 				

Non-Major Skill Based – I For III BA/ B.Sc./B.Com.		Mushroom Cultivation	21UBONSC1		
SEMESTER VI					
III	Core Course – VIII	Plant Physiology	21UBOC8	6	5
	Core Course - IX	Genetics, Plant Breeding and Evolution	21UBOC9	5	5
	Core Course – X	Plant Ecology	21UBOC10	5	5
	Elective – III	Genetic Engineering/ Plant Protection	21UBOEC3 / 21UBOESC3	5	5
	Core Practical – V	Practical – V	21UBOQC5	6	2
IV	Non Major Skill Based - II			2	2
	Value Education		21UVENC	1	2
TOTAL				30	26
VI	Extension Activity	Group project based on Extension Activity		-	2(Extra)
	Life Skill Course	Course IV : Universal Human Values		2	2(Extra)
VI	<ul style="list-style-type: none"> • Articulation and Idea Fixation skills-1 Extra Credit • Physical Fitness Practice – – 35 hrs. per semester -1 credit extra • Advanced Diploma in Horticulture Level 3: Advanced Diploma 100 Hrs. per year -2 Extra Credits • Extra credits are given for extra skills and courses qualified in MOOC/NPTEL and Subject oriented group projects 				

Non-Major Skill Based – II For III BA/B.Sc./B.Com.	Herbal Therapy	21UBONSC2
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GRAND TOTAL CREDITS - 140

Programme Title : B. Sc. Botany
Course Title : Plant Diversity I
Course Code : 21UBOC1 **Hours/Week : 6**
Semester : I **Credits: 5**
Course Objectives : The course aims

- To understand the fundamentals of the plant kingdom.
- To study the structure and reproduction of lower plants.
- To study the commercial importance of lower groups of plants such as Algae, Fungi and Lichen.
- To understand the relationship between Algae and Fungi forming Lichen.
- To differentiate disease causing microbes (pathogens) from beneficial and cause diseases in plants under plant pathology.

SYLLABUS

UNIT - I (Hours: 18)

An outline classification of Algae - (G.W. Prescott 1969). Thallus organization, reproduction, life cycle of patterns and economic importance of Algae. A detailed study of structure, reproduction and life cycle of the following genus (development excluded).

Cyanophyta - *Oscillatoria*, *Nostoc*

UNIT - II (Hours: 18)

A detailed study of structure, reproduction and the life cycle of the following genera (development excluded)

Chlorophyta - *Volvox*, *Ulva*, *Oedogonium*, *Caulerpa*.

Charophyta – *Chara*

UNIT - III (Hours: 18)

A detailed study of structure, reproduction and life cycle of the following genera (development excluded)

Phaeophyta - *Sargassum*

Bacillariophyta - *Diatoms* - *Navicula*

Rhodophyta - *Polysiphonia*

UNIT – IV (Hours: 18)

An outline classification of fungi (Alexopoulos and Mims, 1978). Economic importance of fungi. A study of the structure and reproduction of the following genera (development excluded).

Oomycetes - *Albugo*

Ascomycetes - *Saccharomyces*

Basidiomycetes - *Puccinia* and *Agaricus*

UNIT - V (Hours:18)

Causal organisms, symptoms and control measures of the following - Red rot of sugarcane, Blast of rice, Leaf spot of Tikka disease of groundnut and Citrus Canker. Structure and reproduction of Lichen - Crustose, Foliose and Fruticose. Economic importance of Lichen.

Books for Study:

1. Srivastava, H.N. 2004. *Algae*. Pradeep Publications. (Unit I,II & III)
2. Srivastava, H.N. 2004. *Fungi*. Pradeep Publications.(Unit IV & V)

Books for Reference:

1. Bold, H.C. and Wynne, M.J.1978. *Introduction to the Algae*, Prentice-Hall, New Jersey.
2. Fritsch, F.E. 1945. *The Structure and Reproduction in Algae*, Cambridge University Press.
3. Kumar, H.D. 1990. *Introductory Phycology*. East-West Press Pvt. Ltd.
4. Sharma, O.P. 1992. *Text book of Thallophytes*. Tata McGraw Hill Publishing Company Ltd.
5. Smith, G.M. 1955. *Cryptogamic Botany Vol-I*, McGraw Hill Publishing Company Ltd.
6. Alexopoulos, C.J., Mims, C.S., Blackwell, M. 1996. *Introductory Mycology*. Wiley. NY.
7. Sharma, O.P. 2004. *Text book of Thallophyta*. Tata McGraw – Hill, Publishing Company Ltd.

Web Resources:

<https://diatom.ansp.org>

<https://www.nature.com/articles/nmicrobiol2017120>

<https://www.psalgae.org/> algal- web. links/#general links.

Course Outcomes (CO): On completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Demonstrate the fundamentals concepts related to Algae, Fungi and Lichen	K2

CO2	Develop skills to illustrate Plant diseases.	K3
CO3	Examine the Morphology and life cycles of genera under Algae, Fungi and Lichens.	K4
CO4	Evaluate the significance of Fungi and its different types.	K5
CO5	Justify the economic importance of Algae and Fungi.	K5

K1-Knowledge; K2-Comprehension; K3-Application; K4-Analysis; K5-Evaluation; K6-Synthesis

Mapping of COs with POs:

POs Cos	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	S	S
CO2	S	S	S	S	S
CO3	S	S	S	S	S
CO4	S	S	S	S	S
CO5	S	S	S	S	S

L – Low; M – Medium; S- Strong

Programme Title : B. Sc. Botany
Course Title : Core Practical I
Course Code : 21UBOQC1
Semester : I

Hours/Week : 4

Credits: 2

SYLLABUS

A detailed study of the genera included in Algae, Fungi and Lichens.

UNIT - I

Cyanophyta - *Oscillatoria, Nostoc*

UNIT – II

Chlorophyta - *Volvox, Ulva, Oedogonium, Caulerpa.*

Charophyta - *Chara*

UNIT - III

Phaeophyta - *Sargassum*

Bacillariophyta - *Diatoms - Navicula*

Rhodophyta - *Polysiphonia*

UNIT – IV

Oomycetes - *Albugo*

Ascomycetes - *Saccharomyces*

Basidiomycetes - *Puccinia* and *Agaricus*

UNIT - V

Causative organisms and its symptoms

Red rot of sugarcane

Blast of rice

Tikka disease of groundnut

Citrus Canker

Lichen - Crustose, Foliose and Fruticose

Programme Title : B. Sc. Botany

Course Title : Skill Based I (Practical): Nursery Raising Techniques

Course Code : 21UBOSQC1

Hours/Week : 2

Semester : I

Credits: 2

Course Objectives : The course aims

- To emphasize the basic principles and practices in nursery raising.
- To impart knowledge about various propagation techniques.
- To know how the nurseries provide growers a head on start on plant production.

SYLLABUS

- Garden tools – Spade, Fork, Garden knife, Secateurs, Shears, Toppers, Pruning saw, Watering can.
- Preparation of nursery bed – Containers and field
- Preparation of soil mixture
- Raising of seedlings
- Techniques in propagation –
 - (i) Cutting – Soft wood and Hard wood
 - (ii) Layering – Ground - Simple, Compound and Air Layering
 - (iii) Grafting – Cleft and Whip
 - (iv) Budding – T- budding and Patch
 - (v) Pruning – Pinching and Disbudding

Books for Study:

1. Kumaresan, V., 2016. *Horticulture*, Saras Publication, Nagercoil.
2. Kumar, N. 2010. *Introduction to Horticulture*, Rajalakshmi Publications, Nagercoil, Kanyakumari.

Books for Reference:

1. George Acquaah, 2002. *Horticulture – Principles and Practices*, 2nd edition, Prentice – Hall of India Pvt. Ltd., New Delhi.
2. Deena Beverley, 2004. *Practical Gardening*, Paragon Publishers, bath BAI IHE, UK.
3. ManibhushanRao, K. 2005. *Text book of Horticulture*, Second Edition, Macmillan Publications, New Delhi.

Web Resources:

<https://www.nature.com> > hortres > about

<https://vfic.tanu.edu> > about > concepts

Course Outcomes (CO) : On completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
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CO1	Apply the basic principle and practices in nursery raising	K3
CO2	Analyse the different methods of plant propagation.	K4
CO3	Develop the skills to do various propagation techniques.	K6

Mapping of COs with POs:

Cos \ POs	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	S	S
CO2	S	S	S	S	S
CO3	S	S	S	M	S

Programme Title : B. Sc. Botany
Course Title : Plant Anatomy and Embryology
Course Code : 21UBOC2 **Hours/Week: 5**
Semester : II **Credits: 5**
Course Objectives : The course aims

1. To know basic concepts of cell and Tissue systems and their organization in higher plants.
2. To differentiate dicot plants and their growth pattern from monocot plants.
3. To understand the abnormal (anomalous) secondary growth in higher plants as well as wound healing and Abscission processes.
4. To study and differentiate ovules and their types.
5. To know the importance of polyembryony and development patterns in higher plants.

SYLLABUS

UNIT – I (Hours:15)

Meristem - Definition, classification and theories of shoot and root apex – Apical cell theory, Histogen theory, Tunica corpus theory and Mantle core concept. Tissues – Simple permanent - parenchyma, collenchyma, sclerenchyma, complex permanent tissues - xylem and phloem. Types of vascular bundles, Secretory tissues - laticiferous tissues.

UNIT – II (Hours:15)

Primary Structure – root, stem and leaf of dicots and monocots. Types of stomata. Normal secondary growth in dicot root and stem – secondary xylem – axial system and ray system, annual rings, Heart wood and sap wood, tyloses, secondary phloem.

UNIT – III (Hours:15)

Anomalous secondary growth in Dicot stem (*Bignonia*, *Boerhaavia* and *Nyctanthes*) and Monocot stem (*Dracaena*). Abscission and wound healing. Nodal Anatomy - Unilacunar, trilacunar and multilacunar nodes.

UNIT – IV (Hours:15)

Structure of mature anther, microsporogenesis. Structure of ovule, Megasporogenesis. Types of ovules - Monosporic (*Polygonum*), Bisporic (*Allium*) and Tetrasporic (*Peperomia*).

UNIT – V (Hours:15)

Double fertilization, endosperm, types - cellular, nuclear, helobial and ruminant. Haustoria and its functions. Embryo development in Monocots (*Luzula* type) and Dicots (*Crucifer* type), Apomixis and Polyembryony.

Books for Study:

1. Pandey, S.N. and Chadha, A. 2006 (Reprint Edition). *Plant Anatomy*. S. Chand and Co. (For Unit I, II & III)
2. Annie Ragland and Kumaresan, V. 2010. *Developmental Botany and Experimental Embryology*. Saras Publication, Nagercoil. (For Unit IV &V)

Books for Reference:

1. J. Eames and L.H. Mac Daniels. 1953. *An Introduction to Plant Anatomy*. McGraw Hill Book Company.
2. Cutter E.G. 1969. *Plant Anatomy – Part I and II Edition – Wesley Publishers*.
3. Maheswari. P. 1971. *An Introduction to the Embryology of Angiosperms*. Tata McGraw Hill Pub. Co. Ltd.
4. Esau. K. 1985. *Plant Anatomy*. Wiely Eastern Pvt. Ltd.
5. Fahn. A. 1987. *Plant Anatomy*. Pergamon Press.
6. Bhojwani, S.S and Bhat Nagar, S.P. 2009. *The Embryology of Angiosperms*. Vikas Publishing House (P) Ltd. New Delhi

Web Resources:

<https://catalog.princeton.edu> >

<https://searchworks.stanford.edu> >

Course Outcomes (CO) : On completion of the course, students should be able to

CO Number	CO Statement	Knowledge Level
CO1	Describe the organization of cell and tissue systems in higher plants.	K2
CO2	Explain anomalous secondary growth in higher plants.	K2
CO3	Distinguish the internal structure of dicot plants from monocots.	K4
CO4	Examine the Microsporogenesis and Megasporogenesis.	K4
CO5	Elaborate the mode of embryo development in dicots and monocots.	K6

Mapping of COs with POs:

COs \ POs	PO1	PO2	PO3	PO4	PO5
CO1	M	S	S	S	M
CO2	M	S	M	S	M
CO3	M	S	S	S	M
CO4	M	S	S	S	M
CO5	M	S	S	S	M

Programme Title : B. Sc. Botany

Course Title : Core Practical - II

Course Code : 21UBOQC2

Hours/Week : 4

Semester : II

Credits: 2

SYLLABUS

1. Simple and complex tissue in cross section and maceration, and types of wall thickening to be observed.
2. Internal structure of stem– Dicotyledonous stem – Young (with discrete vascular bundles and continuous vascular cylinder) and old stems. Monocotyledonous stem – *Maize*.
3. Internal structure of root, dicot – young and old roots, Monocot root – *Maize*, Aerial root – *Tinospora*, *Ficus*. Anomalous secondary growth in stems – *Nyctanthes*, *Bignonia*, *Boerhaavia*, *Dracaena*.
4. Internal structure of leaf– Dicot leaf – Isobilateral – *Nerium*, *Eucalyptus* , Dorsiventral – *Hibiscus*.
5. Monocot leaf - Gramineous – *Grass*. Non-Gramineous – *Tradescantia* or *Allium*, Stomatal types.

Embryology

1. Anther – T.S. – young and mature
2. Ovule – L.S. showing embryo sac & developing stages – 2 & 4 Nucleate stage
3. Embryo mounting – *Tridax* or *Cucumber*.

Programme Title : B. Sc. Botany

Course Title : Skill Based II (Practical) Home Gardening and Floriculture

Course Code :21UBOSQC2

Hours/Week : 2

Semester : II

Credits: 2

Course Objectives : The course aims

1. To provide basic knowledge about various types of garden.
2. To impart the importance of organic manuring.
3. To inculcate career opportunities and self-entrepreneurial skills.

SYLLABUS

- Training on establishment of various types of garden
 - (i) Herbal garden (Medicinal plants)
 - (ii) Terrace garden
 - (iii) Kitchen garden
 - (iv) Ornamental garden
 - (v) Bottle garden
- Bonsai
- Protocol for preparing organic manure
- Display of flowers – Floral designing – Circular, Triangular, Line and Holiday arrangements
- Flower projects for the home – Greeting card; Gift card; Gift tag & Family album
- Bouquet making

Books for Study:

1. ManibhushanRao, K. 2005. *Text book of Horticulture*, Second Edition, Macmillan Publications, New Delhi.
2. Kumar, N. 2010. *Introduction to Horticulture*, Rajalakshmi Publications, Nagercoil, Kanyakumari.
3. Kumaresan, V., 2016. *Horticulture*, Saras Publication, Nagercoil.

Books for Reference:

1. Jane Newdick, Veevers-Carter, M. 1993. *The Complete Flower Arranger*, Colour Library Books, Singapore.
2. Charles Griner, 1995. *Floriculture Designing and Merchandizing*, DelmerPublishers™, New York.
3. Joanna Sheen, 1995. *Flower projects for the Home*, Premier editions, London.

Web Resources:

<https://okcareertech.org>

Course Outcomes (CO) : On completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Illustrate the fundamental principle and utilize the elements of home gardening.	K2,K3
CO2	Apply basic knowledge on various types of garden.	K3
CO3	Utilize opportunities in home gardening.	K3

Mapping of COs with POs :

POs	PO1	PO2	PO3	PO4	PO5
COs					
CO1	S	S	S	S	S
CO2	S	S	M	S	S
CO3	S	M	M	M	S

Programme Title : B. Sc. Botany
Course Title : Plant Diversity- II
Course Code : 21UBOC3 **Hours/Week : 5**
Semester : III **Credits: 5**

Course Objectives: The course aims

- To understand the basics of Bryophytes, Pteridophytes, Gymnosperms and Paleobotany.
- To study the structure, reproduction and life history of plants.
- To highlight the importance of Bryophytes, Pteridophytes and Gymnosperms in the plant kingdom.

SYLLABUS

Unit I - (Hours:15)

Bryophytes – General characters and classification (Proskauer and Reimer, 1954). A detailed study of the structure and life history of the following genera. (Excluding the developmental stages)

Marchantia and *Polytrichum*

Unit II - (Hours:15)

Pteridophytes – General characters and classification (Reimer's, 1958). Eusporangiate and Leptosporangiate development. Homospory, heterospory and seed habit. Embryo development – endoscopic and exoscopic, apogamy, apospory and parthenogenesis. Stellar evolution.

Unit III - (Hours:15)

A detailed study of the structure and life history of the following genera (excluding the developmental stages)

Lycopodium, *Selaginella* and *Equisetum*

Unit IV - (Hours:15)

A detailed study of the structure and life history of the following genera (excluding the developmental stages)

Adiantum and *Marsilea*

Gymnosperms - General characters and classification (Sporne, 1962). A detailed study of the structure and life history of the following genera (excluding the developmental stages)

Cycas and *Gnetum*

Unit V - (Hours:15)

Fossils, Fossilization, Dating of Fossil – Carbon dating method, Geological time scale. Study of form genera – *Rhynia*

Ecological and Economic importance of Bryophytes, Pteridophytes, Gymnosperms.

Books for Study:

1. Srivastava, H.N. 2004. *Bryophyta*. Pradeep Publications, New Delhi. 2. Srivastava, H.N. 2004. *Pteridophyta*, Pradeep Publications, New Delhi. 3. Srivastava, H.N. 2004. *Gymnosperms*. Pradeep Publications, New Delhi.

Books for Reference:

1. Vashishta, B.R. 1991. *Bryophyta*. S. Chand and Company Ltd. Ram Nagar, New Delhi. 2. Eames, A.J. 1936. *Morphology of Lower Vascular Plants*. McGraw Hill. 3. Vashishta, P.C.1987. *Vascular Cryptogams Pteridophyta*. S. Chand & Company Ltd. Ram Nagar, New Delhi.
4. Vashishta, P.C, Sinha, A.K. and Anil Kumar, 2006. *Gymnosperms*. S. Chand & Company Ltd. Ram Nagar, New Delhi.
5. Gangulee and Kar. 1999. *College Botany Vol. II*. Revised Edition S. Chand& Company Ltd. RamNagar, New Delhi.

Web Resources:

https://onlinecourses.swayam2.ac.in/cec20_bt11/preview

Course Outcomes (CO): On completion of the course, the students will be able to

CO Number	CO Statement	Knowledge Level
CO1	List out the fundamental characters of Bryophytes, Pteridophytes and Gymnosperms	K1
CO2	Explain the general characters, stelar evolution in Pteridophytes, heterospory and origin of seed habit.	K2
CO3	Examine the morphology, structure, reproduction and life cycle of Bryophytes, Pteridophytes and Gymnosperms	K4

CO4	Analyse the alternation of the generation of Cryptogams and Gymnosperms.	K4
CO5	Discuss the fossil and fossilization, the economic importance of Bryophytes, Pteridophytes and Gymnosperms.	K6

Mapping of COs with POs:

POs COs	PO1	PO2	PO3	PO4	PO5
CO1	M	S	S	S	M
CO2	M	S	S	S	M
CO3	M	S	S	S	M
CO4	M	S	S	S	M
CO5	M	S	S	S	M

Programme Title : B. Sc. Botany

Course Title : Core Practical III

Course Code : 21UBOQC3

Hours/Week: 4

Semester : III

Credits: 2

SYLLABUS

A Study of Morphological, Anatomical and Reproductive Structure of:

Bryophytes : *Marchantia* and *Polytrichum*.

Pteridophytes: *Lycopodium*, *Selaginella*, *Equisetum*, *Adiantum* and *Marsilea*.

Gymnosperms: *Cycas* and *Gnetum*.

Fossils: *Rhynia*

Programme Title : B. Sc. Botany
Course Title : Skill Based III (Practical): Analytical techniques in Plant Science
Course Code : 21UBOSQC3 **Hours/Week: 2**
Semester : III **Credits: 2**
Course Objectives : The course aims

1. To provide basic knowledge about analytical techniques used in plant science.
2. To improve practical skills for higher studies.
3. To inculcate lab-oriented skills among students.

SYLLABUS

- Safety guidelines – General guidelines for lab session (Good Laboratory practice - GLP)
- Guidelines for working with bacteria
- Universal precautions – Biosafety levels – I, II, III, IV
- Handling of microscopes – Light microscope, Dark field, Phase contrast; Microscope accessories – Micrometer, Camera Lucida and Ultrascope.
- Homogenizer (Mortar and Pestle), Magnetic stirrer, Vortex mixer, Bunsen Burner, Water Bath, Glass Distillation Apparatus
- Centrifuge and Spectrophotometry – Principles and working mechanism.

Books for Study:

1. Rajan, S., Selvi Christy, R. 2015. *Experimental Procedures in Life Sciences*, Anjanaa Book house Publishers, Chennai.

Books for Reference:

1. Kalaichelvan, P.T., 2008. *Microbiology and Biotechnology – A laboratory manual*, MJP Publishers, Chennai.
2. Sadasivam, S., Manickam, A. 2008. *Biochemical Methods*, 3rd edition, New age international (P) Ltd., Publishers, New Delhi.
3. David T Plummer. 2017. *An Introduction to Practical Biochemistry*, 3ed edition, Mac Graw Hill Publications, New York
4. Jayaraman, J. 2011. *Laboratory Manual in Biochemistry*, New Age International Publishers, Bengaluru.
5. Das, S. and Saha, R. 2020. *Microbiology Practical Manual*, CBS Publishers, New Delhi.

Web Resources:

<https://microbiologyonline.org/file/7926d7789d8a2f7b2075109f68c3175e.pdf>

elte.prompt.hu/sites/default/files/tananyagok/PracticalMicrobiology/book.pdf

Course Outcomes (CO): On completion of the course, the students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Interpret the safety guidelines for working with microorganisms.	K2
CO2	Organize the usage of instruments employed in plant Science research	K3
CO3	Categorize the laboratory Equipments in Plant Science	K4
CO4	Choose appropriate techniques adapted in Plant Science	K6

Mapping of COs with POs :

POs COs	PO1	PO2	PO3	PO4	PO5
CO1	M	S	S	S	M
CO2	S	S	S	M	M
CO3	M	S	S	M	M
CO4	S	S	S	S	S

Programme Title : B. Sc. (Zoology)
Course Title : Allied Botany – I (Morphology, Taxonomy, Anatomy and Embryology)
Course Code : 21UZOAC3 **Hours/Week : 3**
Semester : III **Credits: 3**
Course Objectives : The course aims

- To study the morphology of the plant parts.
- To study the characters and economic importance of selected families.
- To understand the internal structure of various plant parts.
- To acquire knowledge about the reproductive parts of plants.

SYLLABUS

UNIT - I (Hours:9)

Morphology of Angiosperms – Root and Stem – structure and types. Leaves – stipules, phyllotaxy, venation and types – simple, compound (modifications excluded).

UNIT - II (Hours:9)

Inflorescence – types – Racemose, Cymose and Special Types. Flower – Parts of the flower – calyx, corolla, androecium and gynoecium. Fruit – Fleshy and dry fruits.

UNIT - III (Hours:9)

Taxonomy - Outline of Bentham and Hooker's system of classification. A detailed study of the range of characters in the following families - Annonaceae, Rutaceae, Cucurbitaceae, Rubiaceae, Amaranthaceae and Poaceae.

UNIT - IV (Hours:9)

Anatomy – Introduction, Meristem - classification and types: Tissues - Simple Permanent tissues; Complex tissues (A brief outline of xylem and phloem), Primary (Dicot and Monocot) and Secondary (Dicot) structures of stem and root (excluding anomalous). Leaf – dicotyledon (*Hibiscus*, *Nerium*) and monocotyledon (Grass).

UNIT - V (Hours:9)

Embryology - Structure of Anther - Microsporangium, Male gametophyte, Structure of Ovule - Megasporangium, female gametophyte, dicot embryo – *Capsella bursa-pastoris* (development excluded).

Books for Study:

1. Rao, K. N., Krishna Murthy, K.V. and Sudhakara, Rao G. 1993, *Ancillary Botany*, Viswanathan (Printers & Publishers) Pvt. Ltd, Chennai

Books for Reference:

1. Muneeswaran, A., 1983, *A Text Book of Botany*, 2nded, Brighton Book House, Chennai.
2. Gangulee, H.C and Kar, A.K. 2002. *College Botany*, Vol.II, Revised Edition, New Central Book Agency (P) Ltd., Kolkata.
3. Rasod, S. K., Sekar, T., 2004. *Allied Botany Paper II*, 1st ed., Popular Book Depot, Chennai.
4. Gangulee, H.C., Das, K.S. and C. Duta, 2007. *College Botany*, Vol.I, 6thed. New Central Book Agency (P) Ltd., Kolkata.
5. Annie Ragland, Kumaresan, V. & Arumugam, N. 2014. *Algae, Fungi, Bryophytes and Plant pathology*. Saras Publication, Nagercoil.

Web Resources:

www.freebookcentre.net/Biology/Botany-Books.html

Course Outcomes (CO): On completion of the course, the students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Demonstrate the Morphology of vegetative parts of plants.	K2
CO2	Describe the basic concepts in Plant Anatomy and Embryology.	K2
CO3	Identify the morphology of reproductive structures of the Plant.	K3
CO4	Classify the plants based on Bentham and Hooker's system of classification.	K4
CO5	Examine the internal structure of various plant organs.	K4

Mapping of COs with POs

	POs	PO1	PO2	PO3	PO4	PO5
Cos						
CO1		M	S	M	S	M
CO2		M	S	M	S	M

CO3	M	S	M	S	M
CO4	M	S	M	S	M
CO5	M	S	M	S	M

Programme Title : B.A./ B. Sc./ B.Com.
Course Title : Non Major Elective I: Horticulture
Course Code : 21UBONEC1 **Hours/Week:2**
Semester : III **Credits – 2**
Course Objectives : The course aims

- To incorporate the principles and practices of horticulture.
- To provide knowledge of the propagation techniques.
- To create an aesthetic value among students.
- To offer immense scope for growing horticultural plants.
- To highlight the value of cultivating horticultural crops.

SYLLABUS

Unit – I (Hours : 6)

Introduction, divisions and scope of Horticulture, A brief knowledge of ornamental plants - annuals, biennials and perennials.

Unit –II (Hours : 6)

Propagation techniques – Cuttage and its types - root cuttings, stem cuttings – herbaceous, soft wood, semi-hard wood, hard wood cuttings, leaf and leaf bud cuttings. Layering and its types – ground layering – tip, simple, compound, trench, mound layering and air layering.

Unit – III (Hours : 6)

Budding and its types – T - budding, patch, chip, flap, ring and flute budding. Graftage and its types – approach or inarching, whip, cleft, top, veneer, epicotyl and bud grafting.

Unit – IV (Hours : 6)

Pruning - root, ringing, notching, smudging, bending, pinching and thinning. System of irrigation – surface, sub-surface and overhead irrigation.

Unit – V (Hours : 6)

Types of manures, fertilizers and its applications, types of pots and containers, pot mixtures for horticultural plants.

Books for Study:

1. Kumar, N. 1986. *Introduction to Horticulture*, Rajalakshmi Publications, Nagercoil, Kanyakumari.

2. Kumeresan, V. 2009. *Horticulture*, Saras publication, Nagercoil, Kanyakumari.

Books for Reference:

1. Adams, C. R., K. M. Banford and M. P. Early. 1993. *Principles of Horticulture*. Butterworth Heineman Ltd., London.
2. Edmond, J. B., T. L. Senn, F.S. Adrews and R. J. Halfacre. 1977. *Fundamentals of Horticulture* (4th Ed.) Tata McGraw-Hill, New Delhi.
3. Rao, K .M 1991. *A Text Book of Horticulture*. McMillan India Ltd, New Delhi.

Web Resources:

www.agrimoon.com/horticulture-icar-ecourse-pdf-books/

Course Outcomes (CO) : On completion of the course, the students will be able to

CO Number	CO Statement	Knowledge Level
CO1	List out the various groups of Horticultural plants	K1
CO2	Outline plant propagation techniques and its applications.	K2
CO3	Apply the principles and practices of Horticulture.	K3
CO4	Classify the manures and fertilizers for Horticultural plants	K4
CO5	Distinguish different groups of ornamental plants	K4

Mapping of COs with POs

Cos \ POs	PO1	PO2	PO3	PO4	PO5
CO1	M	M	M	S	S
CO2	M	M	M	M	S
CO3	S	M	M	M	S
CO4	S	M	M	M	S
CO5	S	M	M	S	S

Programme Title	: B. Sc. Botany	
Course Title	: Microbiology	
Course Code	: 21UBOC4	Hours/Week :4
Semester	: IV	Credits – 4

Course Objectives: The course aims

- To understand the scope of Microbiology.
- To know the structure and classification of bacteria and viruses.
- To provide knowledge about the spoilage of food and preservation.
- To study the production of antibiotics, alcohol and organic acids.

SYLLABUS

UNIT - I (Hours:12)

History and scope of Microbiology - Biogenesis, Abiogenesis, Germ theory of diseases, Koch postulates, Whittaker's Five Kingdom Concept.

An outline classification of bacteria (Bergey's system), Ultrastructure of bacteria – Capsule, Flagella (structure and locomotion – spirochetal and gliding), Pili. Cell wall – chemical composition, Gram-positive and Gram-negative bacteria. Bacterial growth – growth curve, Cultivation techniques – pour plate, spread plate, streak plate, subculturing and broth culture.

Unit II - (Hours:12)

Nutritional types of bacteria – Autotrophs – Photoautotrophs, Chemoautotrophs; Heterotrophs and its types. Genetic recombination in bacteria - Transformation, Conjugation, Transduction, Lysogeny. Economic importance of bacteria.

UNIT - III (Hours:12)

An outline classification of viruses. Viruses – general characters, symptoms, structure and replication. General characters of Bacteriophage, Cyanophage, Mycophage; Structure and reproduction of Tobacco Mosaic Virus (TMV).

UNIT - IV (Hours:12)

Microbes in industries – Antibiotics – Penicillin (fermentation, recovery), Production of organic acids – Vinegar (substrate, method) and citric acid (fermentation, medium manufacturing process, recovery and uses) production. Microbiology of water – sewage treatment – primary, secondary and tertiary.

UNIT - V (Hours:12)

Food Microbiology – Spoilage of food, methods of food preservation – physical and chemical. Dairy Microbiology – Dairy Products – Cheese and yogurt; Single Cell Protein (SCP) – definition, advantages and mass culture of Spirulina.

Books for Study:

1. Dubey, R.C. & Maheswari, D. K. 2000. *A Textbook of Microbiology*. S. Chand and Company Ltd., Ram Nagar, New Delhi.
2. Biswas, S.B. 1976. *An Introduction to Virus*. Vikas Publishing House Ltd.

Books for Reference:

1. Atlas, R.M. 1996. *Principles of Microbiology*, Second Edition, W.M.T. Brown Publishers.
2. Willey, J.M., Sherwood, L.M., Woolverton, C.J. 2008. *Prescott, Harley and Klein's Microbiology*, Seventh Edition, McGraw Hill Higher Education
3. Pelczar, M.J., Chan, E.C.S., Kreig, N.R. 1993. *Microbiology*. Fifth Edition. McGraw Hill Book Company.
4. Stainer, R.Y., Ingraham, J.L., Wheelis, M.L., Painter, P.R. 2005. *General Microbiology*, Fifth Edition, McMillan.
5. Tortora, G.J., Funke, B.R., Case, C.L. 2008. *Microbiology: An Introduction*. Ninth Edition. Pearson's Education.

Web Resources:

<https://microbiologynotes.org/>

<https://nptel.ac.in/courses/102/103/102103015/>

Course Outcome (CO): On completion of the course, the students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Comprehend the principles and scope of Microbiology.	K2
CO2	Explain salient features of microorganisms.	K2
CO3	Organize the fundamentals of the association of microbes in industry.	K3
CO4	Analyse the role of microbes in the production of food and food spoilage.	K4
CO5	Choose experiments to study microorganisms and their applications	K6

Mapping of COs with POs

POs COs	PO1	PO2	PO3	PO4	PO5
CO1	M	S	S	S	S
CO2	S	S	S	S	S
CO3	S	S	S	S	S
CO4	S	S	S	S	S
CO5	S	S	S	S	S

Programme Title : B. Sc. Botany

Course Title : Elective I: Plant Biotechnology

Course Code : 21UBOEC1

Hours/Week: 5

Semester : IV

Credits: 5

Course Objectives: The course aims

- To understand the basic concepts of Biotechnology.
- To learn tissue culture techniques.
- To understand the importance of producing virus free plants through tissue culture.
- To study different kinds of techniques of Plant Biotechnology.
- To create awareness about the plant products obtained through transgenic plants.

SYLLABUS

UNIT - I (Hours:15)

Introduction – History of tissue culture; Establishment of tissue culture lab, Sterilization techniques – Wet, Dry, Flame, Filter and Surface Sterilization methods, Nutritional composition of the medium. Types of media – Solid (MS and Nitsch) and Liquid (B5 and Gamborg's). Micropropagation- Tissue and Organ. Anther and embryo culture.

UNIT - II (Hours:15)

Callus culture – initiation and maintenance of callus, suspension culture – types – batch, continuous and immobilized cultures, Subculturing, Hardening, Somatic Embryogenesis.

UNIT - III (Hours:15)

Meristem culture – production of virus-free plants, culture, browning of the medium, thermotherapy, Cryotherapy and Chemotherapy. Virus – indexing, maintenance of virus-free stocks, applications and limitations.

UNIT - IV (Hours:15)

Somatic hybridization – protoplast isolation, fusion, selection of hybrid cells, regeneration of hybrid plants, symmetric and asymmetric hybrids, fate of plasma genes, Cybrids.

UNIT - V (Hours:15)

In vitro Plant Secondary metabolite production – Alkaloids, Terpenoids and Phenolic Compounds, Factors affecting secondary metabolite production, Synthetic seed Technology.

Books for Study:

1. Singh.B.D., 2015. *Biotechnology*. Kalyani Publishers, Ludhiana.
2. Sathyanarayana.U & Chakrapani. U 2020. *Biotechnology* Biotechnology books & Allied Ltd. Books& Ltd.

Books for Reference:

1. Reinst, J., and Bajaj, Y.P.S., 1990. *Plant, Cell, Tissue and Organ culture*. NarosaPublication, New Delhi.
2. Singh, B.D., 2003. *Biotechnology*, Kalyani Publishers, Ludhiana.
3. Ramawat, K.G., 2006. *Plant Biotechnology*. S. Chand and Co. Ram Nagar, New Delhi
4. Chawla, H.S., 2003. *Laboratory Manual for Plant Biotechnology*. Oxford and IBH Publication PVT Ltd., New Delhi.
5. Razdan.M.K. (2003), *Introduction to Plant Tissue Culture (2nd Edition)* Enfield.N.H. (u.a). Oxford Publishers,

Web Resources:

<https://www.university.youth4works.com>

<https://agrimoon.com>

Course Outcomes (CO): On completion of the course, the students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Define the fundamentals of Biotechnology and Tissue culture	K1
CO2	Interpret the significance of Sterilization Techniques, Callus culture and Somatic Embryogenesis.	K2
CO3	Apply the various techniques adapted to develop Somatic hybrids and Plasma genes	K3
CO4	Analyse the techniques to protect the plants from viral diseases.	K4
CO5	Discuss the production of Secondary metabolites with factors and Synthetic Seed Technology.	K6

Mapping of COs with POs

POs \ COs	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	S	S
CO2	S	S	S	S	S

C03	S	S	S	S	S
C04	S	S	S	S	S
C05	S	S	S	S	S

Programme Title : B. Sc. Botany

Course Title : Elective I: Agricultural Microbiology

Course Code : 21UBOESC1

Hours/Week : 5

Semester : IV

Credits: 5

Course Objectives : The course aims

- To understand the basic concepts of soil-microbe interaction.
- To create awareness on restoration of soil fertility through microbes.

SYLLABUS

UNIT – I (Hours:15)

Types of Microorganisms in soil - bacteria, fungi, actinomycetes, algae and protozoa.

UNIT - II (Hours:15)

Brief account of microbial interaction: Symbiosis, neutralism, Commensalism, Competition, Ammensalism, Synergism, Parasitism.

UNIT - III (Hours:15)

Role of rhizosphere, microorganism in improving soil fertility. Crop Rotation. Role of microorganism in decomposition of organic matter.

UNIT - IV (Hours:15)

Nitrogen cycle in nature – biological nitrogen fixation, biofertilizer, *Rhizobium* – root nodulation – mass multiplication methods, field application. *Azospirillum*, mass multiplication methods.

UNIT - V (Hours:15)

Biological control of soil-borne microbial pathogens and nematodes - Microbial pesticides. Interaction of synthetic pesticides with soil Microorganisms. Entomopathogenic fungi.

Books for Study:

1. Bagyaraj, D. J., Rangaswami, G. 2007. Agricultural Microbiology. 2nd edition, PHI Learning Pvt. Ltd. New Delhi.
2. Subba Rao, N.S. 1999. Soil Microbiology. 4th edition, Oxford and IBH Publishing, New Delhi.
3. Craig C. Sheaffer and Kristine M. Moncada. 2012. Introduction to Agronomy-Food crops and Environment (Second Edition), Cengage Learning.
4. Reddy S.R. 2017. Principles of Agronomy, Kalyani Publishers.
5. George Acquaaah, 2015. Principles of Crop production: Theory, Techniques and Technology, Prentice Hall India Learning Private Limited.

Web Resources:

<https://www.university.youth4works.com>

<https://agrimoon.com>

Course Outcomes (CO): On completion of the course, the students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Summarize different groups of soil microorganisms.	K2
CO2	Compare the interaction between microorganisms and plants.	K4
CO3	Distinguish different components of soil and its role in Agricultural Microbiology.	K4

Mapping of COs with POs

POs	PO1	PO2	PO3	PO4	PO5
COs					
CO1	S	S	S	S	S
CO2	S	S	S	S	S
CO3	S	S	S	S	S

Programme Title : B. Sc. Botany
Course Title : Skill Based – IV (Practical): Laboratory techniques in Applied Biology
Course Code : 21UBOSQC4 **Hours/Week : 2**
Semester : IV **Credits: 2**
Course Objectives : The course aims

- To create awareness among students about basic techniques of applied biology. • To cultivate lab-oriented skills among students.
- To acquire hands-on training in Microbiology and Biotechnology.
- To enhance the practical knowledge of students for their higher studies.

SYLLABUS

- Sterilization – Principles and methods – (i) Wet sterilization – Autoclave (ii) Dry sterilization – Hot Air Oven (iii) Flame sterilization (iv) Filter sterilization
- Laminar air flow hood
- Staining of Bacteria – Simple staining; Differential staining - Gram staining
- Temporary wet mount of microorganism (TWM)
- Hanging drop technique
- Preparation of glass wares for Plant Tissue Culture (PTC)
- Sterilization of explants in PTC
- Media preparation – Nutrient agar and broth (Bacteria); Potato Dextrose Agar (Fungi); Murashige & Skoog's (MS medium) and inoculation of explants in PTC ➤ Cultivation and subculturing of bacteria.
- Isolation and enumeration of bacteria.
- Growth curve of bacteria
- Cultural Characteristics – IMViC tests
 - a. Indole Production test
 - b. Methyl-Red and Voges-Proskauer test
 - c. Citrate Utilization Test
- Antibacterial potency of natural products

Books for Study:

1. Aneja, K.R., 2003. *Experiments in Microbiology, Plant pathology and Biotechnology* (Fourth Revised edition, New Age International (P Ltd, Publishers, New Delhi).

Books for Reference:

1. Kalaichelvan, P.T., 2008. *Microbiology and Biotechnology – A Laboratory manual*, MJP Publishers, Chennai.
2. Gayatri, M.C., Kavyashree, R., 2015. *Plant tissue culture – Protocols in Plant Biotechnology*, Narosa Publishing House Pvt. Ltd., New Delhi.
3. Das, S. and Saha, R. 2020. *Microbiology Practical Manual*, CBS Publishers, New Delhi.
4. Tejovathi G, Vimala Y, RekhaBhadauria. 1996. *Practical Manual for Plant Biotechnology*, CBS Publishers.
5. Ali, S.M. 2009. *Practical Manual of Biotechnology*, Aavishkar Publishers.

Web Resources:

<https://microbiologyonline.org/file/7926d7789d8a2f7b2075109f68c3175e.pdf>

Course Outcomes (CO): On completion of the course, the students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Demonstrate the basic techniques of Applied Biology.	K2
CO2	Apply the sterilization techniques in Microbiology and Biotechnology.	K3
CO3	Distinguish different plant tissue culture techniques.	K4
CO4	Develop the skill of handling microbes.	K6

Mapping of COs with POs and PSOs

POs \ COs	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	M	S
CO2	S	S	S	M	S
CO3	S	S	S	S	S
CO4	S	S	S	M	S

Programme Title : B. Sc. (Zoology)
Course Title : Allied Botany – II (Cryptogams, Gymnosperms and Plant Physiology)
Course Code : 21UZOAC4 **Hours/Week : 3**
Semester : IV **Credits: 3**
Course Objectives : The course aims

- To understand the diversity among the Cryptogams.
- To study the reproduction and life cycle of Cryptogams and Gymnosperms.
- To understand the metabolic activities of plants.

SYLLABUS

UNIT – I (Hours:9)

Algae – Detailed study of structure and reproduction of the following genera *Oscillatoria* and *Oedogonium*

UNIT - II (Hours:9)

Fungi - Detailed study of structure and reproduction of the genus *Polyporus*.
Bryophytes - Detailed study of structure and reproduction of the genus *Funaria*

UNIT – III (Hours:9)

Pteridophytes - Detailed study of structure and reproduction of the genus *Lycopodium*.

Gymnosperms - Detailed study of structure and reproduction of the genus *Cycas*

UNIT – IV (Hours:9)

Absorption of water - (Active & Passive) and salts (Contact ion exchange theory, Carbonic acid theory). Transpiration and its types.

UNIT – V (Hours:9)

Photosynthesis - Light and Dark reaction. Respiration - aerobic and anaerobic, Glycolysis and Krebs' s cycle.

Books for Study:

1. Rao, K. N., Krishna Murthy, K.V., and Sudhakara, Rao G., 1993, *Ancillary Botany*, Viswanathan (Printers & Publishers) Pvt. Ltd., Chennai.

Books for Reference:

1. Muneeswaran, A., 1983, *A Text Book of Botany*, 2nded, Brighton Book House, Chennai.
2. Gangulee, H.C and Kar, A.K. 2002. *College Botany*, Vol.II, Revised Edition, New Central Book Agency (P) Ltd., Kolkata.

3. Rasod, S. K., Sekar, T., 2004. *Allied Botany Paper II*, 1st ed., Popular Book Depot, Chennai.
4. Gangulee, H.C., Das, K.S. and C. Duta, 2007. *College Botany*, Vol.I, 6th ed. New Central Book Agency (P) Ltd., Kolkata.
5. Annie Ragland, Kumaresan, V. & Arumugam, N. 2014. *Algae, Fungi, Bryophytes and Plant Pathology*. Saras Publication, Nagercoil.

Web Resources:

www.freebookcentre.net/Biology/Botany-Books.html

Course Outcomes (CO): On completion of the course, the students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Relate the diversity of Algae, Fungi, Bryophytes and Pteridophytes at various levels.	K1
CO2	Demonstrate the Structure and reproduction in Cryptogams.	K2
CO3	Explain the significance of Photosynthesis and Respiration.	K2
CO4	Examine the Structure and reproduction of Gymnosperms.	K4
CO5	Discuss the basic concepts related to Plant Physiology.	K6

Mapping of COs with POs:

POs \ COs	PO1	PO2	PO3	PO4	PO5
CO1	M	S	S	S	S
CO2	M	M	S	S	M
CO3	M	S	S	S	M
CO4	M	S	S	S	M
CO5	M	S	S	S	M

Programme Title : B. Sc. (Zoology)

Course Title : Allied Botany Practical

Course Code : 21UZOAQC2

Hours/Week:2

Semester : IV

Credits: 2+2

SYLLABUS

1. Description in technical terms of plants belonging to the families prescribed and identification of the family.
2. Suitable micro preparation of stem, root and leaf of Angiosperms and leaflet and rachis of Gymnosperm included in the syllabus.
3. Demonstration and recording of the following Plant Physiology experiments included in the syllabus.
 - a. Osmosis
 - b. Imbibition
 - c. T/A Balance
 - d. Ganong's Potometer
 - e. Test tube Funnel Experiment
 - f. Light Screen Experiment
 - g. Aerobic Respiration
 - h. Anaerobic Respiration

Programme Title : B.A./ B. Sc. / B.Com.
Course Title : Non Major Elective II: Home Gardening
Course Code : 21UBONEC2 **Hours/Week :2**
Semester : IV **Credits:2**
Course Objectives : The course aims

- To help the students to gain knowledge on planning and maintaining of garden
- To widen their knowledge to create garden of their own interest.
- To upsurge the student community about gardening as a leisure activity.

SYLLABUS

Unit – I (Hours: 6)

Introduction and importance of home gardening: Kitchen garden – selection of site, size and shape, layout, soil, climate, cropping season, raising of nursery, transplanting, irrigation, manuring, stacking, training, pruning, weeding and harvesting.

Unit – II (Hours: 6)

General aspect of terrace garden; cultivation aspects of vegetables and fruits (mention any three examples in each group).

Unit – III (Hours: 6)

Bonsai – introduction, principle and importance. Tools and accessories. Ideal environment – containers and potting compost, methodology – repotting, fixing in shallow pots, dwarfing, watering, weeding and feeding. Different styles. Training of Bonsai – disbudding, pruning, wiring and other methods.

Unit – IV (Hours: 6)

Water gardens – types - formal and informal pools; planting, management and plants for the water garden. Rock garden – establishment, construction, management and suitable plants for rockery.

Unit –V (Hours: 6)

Lawn – Definition; Methods of lawn making – From seed, by turfing, turf plastering and dibbling roots, Maintenance of lawn; Plants suitable for planting in lawn, commonly growing grass species.

Books for Study:

1. Kumar, N. 1986. *Introduction to Horticulture*, Rajalakshmi Publications, Nagercoil, Kanyakumari.

Books for Reference:

1. Dey, S.C. 2006. *Bonsai – An Art of miniature plant culture*. Agrobios,

2. Amarnath, V. 2007. *Nursery and Landscaping*. Agrobios, Jodhpur, India.
3. Sheela, V.L. 2011. *Horticulture*, MJP Publishers, Triplicane, Chennai.

Web Resources:

www.agrimoon.com/horticulture-icar-ecourse-pdf-books/

Course Outcomes (CO): On completion of the course, the students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Outline the importance and maintenance of Home Gardening.	K1
CO2	Summarize the significance of water gardens and propagate variety of aquatic plants.	K2
CO3	Develop the skills in creating lawns and their maintenance.	K3
CO4	Apply the knowledge of growing Bonsai as realistic representations.	K3
CO5	Recommend the designs of terrace garden tailored to suit individual's taste.	K5

Mapping of COs with POs and PSOs

POs COs	PO1	PO2	PO3	PO4	PO5
CO1	M	M	M	S	S
CO2	S	S	S	S	S
CO3	S	S	M	M	S
CO4	S	S	S	S	S
CO5	S	S	S	S	S

Programme Title : B. Sc. Botany

Course Title : Cytology

Course Code : 21UBOC5

Hours/Week: 5

Semester : V

Credits: 5

Course Objectives: The course aims

- To understand the basic structure and function of the plant cell.
- To gain knowledge about the cellular organelles of the plant cell.
- To study the cell division in plants.
- To know the evolutionary concept and theories.

SYLLABUS

UNIT - I (Hours:15)

Ultrastructure of prokaryotic and eukaryotic cells. Ultrastructure of a cell wall and Plasma Membrane – their chemical composition - Lamellar model, Fluid mosaic model. Cytoplasm - Structure and functions of nucleus.

UNIT - II (Hours:15)

Structure and functions of the following organelles - Endoplasmic Reticulum, Ribosomes, Lysosome, Mitochondria and Chloroplast.

UNIT - III (Hours:15)

Chromosomes – structure, types and chemical composition. Cell Division: Cell cycle -G1, S, G2 and M phase, Mitosis, Meiosis. Significance of Mitosis and Meiosis.

UNIT - IV (Hours:15)

Occurrence, Structure of Nucleic acids - DNA - forms of DNA - A, B, C, D and Z – DNA, RNA - Types - rRNA, mRNA and tRNA.

UNIT - V (Hours:15)

Organization of genetic material - Unique and repetitive DNA - Uninterrupted genes, Split genes, Overlapping genes and pseudogenes. Fine structure of the gene - Cistron, muton and recon. Replication of DNA - semi-conservative method. Salient features of Genetic code; Translation in Prokaryotes; Translation in Eukaryotes, post-translational modification.

Books for Study:

1. Verma, P.S. and V.K. Agarwal. 2004. *Cell Biology, Genetics, Molecular Biology and Evolution*. S.Chand& Co. New Delhi.

Books for Reference:

1. Becker, W.M., Kleinsmith, L.J., Hardin. J. and Bertoni, G. P. 2009. *The World of the Cell*. 7th edition. Pearson Benjamin Cummings Publishing, San Francisco.

Cooper, G.M. and Hausman, R.E. 2009. *The Cell: A Molecular Approach*. 5th edition. ASM Press & Sunderland, Washington, D.C.; Sinauer Associates, MA. 3. De Robertis, E.D.P. and De Robertis, E.M.F. 2006. *Cell and Molecular Biology*. 8th edition. Lippincott Williams and Wilkins, Philadelphia.

4. Karp, G. 1996. *Cell and Molecular Biology*. John Wiley & Sons Inc. New York. 5. Powar, C.B. 2010. *Cell Biology*. Himalaya Publishing House.

Web Resources:

<https://www.docsity.com/en/subjects/cellular-and-molecular-biology/>

https://onlinecourses.swayam2.ac.in/cec20_bt03/preview

Course Outcomes (CO): On completion of the course, the students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Classify different types of Plant cells and cell organelles.	K2
CO2	Describe the structure and functions of cell organelles.	K2
CO3	Identify the concepts of Genetic material.	K3
CO4	Analyse the general structure of Plant cell and cell divisions	K4
CO5	Distinguish the structure and functions of Nucleic acid and translation process.	K4

Mapping of COs with POs:

POs \ Cos	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	S	S
CO2	S	S	S	S	S
CO3	S	S	S	S	S
CO4	S	S	S	S	S
CO5	S	S	S	S	S

Programme Title : B. Sc. Botany
Course Title : Morphology & Taxonomy of Angiosperms
Course Code : 21UBOC6 **Hours/Week: 6**
Semester : V **Credit: 5**
Course Objectives : The course aims

- To know the basic morphological features of plant parts.
- To study the classification of plants based on morphological characters.
- To study the morphological, taxonomic details, and economic importance of plants belonging to some selected families.

SYLLABUS

UNIT - I (Hours:18)

Morphology - Root system and its modifications - Shoot system - Types and Modifications. Leaf Types and Modification, Phyllotaxy and its types. Inflorescence – Racemose, Cymose and mixed types. Descriptive terminologies of the flower.

UNIT - II (Hours:18)

Fruits - Types, Dispersal of fruits and seeds, seed germination - epigeal, hypogeal and viviparous. Taxonomy and its importance, Flora, Herbarium techniques. System of classifications – Bentham and Hooker (Natural), Cronquist (Modern) - Merits and Demerits; Taxonomic hierarchy. Plant nomenclature –ICN, Typification; Identification methods - Keys (Indented and Bracketed).A brief account of Chemotaxonomy and Numerical Taxonomy.

UNIT - III (Hours:18)

A detailed study and economic importance of the following families: Annonaceae, Capparidaceae, Rutaceae, Caesalpiniaceae and Mimosaceae, Myrtaceae, Cucurbitaceae and Apiaceae

UNIT - IV (Hours:18)

Asteraceae, Apocynaceae, Asclepiadaceae, Lamiaceae, Acanthaceae, Amaranthaceae, Euphorbiaceae, Moraceae, Cannaceae, Liliaceae, Orchidaceae and Poaceae.

UNIT - V (Hours:18)

Medicinal values of plants and their products: Sources (botanical name, family, common name and morphology of the useful parts for the following ailments) indigestion (coriander and mentha leaves, cumin, pepper, ginger), laxatives (castor oil, senna leaves), cough and cold (tulsi, Coleus) mouth ulcers - black nightshade (Solanum nigrum), diabetes (fenugreek and jambolana seed powder), antioxidants (green tea and beetroot), herb drinks (juice of amla and lime).

Books for Study:

1. Annie Ragland and Kumaresan V. 2004, *Taxonomy of Angiosperms*. Saras Publication. Nagercoil.
2. Rao, K.N. and Krishnamurthy, K.V. 1990. *Angiosperms*, Viswanathan Publishers.

Books for Reference:

1. Jeffrey, C. 1968. *Introduction to Plant Taxonomy*. Allied Publishers. J.A.Churchill. London.
2. Sivarajan, V.V. 1986. *Introduction to Plant Taxonomy*. Oxford and IBH Publishers & Co. Pvt., Ltd., New Delhi.
3. Datta, S.C. 1988. *Systematic Botany* (4th Ed.). Wiley Eastern Ltd.
4. Gurucharan Singh. 2004. *Plant systematic - Theory and Practice*. Oxford and IBH Publishing Co. Pvt. Ltd. New Delhi. 2nd Edition.
5. Gangulee, H.C., Das, K.S. and Datta, C. 2011. *College Botany* Vol. I. New Central Book Agency. Calcutta.

Web Resources:

<https://www.easybiologyclass.com/angiosperm-systematics-and-taxonomy-free-online...>

Course Outcomes (CO): On completion of the course, the students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Describe traditional aspects of Plant Taxonomy.	K2
CO2	Identify and classify plants based on morphological features.	K2, K3
CO3	Apply an insight on the association among plants belonging to various families.	K3
CO4	Organize scientific knowledge to meet the needs of current requirements.	K4
CO5	Develop skills to collect, preserve and identify Herbarium specimen.	K6

Mapping of COs with POs

POs \ COs	PO1	PO2	PO3	PO4	PO5
CO1	S	M	M	S	M
CO2	M	S	M	S	S

CO3	M	S	S	S	M
CO4	S	S	S	S	S
CO5	S	S	S	S	S

Programme Title : B. Sc. Botany
Course Title : Biochemistry and Biophysics
Course Code : 21UBOC7 **Hours/Week: 5**
Semester : V **Credits: 5**
Course Objectives : The course aims

- To understand the role of chemistry in Biology.
- To analyse chemical reactions occurring in living organisms.
- To understand the interrelationships of structure, properties and functions of plants.
- To impart the knowledge about the structure of proteins, carbohydrates, lipids, amino acids, enzymes and coenzymes.
- To make an emphatic study on Enzyme kinetics and physical, chemical organizations of protoplasm.

SYLLABUS

UNIT - I (Hours:15)

Biochemistry - definition and scope. Atoms and molecules, Chemistry of solutions, colloid and its properties, Chemical bonds - ionic bond, covalent bond and hydrogen bond. Principle and working mechanism of pH meter, Centrifugation - Rotary, Zonal and Ultracentrifuge and Colorimetry. Chromatography – Principle, classification. Paper and Thin layer.

UNIT - II (Hours:15)

Carbohydrates - Classification, Structure, Chemical Properties and Functions of monosaccharides, disaccharides and polysaccharides. Amino Acids and Proteins - Classification (based on structure and chemical nature of amino acids), structure & properties.

UNIT - III (Hours:15)

Lipids - Classification, structure, properties and functions. Enzymes - IUBAB - classification, properties, mechanism of enzyme action and factors affecting enzyme activity.

UNIT - IV (Hours:15)

Light - Nature, properties, Absorption and Action spectrum - fluorescence and phosphorescence. Laws of thermodynamics; First Law of thermodynamics and its applications - Entropy - its physical significance.

UNIT - V (Hours:15)

Electron transport chain:- Role of respiratory chain in mitochondria; in energy capture; respiratory control. Oxidative phosphorylation:- Mechanism of oxidative phosphorylation; Chemiosmotic theory; uncouplers of oxidative phosphorylation

Books for Study:

1. Deb, A.C. 2004. *Fundamentals of Biochemistry*. New Central Book Agency.

2. Satyanarayana, U. and U.Chakrabani. 2007. *Essentials of Biochemistry*. Book and Allied Pvt. Ltd. Kolkata.
3. Arumugam, N. and V. Kumaresan. 2012. *Biophysics and Bioinstrumentation*. Saras Publication. Nagercoil.

Books for Reference:

1. Boyer, R. 2002. *Concepts in Biochemistry* 2nd edition Brooks Cole.
2. Eric. E.C. and P.K.Stumpf-John.2004. *Outlines of Biochemistry*.Wiley and Sons, Inc. New York.
3. Harper's Biochemistry (2012) 29th ed., Murray, R.K., Granner, D.K.,Mayes andP.A.,Rodwell, V.W., Lange Medical Books/McGraw Hill
4. Voet and Voet (2010) Biochemistry. 4th Edition. John Wiley and Sons
5. Lehninger (2013) Principles of Biochemistry 6th ed., Nelson, D.L. and Cox, M.M.,W.H. Freeman and Company, New York.

Web Resources:

www.colby.edu/chemistry/BC176/CH1.pdf

https://www.saddleback.edu/faculty/jzoval/mypptlectures/ch15_metabolism/lecture_notes_ch15_metabolism_current-v2.0.pdf

Course Outcomes (CO) : On completion of the course, the students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Describe fundamental concepts and principles of chemistry of life.	K2
CO2	Comprehend the chemical nature and behaviour of living matter and their transformation in biological systems.	K2
CO3	Apply physical concepts and techniques to address problems in biology.	K3
CO4	Distinguish biomolecules and its chemical organization within plant cells.	K4
CO5	Analyse the importance of bioenergetics in Biological systems.	K4

Mapping of COs with POs

POs COs	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	S	S
CO2	S	S	S	S	S
CO3	S	S	S	S	S
CO4	S	S	S	S	S
CO5	S	S	M	S	S

Programme Title : B. Sc. Botany
Course Title : Elective II – Biostatistics and Bioinformatics
Course Code : 21UBOEC2 **Hours/Week : 5**
Semester : V **Credits: 5**

Course Objectives : The course aims

- To facilitate the students, an investigative approach to understand science observed through mathematical data.
- To bridge the gap between the exposition of subject matter to exercise practical problems.
- To link biology to the world of technology.

SYLLABUS

UNIT - I (Hours:15)

Biostatistics - Definition. Data - objectives, types, classification and collection methods - Primary and secondary. Methods of classification- individual, discrete & continuous series. Tabulation - parts - simple and Complex tables.

UNIT - II (Hours:15)

Graphic presentation of data - Kinds of Diagram - line, bar, pie, pictograms, cartograms, histogram, Frequency polygon and Frequency curve-limitations, rules and significance.

UNIT - III (Hours:15)

Measures of Central Tendency - Definition and calculation of mean, median and mode. Definition and calculation of standard deviation, standard error and variance. Chi square test and Test for Goodness of fit.

UNIT - IV (Hours:15)

Bioinformatics - Definitions; Fundamentals of Computer - Hardware components, CPU and peripherals, Software types - system and application. CPU Operating System, Network types - LAN, WAN and INTERNET.

UNIT - V (Hours:15)

Application of Bioinformatics in various fields. Classification of Biological Databases - Primary and secondary Databases - Protein - PDB, PIR, SWISS-PROT and Nucleic acid Database - NCBI, DDBJ, EMBL and specialized database - MMDB.

Books for Study:

1. Sundarrajan, S. and Balaji, R. 2002. *Introduction to Bioinformatics*. Himalaya Publishing House, Mumbai.
2. Arumugam, N. 2011. *Basic concepts of Biostatistics*. Saras Publication, Nagercoil.

Books for Reference:

1. Ignachimuthu. S.J. 2006, *Basic Bioinformatics*. Narosa Publishing House, New Delhi.
2. Ramkrishnan, P. 2010. *Biostatistics*. Saras Publication, Nagercoil.
3. Sundar Rao, P.S.S. and Richard, J. 2012. *Introduction to Biostatistics and Research Methods*, PHI Learning Pvt. Ltd., New Delhi
4. Shanmughavel, P. and Wadhwa, G. 2009, *Practicals in Bioinformatics*, Pointer Publishers, Rajasthan.
5. Rastogi, S. C. 2009. *Bioinformatics Concepts, Skills & Applications*, CBS Publications, New Delhi

Web Resources:

<https://www.easybiologyclass.com/biostatistics-free-lecture-notes-online-tutorials-ppts-and-mcqs/>

<https://nptel.ac.in/courses/102106065/>

Course Outcomes (CO) : On completion of the course, the students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Comprehend the fundamental concepts of mathematics to understand Biology.	K2
CO2	Describe the concepts of computer databases.	K2
CO3	Apply statistical analysis for collection and interpretation of biological data.	K3
CO4	Examine different public domains for Nucleic acids and proteins sequence retrieval.	K4
CO5	Develop skills in Data tabulation and graphical representation of Data.	K6

Mapping of COs with POs

POs \ COs	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	S	S
CO2	S	S	S	S	M
CO3	S	S	S	S	S
CO4	S	M	S	S	S
CO5	S	S	M	S	S

Programme Title : B. Sc. Botany
Course Title : Elective II – Bioinstrumentation
Course Code : 21UBOESC2 **Hours/Week: 5**
Semester : V **Credits: 5**
Course Objectives : The course aims

1. To gain knowledge on measurements in cellular and molecular biology.
2. To understand basic principles and application of tools and techniques in biology for higher studies and research based careers.

SYLLABUS

UNIT - I (Hours : 15)

General Biophysical methods– Measurement of pH, Radioactive labeling and counting, Autoradiography.

UNIT - II (Hours : 15)

Separation & Identification of Materials- concept of Chromatography (Partition Chromatography, Paper Chromatography, Adsorption Chromatography, TLC, GLC, Ion Exchange Chromatography, Gel Chromatography, HPLC, Affinity Chromatography); Electrophoresis (Gel Electrophoresis, Paper Electrophoresis).

UNIT - III (Hours : 15)

Centrifugation – Basic Principle of Centrifugation, Instrumentation of Ultracentrifuge (Preparative, Analytical), Factors affecting Sedimentation velocity, Standard Sedimentation Coefficient, Centrifugation of associating systems, Rate-Zonal centrifugation, sedimentation equilibrium Centrifugation.

UNIT - IV (Hours : 15)

X-Ray Crystallography – X-ray diffraction, Bragg equation, Reciprocal lattice, Miller indices & Unit cell, Concept of different crystal structure, determination of crystal structure concept of rotating crystal method, powder method.

UNIT - V (Hours : 15)

Spectroscopy: Absorption Spectroscopy – Simple theory of the absorption of light by molecules, Beer-Lambert law, Instrumentation for measuring the absorbance of visible light, Factors affecting the absorption properties of a Chromophore. Instrumentation of UV-Vis Spectrophotometer.

Reference Books:

1. John G. Webster., 2003. Bioinstrumentation. Wiley Publisher.
2. Veerakumari, L. 2006. Bioinstrumentation. MJP Publishers.

3. Kalaichelvan, P.T., 2008. *Microbiology and Biotechnology – A laboratory manual*, MJP Publishers, Chennai.
4. Sadasivam, S., Manickam, A. 2008. *Biochemical Methods*, 3rd edition, New age international (P) Ltd., Publishers, New Delhi.
5. David T Plummer. 2017. *An Introduction to Practical Biochemistry*, 3ed edition, Mac Graw Hill Publications, New York

Course Outcomes (CO): On completion of the course, students should be able to

CO Number	CO Statement	Knowledge Level
CO1	Recall fundamental knowledge in instruments of biology.	K1
CO2	Illustrate the techniques employed in X – ray crystallography and spectroscopy useful for higher studies.	K2
CO3	Distinguish the principle, concepts and mechanism of various separation techniques.	K3

Mapping of COs with POs

POs \ COs	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	S	S
CO2	S	S	M	S	S
CO3	S	S	S	M	S

Programme Title	: B. Sc. Botany	
Course Title	: Core Practical IV (Morphology & Taxonomy of Angiosperms, Cytology, Biochemistry & Bioinformatics)	
Course Code	: 21UBOQC4	Hours/Week : 6
Semester	: V	Credits: 2

SYLLABUS

Morphology and Taxonomy of Angiosperms

1. Training in dissection, observation and sketching of the vegetative and floral parts of plants belonging to the following families.

Annonaceae, Capparidaceae, Rutaceae, Caesalpiaceae, Mimosaceae, Myrtaceae, Cucurbitaceae, Apiaceae Asteraceae, Apocynaceae, Asclepiadaceae, Lamiaceae, Acanthaceae, Amaranthaceae, Euphorbiaceae and Poaceae.

2. Description of plants in technical terms; Training in herbarium techniques. (Locally available plants - Preparation of minimum of 10 herbarium sheets to be valued internally).

Cytology

Structure of cell - Onion peeling - Hydrilla leaf cells showing chloroplast and rotation of protoplasm.

Electron Micrographs

- a. Ultrastructure of Plant cell
- b. Endoplasmic reticulum
- c. Chloroplast
- d. Mitochondria
- e. Golgi complex
- f. Nucleus

Models

- a. Plasma membrane
- b. Chromosome
- c. DNA
- d. tRNA

Cell division - Squash technique –Mitosis - Onion root tip. Meiosis - Tradescantia (Demo only).

Biochemistry

1. Histochemical staining of cellulose
2. Histochemical staining of starch

3. Histochemical staining of callose
4. Histochemical staining of protein (Mercuric – bromophenol blue method)
5. Isolation of starch from potato
6. Isolation of casein from milk
7. Determination of pH of the soil sample
8. Determination of pH of the plant sap
9. Study of catalase activity in plant tissue
10. Study of peroxidase activity in plant tissue
11. Study of dehydrogenase activity in plant tissue
12. Identification of metabolites from Plant samples
13. Qualitative analysis of Carbohydrate
 - a. Reagent preparation for analysis of carbohydrates
 - b. Analysis of monosaccharides (Glucose)
 - c. Analysis of disaccharides (Lactose)
 - d. Analysis of polysaccharides (Starch)
14. Estimation of reducing sugars by Nelson-Somogyi method
15. Estimation of protein by Lowry's method.

Bioinformatics

1. Accession of various databases, bioinformatics tools and data retrieval systems from NCBI.
2. Retrieving structural data of a protein using PDB database.
3. Retrieving protein sequence from SWISS-PROT.
4. Retrieving nucleic acid sequence from GenBank.

Programme Title : B.A. / B. Sc. / B. Com.
Course Title : Non Major Skill Based – I: Mushroom Cultivation
Course Code : 21UBONSC1 **Hours/Week : 2**
Semester : V **Credit: 2**
Course Objectives : The course aims

1. To know about the food and energy value of mushrooms.
2. To study the cultivation of different kinds of mushrooms.
3. To know about the medicinal value of mushrooms.
4. To make aware of diseases and storage of mushrooms.

SYLLABUS

UNIT – I (Hours: 6)

Mushroom - morphology, types and advantages of mushroom cultivation. Medicinal and nutritional value of mushrooms. Edible and poisonous mushroom.

UNIT – II (Hours: 6)

Mushroom cultivation: Spawn and spawning - different types of spawn - virgin, flake, brick and grain spawn. Methods of spawning - double layer, top, through , shake-up, active mycelium, spot and super spawning, storage of spawn. Casing - sterilization, Time of casing.

UNIT – III (Hours: 6)

Techniques in mushroom cultivation - mushroom farm location, layout. Cultivation of Paddy straw mushroom - Standard bed, Hollow bed, Cage method - Substrates, spawn making methods and field cultivation.

UNIT – IV (Hours: 6)

Oyster and White button Mushroom cultivation - substrates, spawn making methods and field cultivation. Factors affecting Mushroom cultivation.

UNIT – V (Hours: 6)

Storage of mushrooms-blanching, steeping, sun-drying, canning, pickling and freeze drying. Do's and Don'ts of mushroom growing. Diseases of mushrooms - Bacterial, Fungal, Viral diseases and other diseases caused by insects, mites and nematodes. Recipes for mushrooms (omelette, tikka, chilly, soup and pickle).

Books for Study:

1. Pandey, R.K. and S.K. Ghosh. 1999. A Handbook on Mushroom Cultivation. Emkay Publications, Delhi

Books for Reference:

1. Bahl, N. 1988. Hand book on Mushrooms. Oxford and IBH publishing Co. Pvt. Ltd., Delhi. (2nd Edition).
2. Suman, B.C. and V.P. Sharma. 2011. Mushroom Cultivation and Uses. Agrobios Publication, Jodhpur.
3. V.P. Sharma and B.C. Suman, 2011. Diseases and pests of Mushroom. Agrobios publication, Jodhpur.

Web Resources:

<https://www.agricultureguruji.com>

Course Outcomes (CO) : On completion of the course, students should be able to

CO Number	CO Statement	Knowledge Level
CO1	List out the significance of food and energy value of mushrooms.	K1
CO2	Illustrate cultivation methods of various kinds of mushrooms.	K2
CO3	Apply the medicinal values of mushrooms in terms of human welfare.	K3
CO4	Compile different kinds of diseases and mushroom preservation methods.	K4
CO5	Create different food recipes using mushrooms.	K6

Mapping of COs with POs

POs \ COs	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	S	S
CO2	S	S	M	S	S
CO3	S	S	S	M	S
CO4	S	S	S	S	S
CO5	S	S	S	S	S

Programme Title : B. Sc. Botany
Course Title : Plant Physiology
Course Code : 21UBOC8 **Hours/Week :6**
Semester : VI **Credits: 5**
Course Objectives : The course aims

- To lay an emphasis on the physiological functions in plants.
- To understand the growth of the plants.
- To reveal the knowledge about the scope and role of plant physiology in applied sciences.

SYLLABUS

UNIT - I (Hours:18)

Water – Molecular structure, properties and its importance; Physical processes – diffusion, osmosis, plasmolysis and imbibition. Plant cell as an osmotic system - relationship of water, solute, pressure potential and DPD. Absorption of water - active and passive absorption theories; Ascent of sap - Transpiration pull and cohesion theory. Transpiration – types, mechanism and significance, Steward's hypothesis, ATP driven (H⁺)-K⁺exchange pump theory. Mineral nutrition - physiological role of micro and macronutrients. Translocation of ions - cytochrome pump and protein lecithin theory. Translocation of organic solutes - Munch Mass flow hypothesis.

Unit II (Hours:18)

Photosynthesis – pigment types, Light reaction - Red drop and Emerson's enhancement effect, photosystems I & II, cyclic and non-cyclic Electron transport and Photophosphorylation, significance of light reaction. Dark reaction - C₃ & C₄ cycle and its differences. CAM pathway, Photorespiration and its significance. Factors affecting photosynthesis.

Unit III (Hours:18)

Respiration - Types – Glycolysis; Mechanism of anaerobic respiration, Different types of fermentation (Alcoholic, Lactic, Butyric and Acetic Acid); Aerobic Respiration - Krebs's cycle and its significance. Respiratory Quotient, ETS chain and Chemiosmotic hypothesis - ATP energy Budget - Factors affecting respiration.

Unit IV (Hours:18)

Nitrogen metabolism - Nitrogen cycle - Nodule formation - Biochemistry of Nitrogen fixation. Biosynthesis of Amino Acids - Reductive amination and Transamination - Protein synthesis. Fat metabolism - α , β -oxidation and Glyoxylate cycle.

Unit V (Hours:18)

Growth Hormones - Physiological role of Auxin, Gibberellin, Cytokinin and Ethylene. Physiology of Flowering - Photoperiodism and Vernalization - Role of phytohormone in flowering. Plant movements. Physiology of Fruit ripening and Seed germination.

Books for Study:

1. Jain, V.K. 2014. *Fundamentals of Physiology*. S.Chand & Co. New Delhi.
2. Annie Ragland, K.Rajkumar, M.Jayakumar & K.Rajaratnam. 2011., *Plant Physiology*. Saras Publications. Nagercoil.

Books for Reference:

1. Devlin, R. M. and Witham, F. H. 1983. *Plant Physiology*. PWS Publishers.
2. Salisbury, F. B. and Ross. C. 1991. *Plant Physiology*. 4th revised edition, Brooks/ Cole Publishers.
3. Gill, P.S. 2000. *Plant Physiology*. S.Chand & Co. New Delhi.
4. Pandey, S.N.& B.K. Sinha. 2000. *Plant Physiology*. Vikas Publications. New Delhi.
5. Sinha, R.K.2004. *Modern Plant Physiology*. Narosa Publications House. New Delhi.
6. Srivastava, H.N.2005. *Plant Physiology*. Pradeep Publications. New Delhi.

Web Resources:

<https://www.cliffsnotes.com/study-guides/biology/plant-biology>

<https://www.easybiologyclass.com/plant-physiology-free-lecture-notes-online-tutorials/lecture-notes-ppts-mcqs/>

https://onlinecourses.swayam2.ac.in/cec19_bt09/preview

Course Outcomes (CO): On completion of the course, the students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Demonstrate the various Plant water relationships.	K2
CO2	Outline the significance of Photosynthesis and Photorespiration.	K2
CO3	Explain the physiological process that regulates energy metabolism in plants.	K3
CO4	Distinguish Nitrogen and Fat metabolism in plant growth and development.	K4

CO5	Compare the Physiology of dormancy, flowering and seed germination.	K5
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Mapping of COs with POs

POs COs	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	S	S
CO2	S	S	S	S	S
CO3	S	S	S	S	S
CO4	S	S	S	S	S
CO5	S	S	S	S	S

Programme Title : B. Sc. Botany
Course Title : Genetics, Plant Breeding and Evolution
Course Code : 21UBOC9 **Hours/Week : 5**
Semester : VI **Credits: 5**
Course Objectives : The course aims

- To know the role of genes in character determination of an organism.
- To know the change in the gene order, how it brings the change in the external morphology and the characters in an organism.
- To know the production of hybrids
- To know the techniques in hybridization which brings the new varieties.

SYLLABUS

UNIT - I (Hours:15)

Introduction - Designating symbols for genes. Mendel's Laws of inheritance - Monohybrid and Dihybrid cross. Deviations from Mendelian ratio - Allelic and non - allelic gene interactions with plant examples - Multiple alleles - pseudoalleles - isoalleles - polygenic inheritance.

Unit II (Hours:15)

Linkage – complete & incomplete, coupling and repulsion theory. Crossing over - mechanism and theories. Cytological proof for crossing over. Mapping of genes on chromosome - two point and three point test cross. Sex determination - chromosome, genic balance and single gene. Sex linkage - sex linked inheritance.

Unit III (Hours: 15)

Mutation - types - gene mutation - chemical basis (tautomerism, base analogues). Chromosomal aberrations, Polyploids and heteroploids. Extranuclear inheritance - Plastid inheritance, Kappa particles, Male sterility in Maize and its applications.

Unit IV (Hours:15)

Plant breeding - Principles involved in plant breeding - Green revolution. Hybridization techniques. Methods of crop improvement - Introduction and Acclimatization, Selection – Definition and types- mass, pure line and clonal. Breeding for disease resistance. Seed production, Multiplication, Maintenance and testing of improved seeds. Heterosis - its effects and causes.

Unit V (Hours : 15)

Evolution – Evolutionary concepts – Theories of Lamarck, Charles Darwin and the modern synthetic theories. Population genetics – gene pool, gene frequency and Hardy–Weinberg law. Factors affecting gene frequencies.

Books for Study:

1. Verma, P.S. and V.K.Agarwal. 2009. *Genetics*. S.Chand& Co. New Delhi.
2. Singh, B.D. 2001. *Plant Breeding. Principles and Methods*. Kalyani Publications. New Delhi.
3. Kochhar, P.L. 1989. *Genetics and Evolution*. RatanPrakashanMandir, Agra.

Books for Reference:

1. Stansfield, W.D. 1986. *Theory and Problems of Genetics*. McGraw Hill. New York
2. Kochhar, P.L. 1995. *Genetics and Evolution*. Ratan Prakashan Mandir, Agra.
3. Chaudhary, R.C. 2008. *Introduction to Plant Breeding*. Oxford &Ibh Co Pvt Ltd, India.
4. Singh, B.D.2009. *Fundamentals of Genetics*. Kalyani Publications. New Delhi.
5. Gupta, P.K. 2014. *Genetics*. Rastogi Publications. Meerut. India.

Web Resources:

<https://www.thinkswap.com>

<https://www.nature.com>

https://onlinecourses.swayam2.ac.in/cec20_bt06/preview

Course Outcomes (CO): On completion of the course, the students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Outline the fundamental principles of Genetics and traits in plants.	K2
CO2	Choose the concepts of Mendelian inheritance in gene interactions.	K3
CO3	Apply the different concepts of plant breeding and Evolution.	K3
CO4	Categorize the experiments by establishing principles of Genetics.	K4
CO5	Assess the concepts of Mendelian inheritance in gene interactions.	K5

Mapping of COs with POs

POs \ COs	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	S	S

C02	S	S	S	S	S
C03	S	S	S	S	S
C04	S	S	S	S	S
C05	M	S	S	M	S

Programme Title : B. Sc. Botany

Course Title : Plant Ecology

Course Code : 21UBOC10

Hours/Week: 5

Semester : VI

Credits: 5

Course Objectives : The course aims

1. To understand the interactions of abiotic and biotic factors to maintain the ecosystem.
2. To acquire knowledge about the structure of a community along with ecological succession.
3. To study the effects of different types of pollution and its control measures.
4. To impart the knowledge of conservation and management of natural resources.

SYLLABUS

UNIT - I (Hours: 15)

Ecology - its importance. Autecology and Synecology, Abiotic factors – light, temperature, precipitation and wind. Edaphic factors - formation of soil - Soil Profile - Physicochemical properties - Soil erosion and soil conservation.

UNIT - II (Hours: 15)

Biotic factors - relationships among organisms – positive, negative and neutral interactions; Interaction between plants and animals, among plants and between plants and microorganisms. Morphological, anatomical and physiological adaptations of plants - hydrophytes, mesophytes, xerophytes, epiphytes and halophytes.

UNIT - III (Hours: 15)

Community ecology - Definition, characteristics, composition and structure of a community. Ecological succession - Ecosystem - Definition, types - Food chain, Food web, Ecological Pyramid and Energy flow in an ecosystem. Hydrosere and xerosere.

UNIT - IV (Hours: 15)

Pollution - Definition and types; Study of Source, Causes, effects and control measures of air, water and soil pollution. Pollutants - Definition and types.

UNIT - V (Hours: 15)

Management of Plant Biodiversity- Organisations associated with biodiversity management – Methodology for execution – IUCN (International Union for Conservation of Nature and Natural Resources), UNEP (United Nations Environment Programme), UNESCO (United Nations Educational, Scientific and Cultural Organization), WWF (World Wide Fund for Nature/World Wildlife Fund), NBPGR (National Bureau of Plant Genetic Resources), NBA (National Biodiversity Authority): Biodiversity legislation and conservations, Biodiversity information management and communication.

Books for Study:

1. Sharma, P.D. 2013. *Elements of Ecology*. Rastogi Publications, New Delhi.
2. Krishnamurthy, K.V. 2004. *An Advanced Text book of Biodiversity - Principles & Practices*. Oxford & IBH Publications Co. Pvt. Ltd. New Delhi.

Books for Reference:

1. Ambasht, R.S. 1990. *Text Book of Plant Ecology*. 4th Edition. Students friends & Co. Varanasi, India.
2. Chapman, R.S.M. 1995. *Ecology, Principles and Applications*. Cambridge. London.
3. Odum, E.P. 2004. *Fundamentals of Ecology*. Saunders, Philadelphia.
4. Bhatia, K.N. 2005. *A Treatise on Plant Ecology*. Pradeep Publications. Jalandhar.
5. Shukla, R.S. and Chandel, P.S. 2005. *Plant Ecology and Soil Science*. Chand & Co., New Delhi.

Web Resources:

<https://www.yourarticlelibrary.com> > notes >

<https://biologydiscussion.com>

<https://coursehero.com>

Course Outcomes (CO) : On completion of the course, students should be able to

CO Number	CO Statement	Knowledge Level
CO1	Outline the core concepts of Biotic and Abiotic components in environment.	K2
CO2	Apply the characteristics of different plant communities and concepts of Ecological plant succession.	K3
CO3	Analyse different causes of pollution and their remedies.	K4
CO4	Compare the adaptations of Plants in relation to their physical environment.	K5
CO5	Discuss the conservation and management of natural resources	K6

Mapping of COs with POs:

	POs	PO1	PO2	PO3	PO4	PO5
Cos						
CO1		S	S	S	S	S

C02	S	S	M	S	S
C03	M	S	S	S	S
C04	S	S	M	S	S
C05	S	S	M	S	S

Programme Title : B. Sc. Botany

Course Title : ELECTIVE - III Genetic Engineering

Course Code : 21UBOEC3

Hours/Week: 5

Semester : VI

Credits: 5

Course Objectives: The course aims

- To introduce the basics of recombinant technology and to understand cloning vectors. • To understand the application of genetic Engineering in the production of useful by-products for the public benefit.
- To develop scientific research in cloning vectors and Genetic Engineering. • To acquire knowledge about the Transgenic plants, genetically modified microorganisms and Genetically Engineered animals.
- To know about the transformation techniques involved in Genetic Engineering.

SYLLABUS

Unit I (Hours: 15)

Definition, Importance of Genetic Engineering. Restriction Enzymes - Types - Restriction Endonucleases, Exonucleases - Nomenclature and Recognition sequences. Vectors - Definition - Properties of a good vector - Plasmids - Types - F plasmids, R plasmids and Col plasmids, pBR322 and Bacteriophage vectors - M13.

Unit II (Hours: 15)

Cloning - Definition - Steps involved in Cloning - Isolation and preparation of desired DNA; DNA vector - cDNA library, genomic library; Insertion of desired DNA into plasmid; Selection of recombinants - Nucleic acid probes - characteristics, Preparation of probes and its Applications, Screening by nucleic acid hybridization.

Unit - III (Hours: 15)

Transformation Techniques - Direct gene transfer - Micro injection, Electroporation, Liposome mediated gene transfer and shot gun method. Indirect gene transfer - Agrobacterium mediated gene transfer - Methodology - Infection of wounded plants, co cultivation, leaf disc method, advantages and disadvantages.

Unit - IV (Hours: 15)

Genetically modified organisms (GMOs) - Transgenic plants - Herbicide resistance, Insect resistance, virus resistance, Stress tolerance and engineering for delayed ripening of fruits. Applications and Hazards in Genetic Engineering.

Unit - V (Hours: 15)

Engineering microbes for the production of antibiotics and enzymes, Engineering microbes for the production of insulin, growth hormones, monoclonal antibodies, Engineering microbes for clearing oil spills.

Books for Study:

1. Dubey, R.C.2009. *A Text book of Biotechnology*. S.Chand & Co. New Delhi.
2. Smita Rastogi & Neelam Pathak 2009 *Genetic Engineering*. Oxford University Press – India, Bengaluru
3. Sandhya Mitra. 2017 *Genetic Engineering – Principles and Practice*. 2nd Edition Mc.Graw Hill Education, Noida.

Books for Reference:

1. Nicholl. 2006. *Introduction to Genetic Engineering* Cambridge Low Price Edition, 2Joshi, P. 2003. *Genetic Engineering and its Applications*. Students Edition. Jodhpur.
- 3.Singh, B.D.2003. *Biotechnology*. Kalyani publishers. Ludhiana
4. Chawala, H.S.2003. *Introduction to Plant Biotechnology*. 2nd Ed., Oxford & IBH Publishing Company, New Delhi.
5. Joshi, P. 2003. *Genetic Engineering and its Applications*. Students Edition. Jodhpur.

Web Resources:

<https://www.nature.com>

<https://www.cliffnotes.com>

<https://nptel.ac.in/courses/102/103/102103013/>

Course Outcomes (CO): On completion of the course, the students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Interpret the core concepts and fundamentals of Genetic Engineering.	K2
CO2	Choose different steps employed in Gene cloning techniques	K3
CO3	Categorize various methods of Gene transfer.	K4
CO4	Distinguish the concepts and methodologies in Transgenic organisms.	K4
CO5	Elaborate the major concerns and applications of Transgenic technology.	K6

Mapping of COs with POs

POs Cos	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	S	S
CO2	S	S	S	S	S
CO3	S	S	S	S	S
CO4	S	S	M	S	S
CO5	S	S	M	S	S

Programme Title : B. Sc. Botany

Course Title : Elective III – Plant Protection

Course Code : 21UBOESC3

Hours/Week : 5

Semester : VI

Credits: 5

Course Objectives : The Course aims

1. To gain knowledge to prevent losses to crops caused by diseases.
2. To attain professional application to protect plants from diseases.

SYLLABUS

UNIT - I (Hours : 15)

Damage to crops of India by insects, nematodes, rodents, fungi, bacteria and viruses – a general outline.

UNIT - II (Hours : 15)

Types of plant diseases and causal agents. Insect transmission of bacteria and viruses. A general account of preventive measures of plant diseases including plant protection and quarantine measures. Legislations in plant protection, seed certification, weed control.

UNIT - III (Hours : 15)

Study of symptoms, etiology and control measures of the following diseases: damping off of seedling, bud rot of coconut, black rust of wheat, blast of paddy, smut of maize, red rot of sugarcane, Tikka disease of groundnut, wilt of cotton.

UNIT - IV (Hours : 15)

Soft rot of vegetables, Bacterial blight of rice, canker disease of citrus, ring rot of potato.

UNIT - V (Hours : 15)

Plant disease control methods: physical, chemical and biological control. Method of application of fungicides and pesticides.

Reference Books

1. Bap Reddy, D. 1992. Plant Protection in India. Allied Publishers (PP Limited).
2. Saha L.R. 2006. Handbook of Plant Protection. Kalyani Publishers.
3. Craig C. Sheaffer and Kristine M. Moncada. 2012. Introduction to Agronomy-Food crops and Environment (Second Edition), Cengage Learning.
4. Reddy S.R. 2017. Principles of Agronomy, Kalyani Publishers.
5. George Acquah, 2015. Principles of Crop production: Theory, Techniques and Technology, Prentice Hall India Learning Private Limited.

Course Outcomes (CO) : On completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Outline the need for plant protection.	K2
CO2	Apply different methods to prevent loss of crops caused by plant disease.	K3
CO3	Build skills to protect plants from disease.	K6

Mapping of COs with POs

POs Cos	PO1	PO2	PO3	PO4	PO5
CO1	M	S	S	S	S
CO2	M	S	S	S	S
CO3	S	S	S	S	S

Programme Title : B. Sc. Botany

Course Title : Core Practical – V (Plant Physiology, Genetics, Ecology and Genetic Engineering)

Course Code : 21UBOQC5

Hours/Week : 6

Semester : VI

Credits: 2

SYLLABUS

Physiology

The following experiments to be performed and recorded by the students

1. Osmosis in living cells-Potato Osmoscope.
2. Determination of osmotic pressure by plasmolytic method.
3. Determination of diffusion pressure deficit.
4. Determination of transpirational pull.
5. Determination of water transpiration / absorption ratio by weighing method.
6. Separation of plant pigments by paper Chromatography.
7. Rate of photosynthesis under varying CO₂ concentrations in a water plant
8. Rate of photosynthesis under different light intensities in a water plant
9. Measurement of respiration rate in germinating seeds or flower buds using simple respirator.

The following experiments are to be demonstrated only and these experiments also to be recorded in the note book.

1. Imbibition and imbibitional pressure.
2. Membrane permeability affected by chemicals.
3. Study of relative rates of transpiration in different plants- Ganong's Potometer.
4. Comparison of stomatal and cuticular transpiration by cobalt chloride method.
5. Molish injection method.
6. Lever Auxanometer
7. Ascent of sap.
8. Essentiality of light by using Ganong's light screen.
9. Fermentation-Kuhn's experiment.
10. Anaerobic respiration.
11. Nitrification by soil microorganism.
12. Estimation of chlorophyll by Arnon method.

Genetics

Problems on monohybrid, dihybrid, gene interaction and modified dihybrid ratios. Problems on gene mapping.

Ecology

A study of the morphological and structural adaptations of :

Hydrophytes–Hydrilla, Eichhornia, Nymphaea and Typha

Xerophytes –Asparagus, Casuarina and Acacia

Epiphytes - Vanda

Halophytes – Avicennia , Suaeda and Vivipary - Rhizophora

Genetic Engineering

1. Isolation of genomic DNA from plant cell
2. Isolation of plasmid DNA from bacterial cells.
3. Separation of genomic DNA using Agarose gel electrophoresis (Demonstration)

Programme Title	:B.A./ B. Sc./B.Com.	
Course Title	: Non Major Skill Based – II: Herbal Therapy	
Course Code	: 21UBONSC2	Hours/Week : 2
Semester	: VI	Credits: 2

Course Objectives : The Course aims

1. To understand about Indian system of medicine like Ayurveda and Siddha.
2. To acquire knowledge about some herbal remedies for some common ailments.
3. To know about herbal remedies for skin and hair problems.
4. To gain knowledge about Aroma therapy and its uses.

SYLLABUS

UNIT – I (Hours: 6)

Introduction, Basic principles of Ayurveda, Naturopathy and Siddha medicine- Panchabhutas – Tridosha concept – Vatta, Pitta and Kapha dosha.

UNIT – II (Hours: 6)

Preparation of Ayurvedic and Siddha medicine. Herbal remedies for some common infection diseases: Asthma, Chickenpox, Cold, Diarrhoea, Dental care, fever Worms.

UNIT – III (Hours: 6)

Herbal remedies for some common disorders – Menstrual disorder, Hypertension, Jaundice, Diabetics and Ulcer (symptoms, causes and home remedies).

UNIT – IV (Hours: 6)

Symptoms, causes and herbal remedies for Acne, Black heads, Corns, Warts, Boils, Stings and Bites (symptoms, causes and home remedies).

UNIT – V (Hours: 6)

Dandruff, Premature greying and loss of Hair (symptoms, causes and home remedies). Aroma Therapy – Essential oils and its uses and Nutraceuticals.

Books for Study:

1. Jaibala,S. and G. Balakrishnan. 1975. *A Hand Book of Common Remedies Based on Siddha Medicine*. Ed. St. Louis Institute Press, Madras.

Books for Reference:

1. Vaidya Bhagwar Dash, 1978. *Fundamentals of Ayurvedic Medicine*, Konark, Publishers Pvt. Ltd. Delhi.
2. Saha, N.N.1981. *Herbal Remedies*. Universal Publication – New Delhi.
3. Bakhru, H.K. 1992. *Herbs that Heals*. Vision Books Ltd., New Delhi.

4. Prajapati, N.D., S.S. Purohit & U. Kumar.2003. *A Hand Book of Medicinal Plant*. Agrobios Publication, India.
5. Frank, H. & M. Martin. 2006. *Herbal Medicine and Botanical Medicinal fads*. Viva Books Pvt., Ltd., New Delhi.
6. Despandey, D.J.2008. *A Handbook of Herbal Remedies*. Agrobios, Jodhpur, India.

Web Resources:

<https://www.ayusante.com> > articles

Course Outcomes (CO) : On completion of the course, students should be able to

CO Number	CO Statement	Knowledge Level
CO1	Apply the practice of using herbs and their remedies to maintain health and cure diseases.	K3
CO2	Categorize Indian system of medicine such as Ayurveda, Siddha, Unani and Naturopathy.	K4
CO3	Choose different herbal remedies for skin and hair care.	K5
CO4	Improve skills in better usage of herbal medicines.	K6
CO5	Prioritize about Aromatherapy and its applications.	K5

Mapping of Cos with Pos

Pos \ Cos	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	S	S
CO2	S	S	S	S	S
CO3	S	S	S	S	S
CO4	S	S	S	S	S
CO5	S	S	S	S	S

Question paper pattern for MAJOR and ALLIED

Time: 3Hrs.

Max. Marks: 70

SECTION - A (20x1=20)

Twenty compulsory questions covering all the five units.

SECTION - B (5x4=20)

Five questions with internal choice (i.e) either or type. Each carries 4 marks. One question from each unit

SECTION - C (3x10=30)

Out of five THREE have to be answered (open choice). One from each unit.

Question paper pattern for NME/NMSB

Time: 3Hrs.

Max. Marks: 70

Computer based Test for Non major elective and Non Major Skill Based. 70

Compulsory Objective type questions. 14 from each unit. Each carries one mark.

CIA distribution for B.Sc. Botany and Allied Botany (Theory, Major and Skill Based Practicals)

Theory	Internal -30 Marks Test - 5 Internal components -15 Model examination- 5 Attendance – 5	External - 70 Marks Duration - 3 Hrs
Total	30	70
Practical	Internal -40 Marks Test - 20 Class performance - 10 Viva-Voce -10	External - 60 Marks Duration - 3 Hrs Record - 10 Practical - 50
Total	40	60