NALLAMUTHU GOUNDER MAHALINGAM COLLEGE, POLLACHI

DEPARTMENT OF BOTANY

SYLLABUS – 2023 Batch

Programme Code	**B.Sc.,**	**Programme Title**	**Bachelor of Science (BOTANY)**
Course code	**23UBY101**	**Course Title**	**2023-2026**
		CORE COURSE I- PLANT DIVERSITY I (PHYCOLOGY, MYCOLOGY AND BRYOLOGY)	**Semester 1**
Hrs/Week: 5			**Credits 4**

Course Objective

1.To understand the morphology, structure, life cycle of the selected forms of Algae, Fungi, Lichens and Bryophyte.
2.To appreciate the diversity of lower plants
3.To learn the evolutionary trends in the lower plants

Course Learning Outcome

After successful completion of this course, the student should be able to

K1	CO1	To differentiate lower plants like Algae, Fungi, Lichens and Bryophytes
K2	CO2	To understand the morphology and lifecycle of Algae, Fungi, Lichens, Bryophyte
K3	CO3	To apply different classification systems to appreciate the diversity of lower plants
K4	CO4	To identify the economically important Algae, Fungi, Lichens and Bryophytes
K5	CO5	To appreciate the progressive evolution observed in the lower plant group

Mapping

PO /PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	H	M	M	M	M	H	H	H	H	H
CO2	H	H	M	M	M	H	H	H	H	H
CO3	H	H	M	M	M	H	H	H	H	H
CO4	H	H	H	L	-	H	H	H	H	H
CO5	H	H	H	M	-	H	H	H	H	H

High; M-Medium; L-Low

Unit	Content	Hrs
Unit I	General characters of algae - Classification of algae (Fritsch) – Distribution, structure, reproduction and life cycle of the following: Cyanophyceae (*Nostoc*), Chlorophyceae (*Oedogonium, Chara*) and Phaeophyceae (*Sargassum*).	**15**
Unit II	Distribution, structure, reproduction and life cycle of the following: Rhodophyceae (*Polysiphonia*) and Bacillariophyceae (*Cyclotella* &*Pinnularia*) - ***Economic importance of algae**.	**15**
Unit III	General characters of Fungi - Mode of nutrition - Classification of Fungi (Alexopoulos, 1972) - ***Economic Importance of Fungi** - Structure, reproduction and life cycle of Zygomycetes- *Mucor*, Ascomycetes – *Penicillium*, Yeasts	**15**
Unit IV	Structure, reproduction and life cycle of Basidiomycetes - *Puccinia*. Lichens: Occurrence, Morphology, structure, Reproduction and Economic importance.	**15**
Unit V	General characters and classification of Bryophytes (Reimers), Distribution, structure, development and reproduction of *Riccia*, *Anthoceros* and *Polytrichum*.	**15**

**Self study topics*

Power point Presentations, Seminar ,Quiz, Assignment

Text Books:

1. Smith, G.M., 1971. Cryptogamic Botany Vol. I Algae & Fungi. Tata McGraw HillPublishing Co., New Delhi.
2. Smith, G.M., 1971. Cryptogamic Botany Vol. II Bryophytes &Pteridophytes. TataMcGraw Hill Publishing Co., New Delhi.
3. Sharma O.P. 1992. Text book of Thallophytes. McGraw Hill Publishing Co., NewDelhi.

Reference Books:

4.Sharma P. D. 1991. The Fungi, Rastogi& Co., Meerut

5. Hirendra Chandra Gangulee, Kumuel Shankar Das Chittatosh Datta, 1968. 3rdEdn.College Botany Vol. I & II, New central book agency, Calcutta.

6.Dube H. C. 1990. An introduction to Fungi. Vikas Publishing House Pvt. Ltd., Delhi.

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Programme Code	B.Sc.,	Programme Title	Bachelor of Science (Zoology)
Course code 23UZY1A1		Course Title	2023-2026
		GENERIC ELECTIVE- I ALLIED : BOTANY (PLANT DIVERSITY, ANATOMY, EMBRYOLOGY AND PLANT PATHOLOGY)	Semester 1
Hrs/Week 6			Credits 3

Course Objective

- To appreciate the diversity in lower plants
- To understand the anatomy of angiosperms
- To teach important plant diseases, causal organisms and control.

Course Outcome

K1	CO1	To recollect the existing diversity among lower plants
K2	CO2	To understand the internal structure of angiosperms
K3	CO3	To know the embryo development and fertilization in higher plants
K4	CO4	To analyze the economically important plant diseases and their control measures
K5	CO5	To obtain the skill of technically draw the plant tissues

Mapping

PO /PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	H	H	H	M	L	H	H	H	H	H
CO2	H	H	H	M	L	H	H	H	H	H
CO3	H	H	H	M	M	H	H	H	H	H
CO4	H	H	H	-	-	H	H	H	H	H
CO5	H	H	H	-	-	H	H	H	H	H

igh; M-Medium; L-Low

Unit	Content	Hrs
Unit I	**Plant Diversity:** Structure, life history and ***economic importance** of the following types: Algae: *Spirulina*, *Spirogyra*, *Sargassum* Fungi: *Mucor* and *Polyporus*, Lichens- General characters, structure and Economic importance-Life history of *Usnea*	**18**
Unit II	A brief account of the structure, reproduction and life cycle of the following genera (excluding development of sex organs): Bryophyte: *Riccia*, Pteridophyte: *Lycopodium* and Gymnosperm: *Cycas*.	**18**
Unit III	**Anatomy:** Simple permanent tissues – parenchyma, collenchyma and sclerenchyma - complex tissues – xylem and phloem - cambium – Primary structure of dicot stem (*Tridax*), monocot stem (*Sorghum*), dicot root (Bean), monocot root (*Zea mays*), Internal	**18**

	structure of dorsiventral and isobilateral leaf. Normal secondary thickening in dicot stems (*Polyalthia*).	
Unit IV	**Embryology:** Anther structure – Microsporogenesis – male gametophyte – ovule structure – megasporogenesis - 8 nucleate embryo sac – double fertilization and triple fusion – endosperm (nuclear and cellular) – structure of dicot and monocot embryos (development excluded) –polyembryony - parthenocarpy.	**18**
Unit V	**Plant Pathology:** Plant diseases – classification – host – pathogen types and interaction – disease cycle – symptoms & control measures of - viral disease (TMV) - bacterial disease (citrus canker) - fungal disease (red rot of sugarcane).	**18**

Text Books:

1. Hirendra Chandra Gangulee, Kumuel Shankar Das Chittatosh Datta, 1968. 3rdEdn.College Botany Vol. I & II, New central book agency, Calcutta.
2. Pandey B.P, 1986, Text Book of Botany (College Botany) Vol I and II, S.Chand andco. New Delhi.
3. *Narayanaswamy*, R.V & Rao, K.N .1976. *Outlines of Botany*, S. Viswanthan. Printers& Publishers, Madras.
4. Bhojwani, S.S. and Bhatnagar, S.P., 2009. The embryology of angiosperms, Vikaspublishing house pvt Ltd., New Delhi.
5. Pandey, B.P., 1987. Plant anatomy, 4thEdn., S. Chand & Company, New Delhi.

Reference Books:

6. Gilbert, M. Smith, 1972. Cryptogamic botany: Algae and Fungi, Vol I. 2ndEdn. TataMcGraw Hill Publishing Ltd., New Delhi.
7. Krishnamoorthy, K.V. and K.N. Rao, 1984. Angiosperms, Viswanathan printers pvtLtd., Chennai.
8. Hirendra Chandra Gangulee and Ashok Kumar Kar, 1970. College Botany Vol II.New Central Book Agency, Calcutta.
9. Katherine Esau, 1953. Plant anatomy, 2ndEdn, Wiley Eastern pvt. Ltd., New Delhi.
10. Vashishta, P.C., 1997. Botany for degree students – Pteridophytes Part IV, S. Chand& Company Ltd., New Delhi.
11. Reinert J. and Bajaj, Y.P.S., 1988. Applied and Fundamental aspects of Plant cell andtissue organ culture, Narosa Publishing house, New Delhi.

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Programme Code	B.Sc.,	Programme Title	Bachelor of Science (BOTANY)	
Course code 23UBY202		Course Title		2023-2026
		CORE COURSE II- PLANT DIVERSITY II (PTERIDOPHYTES, GYMNOSPERMS AND PALAEOBOTANY)		Semester 2
Hrs/Week 5				Credits 4

Course Objective

- To study the morphology, life cycle and economic value of selected Pteridophytes, Gymnosperms
- To learn the concept of Evolution and Paleobotany
- To revisit the geological time scale with respect to the plant group

Course Outcome

K1	CO1	To appreciate the morphology and lifecycle of Pteridophytes and Gymnosperms
K2	CO2	To understand the concepts of evolution, Palaeobotany and evolution of land plants
K3	CO3	To identify the economically important Pteridophytes and Gymnosperms
K4	CO4	To study the fossil plants and their fructifications
K5	CO5	To compare the evolutionary trends that exist in anatomical and reproductive structures in Pteridophytes and Gymnosperms

Mapping

PO /PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	H	H	M	L	-	H	H	H	H	H
CO2	H	H	M	L	-	H	H	H	H	H
CO3	H	H	H	-	-	H	H	H	H	H
CO4	H	H	M	-	L	H	H	H	H	H
CO5	H	H	M	-	L	H	H	H	H	H

High; M-Medium; L-Low

Unit	Content	Hrs
Unit I	**Pteridophytes:** General characters and classification of Pteridophytes (Reimers) – stelar evolution – heterospory and origin of seed habit – structure, development and reproduction of Psilotopsida (*Psilotum*)and Lycopsida *(Lycopodium)*	**15**
Unit II	Structure, development and reproduction of Ligulopsida (*Selaginella*) and Filicopsida (*Gleichenia).****Economic importance of Pteridophytes**.	**15**
Unit III	**Gymnosperms:** General characters and classification of Gymnosperms (Sporne, 1965) – structure, development and reproduction of *Cycas*.	**15**
Unit IV	Structure development and reproduction of *Gnetum* – affinities of *Gnetum* with Angiosperms ***Economic importance of Gymnosperms**.	**15**
Unit V	**Palaeobotany:** Geological time scale – fossils –fossilization– kinds of fossils – detailed study of *Rhynia,, Lepidodendron, Lepidocarpon, Lepidostrobus* and *Williamsonia*.	**15**

**Self-study topics*

Power point Presentations, Seminar, Quiz, Assignment,

Text Books:

1.Smith, G.M., 1971. Cryptogamic Botany Vol. II Bryophytes & Pteridophytes. TataMcGraw Hill Publishing Co., New Delhi.

2.Hirendra Chandra Gangulee, Kumuel Shankar Das Chittatosh Datta, 1968. 3rdEdn.College Botany Vol. II, New central book agency, Calcutta.

3.Sporne K.R. 1991. The morphology of Gymnosperms. B.I. Publications Pvt. BombayCalcutta, Delhi.

Reference Books:

4. Sharma O.P. 1992. Text book of Pteridophyta, Macmillan India Ltd., New Delhi.
5. Wilson, N.S. and Rothwell, G.W. 1993. Palaeobotany and the evolution of plants (2ndedition), Cambridge University Press, UK.

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I

Programme Code	B.Sc.,	Programme Title	Bachelor of Science (BOTANY)
Course code	23UBY203	Course Title	2023-2026
		CORE COURSE LAB I – (PLANT DIVERSITY I & II)	Semester 2
Hrs/Week 2			Credits 4

Course Objective

- To get hands on knowledge on microbial culture techniques
- To understand the plant diversity, thallus organization of selected forms
- To learn about the fossilized plant forms and Plant evolution.

Course Outcome

K1	CO1	To revise the morphology and reproductive structures in Algae, Fungi, Lichens, and Bryophyte
K2	CO2	To understand the internal structures and spore bearing parts of selected lower plant forms
K3	CO3	To prepare micro sections and to identify fossil specimen and slides
K4	CO4	To compare the life cycles of Algae, Fungi, Lichens, Bryophytes, Pteridophytes and Gymnosperms
K5	CO5	To professionally draw plant sketches

Mapping

PO /PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	H	H	H	M	-	H	H	H	H	H
CO2	H	H	H	M	M	H	H	H	H	H
CO3	H	M	H	M	M	H	H	H	H	H
CO4	H	H	H	H	H	H	H	H	H	H
CO5	H	H	H	-	-	H	H	H	H	H

igh; M-Medium; L-Low

Unit	Content	Hrs
Unit I	A detailed study of thallus organization and reproductive structures of the following forms: **Algae** – *Nostoc, Oedogonium, Chara, Sargassum, Polysiphonia, Cyclotella* and *Pinnularia*. **Fungi** - *Mucor, Penicillium,*Yeast and *Puccinia.* **Lichen** –*Usnea.*	**6**
Unit II	A detailed study of morphology, anatomy and structure of vegetative & spore bearing parts of the following genera: **Bryophytes** -*Riccia, Anthoceros* and *Polytrichum.*	**6**

Unit III	A detailed study of morphology, anatomy and structure of vegetative & spore bearing parts of the following genera: **Pteridophytes** – *Psilotum, Lycopodium, Selaginella* and *Gleichenia.*	**6**
Unit IV	A detailed study of morphology, anatomy and structure of vegetative & spore bearing parts of the following genera: **Gymnosperms** - *Cycas* and *Gnetum.*	**6**
Unit V	A detailed study of the following fossil genera *Rhynia Lepidodendron, Lepidocarpon, Lepidostrobus* and *Williamsonia* from fossil specimen/parts or slides.	**6**

Preparing micro sections and mounting, Spotters, Specimen, Slides.

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Programme Code	B.Sc.,	Programme Title	Bachelor of Science (Zoology)
Course code 23UZY2A2		Course Title	2023-2026
		GENERIC ELECTIVE II- ALLIED: BOTANY (TAXONOMY OF ANGIOSPERMS, PHYSIOLOGY, HORTICULTURE, PHARMACOGNOSY & PLANT BIOTECHNOLOGY)	Semester 2
Hrs/Week 6			Credits 3

Course Objective

- To know the diversity, utility and physiology flowering plants
- To learn the available horticultural techniques to raise new plantlets
- To understand the basics of plant biotechnology

Course Outcome

K1	CO1	To appreciate the morphology and lifecycle of selected Angiosperms
K2	CO2	To understand the concepts of Plant functions
K3	CO3	To identify flowering plants and medicinal plants in their habit.
K4	CO4	To explain different cutting, layering, grafting, budding methods to propagate different plant plants
K5	CO5	To evaluate and learn the basic concept of Plant Biotechnology

Mapping

PO /PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	H	M	H	H	-	H	H	H	H	H
CO2	H	H	H	M	-	H	H	H	H	H
CO3	H	H	H	H	M	H	H	H	H	H
CO4	H	M	M	H	M	H	H	H	H	H
CO5	H	H	M	M	H	H	H	H	H	H

igh; M-Medium; L-Low

Unit	Content	Hrs
Unit I	**Taxonomy of Angiosperms:** Plant Morphology (Terms only) - Vegetative and floral characters and Economic importance of the following families: Annonaceae, Rutaceae, Fabaceae, Rubiaceae, Acanthaceae, Asteraceae, Lamiaceae, Amarantaceae, Euphorbiaceae and Cannaceae.	**18**
Unit II	**Physiology:** Photosynthesis – A brief account of light and dark reactions with reference to C3 plants – Respiration – glycolysis, krebs cycle, oxidative phosphorylation –Nitrogen Cycle- Growth regulators – auxins, gibberellic acid and ABA – Senescence.	**18**

Unit III	**Horticulture:** Seed propagation- asexual propagation and its advantages – cutting, layering, grafting and budding – ***hydroponics** – bonsai.	**18**
Unit IV	**Pharmacognosy**: Introduction – definition, history and scope – Plant sources of drugs –Organized and unorganized drugs Classification and Adulteration of crude drugs.	**18**
Unit V	**Plant Biotechnology:** Introduction to plant tissue culture totipotency – micropropagation – meristem culture – Haploids – Synthetic seeds – Cryopreservation – Gene transfer medthods – Transgenic plants – Bt cotton and ***Golden rice**.	**18**

**Self-study topics*

Power point Presentations, Seminar ,Quiz, Assignment

Text Books:

1. Hirendra Chandra Gangulee, Kumuel Shankar Das Chittatosh Datta, 1968. 3rdEdn.College Botany Vol. I & II, New central book agency, Calcutta.
2. Susil Kumar Mukerjee, 1984. College botany, Vol.III. New Central Book agency,Calcutta.
3. Jain, V.K., 1974. Fundamentals of plant physiology, 6th Edn., S. Chand & CompanyLtld., New Delhi.

Reference Books:

4. George, H.M., Lawrence, 1958. Taxonomy of vascular plants. The Macmillan Company, Newyork.
5. Pandey, B.P. 1997. Economic botany, C. Chand & Company Ltd., New Delhi.
6. Salisbury, F.B. and Rose, 1986. Plant physiology, 3rdEdn, C.B.S. Publishers, New Delhi.
7. Kumar, N., Abdul Khader, JBM., M.D. Rangaswami, P. and I.Irullappan, 1993. Introduction to species, Plantations crops, Medicinal and aromatic plants, Rajalakshmi publication, Nagercoil, Tamilnadu, India.
8. Wallils, T.E.,1985. Text book of pharmacognosy, 5thEdn. CBS publishers & distributors, Delhi.
9. Kumaresan, V., 1998. Biotechnology. Tata McGraw Hill Publishing Company Ltd., New Delhi.
10. Ignacimuthu, S.,1996. Applied Biotechnology. Tata McGraw Hill Publishing Company Ltd., New Delhi.

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Programme Code	B.Sc.,	Programme Title	Bachelor of Science (Zoology)
Course code	23UZY2A3	Course Title	2023-2026
		GENERIC ELECTIVE LAB - I ALLIED BOTANY PRACTICAL	Semester 2
Hrs/Week 2			Credits 4

Course Objective

- To know the diversity, morphology, anatomy and reproductive structures of selected lower plants and higher plants.
- To impart the basic plant breeding, horticultural techniques and plant diseases.
- To introduce important medicinal plants and principles of plant biotechnology

Course Outcome

K1	CO1	To identify some selected lower plants and higher plants in their habit
K2	CO2	To understand the internal structure, embryology and physiology of angiosperms
K3	CO3	To illustrate the economically important plant diseases and their control measures
K4	CO4	To prepare micro sections and obtain the skill of drawing the plant tissues technically
K5	CO5	To propagate plants using simple horticultural techniques and to introduce plant tissue culture techniques

Mapping

PO /PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	H	H	H	H	H	H	H	H	H	H
CO2	H	H	H	M	H	H	H	H	H	H
CO3	H	H	M	-	M	H	H	H	H	H
CO4	H	H	H	-	L	H	H	H	H	H
CO5	H	H	H	-	H	H	H	H	H	H

igh; M-Medium; L-Low

Unit	Content	Hrs
Unit I	**Plant diversity** Algae- *Spirogyra*, *Spirulina* and *Sargassum*, Fungi- *Mucor* and *Polyporus*, Lichens - *Usnea*, Bryophyte - *Riccia*, Pteridophyte - *Lycopodium* and Gymnosperm - *Cycas*, Symptoms and causal organisms and control measures of TMV, citrus canker and red rot of sugarcane.	**6**
Unit II	**Plant Anatomy and Embryology** Parenchyma, collenchyma, sclerenchyma, xylem and phloem. Primary structure of dicot stem (*Tridax*), Monocot stem (*Sorghum*), Dicot root, Dorsiventral leaf, secondary structure of dicot stems (*Polyalthia*). Permanent slides - structure of anther, ovule, embryo sac and embryo. **Plant Pathology**-TMV, Citrus canker and Red rot of sugarcane	**6**

Unit III	**Taxonomy of Angiosperms** Morphology – Diagrams - A detailed study of the following families: Annonaceae, Rutaceae, Fabaceae, Rubiaceae, Acanthaceae, Asteraceae, Lamiaceae, Amarantaceae, Euphorbiaceae and Cannaceae.	**6**
Unit IV	**Plant Physiology (Demonstration)** Photosynthesis - test tube and funnel experiment and light screen experiment. Respiration – Ganong's respiroscope (aerobic) and Kuhn's fermentation (anaerobic). **Horticulture:** Charts on cutting, layering and grafting.	**6**
Unit V	**Pharmacognosy & Plant Biotechnology** Resins, gums and mucilage for identification Charts of herbal plants for identification and Plant biotechnology charts.	**6**

Slides, Demonstrations, Simple experiments using apparatus, Power point Presentations

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Programme Code	B.Sc.,	Programme Title	Bachelor of Science (BOTANY)
Course code	23UBY304	Course Title	2023-2026
		CORE COURSE IV- CYTOLOGY, ANATOMY AND EMBRYOLOGY	Semester 3
Hrs/Week 5			Credits 4

Course Objective

- To acquire knowledge about the entire Plant cell, growth and development.
- To know various anatomical features of flowering plants
- To comprehend the important events in embryo development and fertilization.

Course Outcome

K1	CO1	To introduce and enumerate the theories on plant cell, tissues and cell division
K2	CO2	To summarize the anatomy of various plant parts
K3	CO3	To demonstrate the internal structure and embryology of angiosperms
K4	CO4	To compare the growth and developmental pattern of dicots and monocots
K5	CO5	To evaluate the anatomical adaptations of xerophytes and hydrophytes

Mapping

PO /PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	H	H	M	-	-	H	H	H	H	H
CO2	H	H	H	-	-	H	H	H	H	H
CO3	H	H	H	H	-	H	H	H	H	H
CO4	H	H	H	-	-	H	H	H	H	H
CO5	H	H	H	-	-	H	H	H	H	H

High; M-Medium; L-Low

Unit	Content	Hrs
Unit I	Cytology: *Ultra structure of Plant cell. Structure and functions of cell wall – plasma membrane – chloroplast - mitochondria – endoplasmic reticulum. Structure and functions of ribosomes - dictyosomes - nucleus - nucleolus – chromosomes: giant chromosomes: polytene and lamp brush - mitosis	**15**
Unit II	Anatomy: Plant body – meristems - Apical meristem – Shoot and root – theories – Cambium and its functions - permanent tissues - simple and complex – Vascular bundles and its types - differentiation – dedifferentiation – redifferentiation..	**15**
Unit III	Primary structure of stem and root (monocot and dicot) – normal secondary growth in dicot stem and dicot root – anomalous secondary growth in dicot stem (*Boerhaavia)* and monocot stem (*Dracaena*) - dicot root (*Achyranthes*) - wood structure (sap wood & heartwood). Dendrochronology	**15**

Unit IV	Leaf – epidermal tissues – trichomes– stomatal types – internal structure of monocot (Grass) and dicot (*Tridax*) leaves. Anatomy of hydrophytic leaf (*Hydrilla*) and xerophytic leaf (*Casuarina*) – Nodal anatomy	**15**
Unit V	Embryology: Flower - structure and development –anther - microsporangium and microsporogensis – ovules- megasporangium and megasporogenesis (*Polygonum* type) – embryosac - pollination – double fertilization –endosperm – embryo - dicot (*Capsella*) and monocot (*Najas*) – polyembryony - formation of seed – fruit – parthenocarpy.	**15**

**Self-study topics*

Charts, Powerpoint presentation, Seminar, Quiz, Assignment

Text Books:

1. Bhojwani S.S. and Bhatnagar, S.P., 2000. The embryology of angiosperms. 4thedition, Vikas printing houses, New Delhi.
2. Esau K. 1977. Anatomy of seed plants. 2nd edition. John Wiley & Sons, New York.
3. Vashista P.C., 1997. Plant Anatomy, S. Chand & Co., New Delhi.

Reference Books:

4. Fahn A., 1974. Plant Anatomy, 2nd edition. Pergamon Press, Oxford.
5. Pandey B.P., 1985. Plant Anatomy, S and Chand & Co., New Delhi.
6. Maheswari P., 1971. An introduction to embryology of angiosperms. Tata McGrawHill Publishing Co., New Delhi.
7. Swamy B.G.L. and Krishnamurthy, K.V., 1980. From flower to fruit: Embryology ofAngiosperms, Tata McGraw Hill Publishing Co., New Delhi.

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Programme Code	B.Sc.,	Programme Title	Bachelor of Science (BOTANY)
Course code 23UBY3N11		Course Title	2023-2026
		NON MAJOR ELECTIVE I- LANDSCAPE DESIGNING	Semester 3
Hrs/Week 1			Credits 2

Course Objective

- To introduce the scope and essential elements of landscape.
- To learn various garden structures.
- To bring creativity in techniques like Bonsai, Rockery and Flower arrangement

Course Outcome

K1	CO1	To know the Gardening types and features
K2	CO2	To understand the Landscape designing principles
K3	CO3	To analyze the uniqueness of indoor garden
K4	CO4	To explain the methods in flower arrangements, kitchen garden and terrarium
K5	CO5	To develop entrepreneurial skill in nursery management and landscape designing

Mapping

PO /PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	H	M	M	H	M	H	H	H	H	H
CO2	H	M	M	H	L	H	H	H	H	H
CO3	H	H	M	H	M	H	H	H	H	H
CO4	H	H	H	H	H	H	H	H	H	H
CO5	H	M	H	H	H	H	H	H	H	H

igh; M-Medium; L-Low

Unit	Content	Hrs
Unit I	Landscape designing – principles and categories of landscaping - important ornamental plants –Manuring and Irrigation.	**3**
Unit II	Gardening – indoor garden: hanging baskets and terrarium – layout and importance of terrace garden – public garden and its components. Japanese garden	**3**
Unit III	Garden features - Lawn: layout – preparation of land – propagation – irrigation – weeding – pruning.	**3**
Unit IV	Glass house: applications and advantages – water garden - rockery – hydroponics – topiary - bonsai.	**3**
Unit V	Flower arrangement - cut flowers - role of botanical garden - *ex situ, in situ* conservation.dry flower arrangements	**3**

Text Books:

1. Kumar N., 1993. An introduction to horticulture, TNAU, Coimbatore.
2. Mani Bhusan Rao, 1964. Text book of Horticulture. Macmillan India Ltd., Newdelhi.
3. Pratibhatrivedi, 1996. Home Gardening. Indial Council of Agricultural Research, NewDelhi.

Reference Books:

4. George Acquaah, 2004. Horticulture – principles and practices. Prentice Hall of IndiaPvt Ltd., New Delhi.
5. Edmond, 1988. Fundamentals of Horticulture. MCGH Publications New Delhi.
6. Satya P. 2012. Plant Breeding. Books and allied Pvt Ltd. Kolkatta.

Powerpoint presentation, Discussion, Demonstration

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Programme Code	B.Sc.,	Programme Title	Bachelor of Science (BOTANY)
Course code 23UBY3N12		Course Title	2023-2026
		NON MAJOR ELECTIVE I- HERBAL COSMETICS	Semester 3
Hr/Week 1			Credits 2

Course Objective

- To understand the role of herbs as a source of natural and safe cosmetics.
- To learn the principles of Herbal cosmetics
- To explore the herbal remedies for personal care products

Course Outcome

K1	CO1	To recollect the medicinal herbs and the need for herbal cosmetics
K2	CO2	To comprehend the principles behind herbal cosmetics
K3	CO3	To illustrate the various personal care remedies using herbs
K4	CO4	To expose the students to prepare home recipes with available herbs
K5	CO5	To enable the students to become entrepreneur in the field of herbal cosmetics

Mapping

PO /PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	H	M	H	H	H	H	H	H	H	H
CO2	M	H	H	H	H	H	H	H	H	H
CO3	M	M	M	H	H	H	H	H	H	H
CO4	M	M	M	H	H	H	H	H	H	H
CO5	M	M	H	H	H	H	H	H	H	H

igh; M-Medium; L-Low

Unit	Content	Hrs
Unit I	Herbal cosmetics & Cosmeceuticals – introduction – principles – definition – history – advantages of herbal cosmetics over synthetics and limitations	**3**
Unit II	Herbal skin and hair care – basic requirements of skin and hair - disorders of skin and hair – herbal hair preparations.	**3**
Unit III	Botanical source, morphological aspects and cosmetical uses of *Aloe vera*, turmeric, neem, henna, shihakai, amla and coconut oil.	**3**
Unit IV	Herbal natural soap production - herbal glycerine soap - herbal manicure and pedicure	**3**
Unit V	Herbal home recipes – face pack, hair colorant – tooth powder mouth washes	**3**

Powerpoint presentation and Demonstration

Text Books:

1. Babu,S.S., 2000. Herbal cosmetics - Pushkal publishers, Mumbai.
2. Asharam,2002.Herbal Indian perfumes and cosmetics, Sri Satguru publications, NewDelhi, India

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Programme Code	B.Sc.,	Programme Title	Bachelor of Science (BOTANY)
Course code	23UBY3VA	Course Title	2023-2026
		VALUE ADDED COURSE I- GARDEN MANAGEMENT	Semester 3
Hr/Week 1			Grade

Course Objective

- To study the basic principles of gardening
- To learn the techniques of plant propagation
- To know the methods and practices in garden maintenance
- To learn about gardening

Course Learning Outcome

K1	CO1	Recognize the basic principles and components of gardening
K2	CO2	Explain the bio-aesthetic planning and conceptualize flower arrangement
K3	CO3	Apply the techniques for design various types of gardens
K4	CO4	Compare and contrast different garden styles and landscaping patterns
K5	CO5	Prioritize and maintain special types of gardens for outdoor and indoor landscaping

Mapping

PO /PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	H	H	H	H	H	M	H	M	H	H
CO2	H	H	H	M	H	H	L	H	L	H
CO3	H	H	H	M	H	H	H	H	H	H
CO4	H	H	M	H	L	M	M	H	L	L
CO5	H	H	H	H	H	H	H	H	M	M

High; M-Medium; L-Low

Unit	Content	Hrs
Unit I	Scope – divisions of horticulture – methods of vegetative propagation– cutting – layering – grafting.	**3**
Unit II	Gardening – types of garden – indoor garden – kitchen garden – outer garden, vertical garden, public garden. Landscaped layout designing.	**3**
Unit III	Important ornamentals – habits and types – garden components – lawn – glass house – rockery – water garden - topiary.	**3**
Unit IV	Introduction – Green house – Shade house – Mist chamber – Topiary – Bonsai culture	**3**
Unit V	Nursery Management: Manures – composting – vermin composting – use of Hormones – pest and disease	**3**

Text Books:

1. Kumar. N., 1993. An introduction to horticulture, TNAU, Coimbatore.
2. Mani Bhusan Rao, 1964. Text book of Horticulture. Macmillan India Ltd., New Delhi.
3. Sharon Pastor *et al.*, 2010. Basics of Horticulture, Oxford Book Company, Jaipur.
4. Kumar. N., et al., 1993. An introduction to spices, plantation crops, medicinal and aromaticplants. Rajalakshmi publications, Nagercoil.
5. Singh P., 1996. Plant Breeding. Kalyani publishers, New Delhi.
6. Shukla R.S. and P.S. Chandal, 1998. Cytogenetics Evolution and Plant Breeding. Chand &Company Ltd. New Delhi.

Reference Books:

7. George Acquaah, 2004. Horticulture – principles and practices. Prentice Hall of India Pvt Ltd.,New Delhi.
8. Edmond, 1988. Fundamentals of Horticulture. MCGH Publications New Delhi.
9. Satya P. 2012. Plant Breeding. Books and allied Pvt Ltd. Kolkatta.

Programme Code	B.Sc.,	Programme Title	Bachelor of Science (BOTANY)
Course code 23UBY405		Course Title	2023-2026
		CORE COURSE V- BIOCHEMISTRY, BIOPHYSICS & BIOINSTRUMENTATION	Semester 4
Hrs/Week 5			Credits 4

Course Objective

- To know the biomolecules of life
- To understand the biophysical laws governing universe
- To analyze the biomolecules using simple separation techniques

Course Outcome

K1	CO1	To revisit and understand the structure and functions of biomolecules
K2	CO2	To prepare and quantify solutions, biomolecules
K3	CO3	To illustrate the central dogma of molecular biology
K4	CO4	To explain the biophysical forces and laws of thermodynamics
K5	CO5	To know-how the quantification of biomolecules using selected optical techniques

Mapping

PO /PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	H	H	M	L	M	H	H	H	H	H
CO2	H	H	M	L	H	H	H	H	H	H
CO3	H	H	M	M	H	H	H	H	H	H
CO4	H	H	H	M	H	H	H	H	H	H
CO5	H	H	H	M	H	H	H	H	H	H

High; M-Medium; L-Low

Unit	Content	Hrs
Unit I	**Biochemistry**: Introduction to biomolecules - structure, classification, properties and functions of carbohydrates, lipids, proteins and nucleic acids.	**15**
Unit II	Enzymes - classification, nomenclature, properties and functions – factors affecting enzyme activity - mode of action of enzymes – coenzymes- Enzyme inhibitors - irreversible and reversible inhibitors- Assay for enzymes.	**15**
Unit III	Biochemical techniques – basics of weights and measurements – atomic weight, molecular weight, gram molecular weight, equivalent weight, density, specific gravity, expression of solution concentration based on volume (molar, normal, w/v) and weight (molal, ppm, w/w) of the solvent. Units of measurement – SI units – problems on molarities and dilutions –Basics of exponents and	**15**
	logarithms - hydrogen ion concentration – calculation of pH.	

Unit IV	**Biophysics:** Chemical bonds (covalent, non-covalent and ionic) vander waal's forces - laws of thermodynamics - redox potential - redox couple - energy states of atom - spin property of electrons – Pauli's exclusion principle - absorption spectrum in molecules.	**15**
Unit V	**Bioinstrumentation:** Principle, types and uses of pH meter– buffers - Colorimetry - principle and laws (Lambert's and Beer's) – Colorimeter and Spectrophotometer. Centrifugation – principle and types of centrifuges and rotors, differential and density gradient centrifugation - Chromatography (paper, column, thin layer, gas, ion-exchange and affinity) – electrophoresis (AGE & PAGE) – PCR.	**15**

**Self-study topics*

Powerpoint presentation, Seminar, Quiz, Assignment, Demonstration

Text Books:

1.Jain J.L., 1999. Fundamentals of Biochemistry, S. Chand & Company, New Delhi, India.

2.Subramanian P., 2005. Biophysics: Principles and techniques, MJP Publishers, Chennai.

Reference Books:

3.Alberts B., Bray, D.,Lewis, J. Raff, M. Roberts, K. and Watson, J.D.,1998. Molecular biology the cell. 2nd edn.., Garland Pub. Inc., New Delhi.

4.Jayaraman J., 1988. Laboratory Manual in Biochemistry. Wiley Eastern Ltd., New Delhi.

5.Lee P.J. and Leegood, R.C., 1999. Plant Biochemistry and molecular biology. John Wiley & Sons, Chichester, England.

6.Voet, D. and Voet, J.G. 2011. Biochemistry, 4th ed. John Wiley & Sons (Asia) Private Limited.

7.Mark Lorch, 2021. Biochemistry: A very Short Introduction, Oxford University Press.

Web Reference:

http://www.brainkart.com/subject/Plant-Biochemistry_257/

https://www.scribd.com/document/378882955/Plant-Biochemistry-Lecture-Notes

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Programme Code	B.Sc.,	Programme Title	Bachelor of Science (BOTANY)
Course code	23UBY406	Course Title	2023-2026
		CORE COURSE LAB II- (CYTOLOGY, ANATOMY & EMBRYOLOGY&BIOCHEMISTRY, BIOPHYSICS & BIOINSTRUMENTATION)	Semester 4
Hrs/Week 2			Credits 4

Course Objective

- To learn various anatomical features of higher plants
- To know the structure and development of anther, ovary, embryo
- To impart training in basic separation techniques

Course Outcome

K1	CO1	To recollect the internal structure and functions of angiospermic plants
K2	CO2	To understand the working principle of selected instruments
K3	CO3	To demonstrate the developmental details of plant embryo
K4	CO4	To prepare permanent micro sections
K5	CO5	To obtain working knowledge in biochemical techniques

Mapping

PO /PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	H	H	H	M	M	H	H	H	H	H
CO2	L	H	H	L	H	H	H	H	H	H
CO3	H	H	H	L	L	H	H	H	H	H
CO4	M	H	H	M	L	H	H	H	H	H
CO5	L	L	H	M	H	H	H	H	H	H

igh; M-Medium; L-Low

Unit	Content	Hrs
Unit I	**Cytology**: Charts of prokaryotic & eukaryotic cell and cell organelles, DNA, RNA models. Cell division - mitosis	**6**
Unit II	**Anatomy**: Plant parts, cell - tissue types - Stem: shoot apex, primary structure of dicot stem (*Tridax* and *Cucurbita*), monocot stem (*Sorghum*) - normal secondary thickening in a dicot stem (*Thespesia*) - anomalous secondary thickening in *Boerhaavia*and *Dracaena* stems. Leaf: stomatal types, dicot (*Nerium*) and monocot (Grass).Root: root apex, primary structure of dicot root (*Dolichos*), monocot root (*Canna*) - normal secondary thickening in and dicot root (Castor). Anomalous secondary thickening in *Achyranthes* root.	**6**

Unit III	**Embryology**: Flower: Permanent slides on structure of anther, ovule, embryosac and endosperm (coconut and areca endosperm) - embryo dissection (*Tridax* and *Waltheria),* Pollinium dissection (*Calotropis*).	**6**
Unit IV	**Biochemistry & Bioinstrumentation:** • Complementary colours • Verification of Beer's law • Absorption spectrum & Chlorophyll estimation • Standard graph preparation • Estimation of carbohydrate using spectrophotometer • Estimation of sugar using Benedicts reagent	**6**
Unit V	• Leaf pigment separation using TLC and paper chromatography • Separation of cell organelles using centrifuge • Estimation of pH in water samples using pH meter • Preparation of buffers • Working principle of centrifuge, pH meter, colorimeter, spectrophotometer, electrophoresis and PCR.	**6**

Preparation of microsections of selected plants, plant parts and discussing their anatomical details, Separation and Quantification of biomolecules using simple apparatus, Demonstrations

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Programme Code	B.Sc.,	Programme Title	Bachelor of Science (BOTANY)
Course code 23UBY4N22		Course Title	2023-2026
		NON MAJOR ELECTIVE II- REMOTE SENSING AND NATURAL RESOURCE MANAGEMENT	Semester 4
Hr/Week 1			Credits 4

Course Objective

- To study the basic principles of remote sensing techniques
- To understand the role of GIS, GPS in managing Natural resources
- To comprehend the role of national and international agencies

Course Outcome

K1	CO1	To list down the natural resources and biosphere reserves
K2	CO2	To understand the concept of Remote sensing
K3	CO3	To apply remote sensing techniques in Resource management
K4	CO4	To update the recent trends in remote sensing techniques
K5	CO5	To expose students in getting to know the employability in the field of Remote sensing

Mapping

PO /PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	M	M	M	L	H	H	H	H	H	H
CO2	M	M	M	M	H	H	H	H	H	H
CO3	M	H	M	L	H	H	H	H	H	H
CO4	L	H	M	M	H	H	H	H	H	H
CO5	L	H	M	M	H	H	H	H	H	H

High; M-Medium; L-Low

Unit	Content	Hrs
Unit I	Natural resources – Terrestrial and aquatic (Forest and marine resources) – Biodiversity – Concept – Conservation strategies (*in situ* and *ex situ*) – IUCN species status.	**3**
Unit II	Remote sensing – Concept, platforms for remote sensing, satellites, sensors and satellite data products – Interpretation of remotely sensed data-Visual interpretation and digital analysis.	**3**
Unit III	Remote sensing and vegetation studies – Forest mapping-Land cover classification and charge detection studies.	**3**
Unit IV	Remote sensing for marine resource management – Coastal vegetation surveys – Marine pollution monitoring.	**3**
Unit V	Recent trends in remote sensing techniques – Role of GIS (Geographical Information System) and GPS (Global Positioning System), IRNSS – National and International Agencies and their achievements.	**3**

Power point presentations, Quiz,

Text Books:

1. Thomas Eugene Avery and GraydonLennis Berlin, 1992. Fundamentals of Remotesensing and Airphoto Interpretation.
2. Agrawal K. C., 1996. Biological diversity, Agro Botanical Publishers, New Delhi.

Reference Books:

3. Solbris, Van Embden and Van dordt., 1994. Biodiversity and global changes. CABInternational, International Union of Biological Sciences, Wallingford.

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Programme Code	B.Sc.,	Programme Title	Bachelor of Science (BOTANY)
Course code 23UBY4N22		Course Title	2023-2026
		NON MAJOR ELECTIVE II- BIOINFORMATICS	Semester 4
Hr/Week 1			Credits 2

Course Objective

- To introduce classical bioinformatics theory to students
- To focus computer science techniques used in biological studies
- To explore the existing Biological databases and searching tools

Course Outcome

K1	CO1	To introduce Bioinformatics and Biological databases
K2	CO2	To comprehend the origin of life and genetic code
K3	CO3	To know-how the gene finding, protein prediction and genetic algorithm
K4	CO4	To analyze the phylogeny between species using pattern recognition and homology
K5	CO5	To encourage the students to carry out research in the field of Bioinformatics

Mapping

PO /PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	H	H	L	L	H	H	H	H	H	H
CO2	H	H	H	L	H	H	H	H	H	H
CO3	M	H	H	M	H	H	H	H	H	H
CO4	L	H	M	M	H	H	H	H	H	H
CO5	L	M	M	M	H	H	H	H	H	H

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

Unit	Content	Hrs
Unit I	Life - origin and evolution – biomolecules – book of life - genetic code – genomics and proteomics – Human Genome Project.	**3**
Unit II	Introduction to bioinformatics – biological databases and searching tools – virtual library – servers for bioinformatics – IT tools for bioinformatics.	**3**
Unit III	Genetic algorithm – sequence analysis –similarity search- pairwise and multiple sequence alignment – structure prediction.	**3**
Unit IV	Gene finding – protein prediction – tools and databases for biomolecular visualization – drug designing.	**3**
Unit V	Phylogenetic analysis – tools and databases for phylogenetic tree construction – homology – orthology – paralogy – analogy.	**3**

Powerpoint presentations, Quiz

Text Books:

1. Lesk A.M.2002, Introduction to Bioinformatics, Oxford University Press,Oxford.
2. Parthasarathy S., 2008. Essentials of programming in C for life sciences. Ane BooksIndia, New Delhi.
3. Sundararajan S. and R. Balaji, 2002. Introduction to Bioinformatics, Himalaya Publishing House – Mumbai.

Reference Books:

4. Chakraborthy C., 2004. Bioinformatics Approaches and Application. Chawlaoffset printers – Delhi.
5. Westhead D.R., J. Parish and R.M.Twyman, 2003. Bioinformatics (instant notes)Viva books pivate limited – New Delhi.
6. KhanI.A.,and A. Khanum, 2002, Emerging trends in Bioinformatics, Ukaaz Publications.

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Programme code	B.Sc.,	Programme Title	Bachelor of Science (BOTANY)
Course code 23UBY4S2		Course title	2023-2026
		SKILL ENHANCEMENT COURSE-II: NAN MUDHALVAN APTITUDE FOR PLACEMENTS	Semester 4
Hours/week: 2			Credits 2

Course Objectives

- The main aim of introducing ‑Quantitative Aptitude‖ is to develop skills to meet the competitive examinations for better job opportunities.
- Enrich their knowledge and develop their logical reasoning thinking ability.
- Explore and apply key concepts in logical thinking to competitive exams.
- Ability to be comfortable with English in use while reading or listening.
- Improve the verbal ability skill and communicative skills of the students

Course outcome

K1	CO1	To solve the problems easily by using the short-cut method with time management.
K2	CO2	To analyze the problems logically and approach the problems in a different manner.
K3	CO3	To evaluate both deductive and inductive arguments, and identify fallacies in argumentative discourse.
K4	CO4	To develop reading, writing and communication skills in the English language
K5	CO5	To enhance students' problem-solving skills.

Mapping

PO /PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	H	H	L	L	H	H	H	H	H	H
CO2	H	H	H	L	H	H	H	H	H	H
CO3	M	L	L	H	H	H	H	H	H	H
CO4	L	H	M	M	H	H	H	H	H	H
CO5	L	M	M	M	H	H	H	H	H	H

igh; M-Medium; L-Low

Unit	Content	Hrs
Unit I	**Quantitative aptitude:** Vedic mathematics- number system- missing number- average- percentage- simple interest- compound interest- probability.	**6**

Unit II	**Data analysis:** Data interpretation (D.I.) - table- D.I.- bar- D.I.- line- D.I.- missing- D.I.-case study.	**6**
Unit III	**Logical reasoning:** Directions test- coding and decoding- number ranking- alphabet numeric sequence puzzles.	**6**
Unit IV	**General English:** Reading comprehension- order of sentences- fillers-propositions- conjunctions- exercisers on error spotting.	**6**
Unit V	**High-level reasoning**: Puzzle- Statement arguments- statement assumption- statement conclusion- Statement course of actions.	**6**

Self-study topics

PowerPoint presentations, Quiz, Aptitude questions.

Text books

1. Aggarwal R.S., Quantitative Aptitude, S. Chand & Company Ltd, Ram Nagar, New Delhi, 2013.
2. Aggarwal R.S., A Modern Approach to Logical Reasoning, Company Ltd, Ram Nagar, NewDelhi, 2018.

Reference Books

3. Wren and Martin., English for Competitive Examinations. S. Chand Publishing house, NewDelhi., 2020.
4. Arun Sharma., How to Prepare For Data Interpretation for CAT ., 8th Edition., Noida,Uttar Pradesh –India., 2023.

Web Resources:

https://www.toppr.com/guides/quantitative-aptitude/
https://affairscloud.com/aptitude-questions-data-analysis-set-1/
https://www.indiabix.com/logical-reasoning/questions-and-answers/
https://www.smartkeeda.com/Verbal_Reasoning/Puzzle_Test_Quiz/Multiple_Ques_Type/newest/all/passage/PT_Set_No_79/

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Programme code	B.Sc.,	Programme Title	Bachelor of Science (BOTANY)
Course code 23UBY4S2		Course title	2023-2026
		SKILL ENHANCEMENT COURSE-II: NAN MUDHALVAN PLACEMENT READINESS	Semester 4
Hours/week: 2			Credits 2

Course Objectives

- Meet the expectation of Recruiters
- Overcome anxiety and stress
- Build your own resume documentation and other communicative letters.
- Develop overall personalities full of confidence and self-esteem.
- Develop a level of excellence in all-round soft skills / interpersonal skills.

Course outcome

K1	CO1	To emphasise on a set of practices and carrier developments
K2	CO2	To improve your interpersonal skills at workplace.
K3	CO3	To create a professional network and build trust within those relationships.
K4	CO4	To assist them in creative thinking abilities.
K5	CO5	To enhance survival and management skills.

Mapping

PO /PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	H	H	L	L	H	H	H	H	H	H
CO2	H	H	H	L	H	H	H	H	H	H
CO3	M	L	L	H	H	H	H	H	H	H
CO4	L	H	M	M	H	H	H	H	H	H
CO5	L	M	M	M	H	H	H	H	H	H

igh; M-Medium; L-Low

Unit	Content	Hrs
Unit I	The opportunities in the specific field- professional grooming- E-mail etiquette.	**6**
Unit II	Communication skill enhancement- interpersonal skills development.	**6**

Unit III	Develop effective networking- Professional resume preparation- cover letter documentation.	**6**
Unit IV	Interview and group discussion- self-motivations- leadership skill enhancements	**6**
Unit V	Managing stress- empathy- goal setting and effective time management skill.	**6**

***Self-study topics*

Quiz, Aptitude questions, language skill enhancement (speaking, reading, writing)

Text Books

1. Archana Ram., Placementor: tests of aptitude for placement readiness- 1 July 2018.
2. Praxis Groups., campus recruitment complete reference – 3 January 2022.

Reference Books

1. Dr. Bharat Bhushan Singh., Winning campus placement: Your Guide to Ace the Campus Selections, October 2020.

Web Resources:

https://www.talinstitute.com/placement-readiness-enhancement-program/#1559069799107-cd7d472c-a406de2a-1250c02d-a269
https://recruit.hct.ac.ae/webforms/ManageJD.aspx?jd=1475

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Programme Code	B.Sc.,	Programme Title	Bachelor of Science (BOTANY)
Course code 23UBY4VA		Course Title	2023-2026
		VALUE ADDED COURSE II- CUT FLOWERS AND BONSAI	Semester 4
Hours/week: 1			Grade

Course Objective

- To Identify and select different propagation methods of cut flowers.
- To know the latest development in the field of Bonsai.
- To develop skills in the area of designing, styles and making of bonsai.
- To create knowledge on self-employment through and entrepreneur skills.

Course Learning Outcome

K1	CO1	Identify metrological instruments and understand the diversity within the profession of Floriculture following safety precautions.
K2	CO2	explain the bio-aesthetic planning and conceptualize flower arrangement
K3	CO3	Understand the necessary skills to take care and maintain a Bonsai plant.
K4	CO4	Apply knowledge on Bonsai cultivation and marketing.
K5	CO5	Implement the acquired knowledge on commercial applications Bonsai

Mapping

PO /PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	H	H	H	H	H	M	H	M	H	H
CO2	H	H	H	M	H	H	L	H	L	H
CO3	H	H	H	M	H	H	H	H	H	H
CO4	H	H	M	H	L	M	M	H	L	L
CO5	H	H	H	H	H	H	H	H	M	M

H-High; M-Medium; L-Low

Unit	Content	Hrs
Unit I	Introduction, important and scope of floriculture. Preparation of ground and beds for planting specific flower crops. Harvesting, conditioning and storage of cut flowers.	**3**
Unit II	Commercial horticulture – extraction of jasmine concrete – papain – bonsai – flower arrangement – cut flowers – preservation of fruits and vegetables.	**3**
Unit III	Introduction - history, aim, scope and importance of Bonsai - Identification and collection of suitable plants for bonsai making.	**3**
Unit IV	Tools, containers, wiring and preparation of media. Designing, Styles and making of bonsai. Training and pruning techniques in bonsai. Irrigation, pest and disease management.	**3**

Unit V	Styles of Bonsai - Upright Style, Formal Upright, Informal Upright Style, Slanting Style, Windswept Style and Broom Style.	**3**

Text Books:

1. Kumar. N., 1993. An introduction to horticulture, TNAU, Coimbatore.
2. Mani Bhusan Rao, 1964. Text book of Horticulture. Macmillan India Ltd., New Delhi.
3. Sharon Pastor *et al.,* 2010. Basics of Horticulture, Oxford Book Company, Jaipur.
4. Kumar. N., et al., 1993. An introduction to spices, plantation crops, medicinal and aromatic plants.Rajalakshmi publications, Nagercoil.
5. Singh P., 1996. Plant Breeding. Kalyani publishers, NewDelhi.
6. Shukla R.S. and P.S. Chandal, 1998. Cytogenetics Evolution and Plant Breeding. Chand & CompanyLtd. New Delhi.

Reference Books:

7. George Acquaah, 2004. Horticulture – principles and practices. Prentice Hall of India Pvt Ltd., NewDelhi.
8. Edmond, 1988. Fundamentals of Horticulture. MCGH Publications New Delhi.
9. Satya P. 2012. Plant Breeding. Books and allied Pvt Ltd. Kolkatta.

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Programme Code	B.Sc.,	Programme Title	Bachelor of Science (BOTANY)
Course code	23UBY507	Course Title	2023-2026
		CORE COURSE VII- TAXONOMY OF ANGIOSPERMS & ECONOMIC BOTANY	Semester 5
Hrs/Week 5			Credits 4

Course Objective

- To learn nomenclature systems and to identify the plants
- To introduce modern trends in taxonomy
- To know the economic uses of plants

Course Outcome

K1	CO1	To introduce and list down the technical terms used in taxonomy
K2	CO2	To understand the principle and classification of angiosperms
K3	CO3	To illustrate and identify the flowering plants of the campus
K4	CO4	To explain the herbarium preparation techniques
K5	CO5	To update the Botanical nomenclature, norms and digital taxonomy

Mapping

PO /PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	H	H	H	M	M	H	H	H	H	H
CO2	H	H	H	M	M	H	H	H	H	H
CO3	H	M	H	M	L	H	H	H	H	H
CO4	H	M	H	H	L	H	H	H	H	H
CO5	H	L	M	H	H	H	H	H	H	H

igh; M-Medium; L-Low

Unit	Content	Hrs
Unit I	Introduction to plant taxonomy – principles - morphology and technical terms used in taxonomy (root, stem, leaf, inflorescence, flowers and fruits) – Systems of classification – natural (Bentham & Hooker) and artificial (Linnaeus) and APGA - merits and demerits.	**15**
Unit II	Botanical nomenclature - ICBN (ICN) – typification - author citation - valid publication - herbarium techniques – floras - *Botanical survey of India (BSI) and its function. Modern trends in taxonomy - digital taxonomy – chemo taxonomy - online herbaria - *Royal botanical garden.	**15**
Unit III	Detailed study of the range of characters and economic importance of the families: **Polypetalae**: Annonaceae, Capparidaceae, Rutaceae, Anacardiaceae, #Fabaceae, Cucurbitaceae and Apiaceae. **Gamopetalae**: Rubiaceae, Apocynaceae, Asteraceae, #Asclepiadaceae, Scorphulariaceae, Acanthaceae, and #Lamiaceae..	**15**

Unit IV	Detailed study of the range of characters and economic importance of the families: **Monochlamydeae**:Amaranthaceae, Euphorbiaceae. **Monocots:**#Orchidaceae, Cannaceae, #Liliaceae, Arecaceae, and Poaceae. #*Pollination mechanisms to be included.*	**15**
Unit V	**Economic Botany:** Economic value of the plants that yield fibres, timber, dye, forage, food, grains, pulses, spices, beverages, latex, gums, resins, oils and ornamental plants.	**15**

**Self-study topics*

Field study, Identification of plants in the campus, Herbarium preparation

Text Books:

1. Chopra G.L., 2004 Angiosperm (Systematics and life cycles), Pradeep publications.Jalandhar.
2. PandeyB.P., 1997. Taxonomy of angiosperms. Chand and Co. Ltd. New Delhi.
3. PandeyB.P., 1980.Economic Botany, Chand and Co. Ltd. New Delhi.

Reference books:

4. SharmaO.P., 1993. Plant taxonomy, Tata McGraw-Hill Education,
5. VasishtaP.C., 1994. Taxonomy on angiosperms. S. Chand & Co., New Delhi
6. Gamble J.S.1967. Flora of Madras, Vol. I, II & III. Govt. of India.
7. Jeffrey C., 1976. An introduction to plant taxonomy. Allied publication.
8. Lawrence .G.H.M., 1964. An introduction to plant taxonomy, Central Book dept.,Allahabad.
9. Porter C.L., 1969. Taxonomy of flowering plants. Eurassia Publication House, NewDelhi.
10. Rendle A.B., 1980. The classification of flowering plants (Vol. 1& 2), Vikas studentsEdn.

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Programme Code	B.Sc.,	Programme Title	Bachelor of Science (BOTANY)
Course code	23UBY508	Course Title	2023-2026
		CORE COURSE VIII- GENETICS & EVOLUTION	Semester 5
Hrs/Week 5			Credits 4

Course Objective

- To learn the principles and theories of inheritance
- To know the concepts of classical and modern genetics
- To update the concepts and theories on Prokaryotic and Eukaryotic expression

Course Outcome

K1	CO1	To revise the Mendelian Genetics
K2	CO2	To understand the concept of gene and molecular basis of heredity
K3	CO3	To learn the significance of Meiosis
K4	CO4	To analyze the causes of mutation and DNA repair mechanisms
K5	CO5	To summarize the theories of evolution and origin of life

Mapping

PO /PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	L	H	M	M	M	H	H	H	H	H
CO2	M	H	M	M	M	H	H	H	H	H
CO3	M	H	L	M	M	H	H	H	H	H
CO4	M	H	L	-	H	H	H	H	H	H
CO5	H	H	L	-	H	H	H	H	H	H

igh; M-Medium; L-Low

Unit	Content	Hrs
Unit I	Introduction to Genetics - Mendelian inheritance-***Mendel and his experiments with pea plant** – Mendels'laws - law of dominance – incomplete dominance – law of segregation - law of independent assortment – Monohybrid cross - dihybrid cross - back and test crosses.	**15**
Unit II	Non-Mendelian inheritance –interaction of genes –complementary genes – supplementary genes – duplicate genes - inhibitory genes – polygenic inheritance – multiple alleles and blood groups in man.	**15**
Unit III	Meiosis - crossing over – chromosome maps – linkage – sex linkage – types of sex linkage – sex linked inheritance – cytoplasmic inheritance – chloroplast and mitochondrial inheritance - sex determination – chromosomal – genic balance – hormonal and environmental sex determination.	**15**

Unit IV	Chemical basis of heredity - DNA as genetic material (McCleod and Mc Carty experiments) - RNA as genetic material (Frankel-Conrat experiment) – concept of gene - genetic code - features and properties – prokaryotic (lac operon) and eukaryotic gene	**15**
	expression and regulation	
Unit V	Mutations - causes of mutation - mutagenic agents – gene mutation - DNA repair mechanisms (photo reactivation, excision and recombinational) - chromosomal aberrations - ploidy - significance of polyploidy.Introduction to Evolution – ***origin of life** – theories of evolution – Lamarck, Darwin and Hugo De Vries – Wisemann theory.	**15**

**Self-study topics*

Powerpoint presentation, Slides, Quiz, Seminar, Assignment

Text Books:

1. Sinnot, Dunn and Dobshansky, Principles of Genetics. McGraw Hill Pub.
2. Verma P. S. and V. K. Agrawal. 2004. Cell Biology, Genetics, Molecular Biology, Evolution and Ecology. S. Chand & Company Ltd., New Delhi.
3. Chawala H. S. 2002. Introduction to Plant Biotechnology. Oxford & IBH Publishing Company, New Delhi.
4. Gifford, E. M. and Foster, A.S. 1989. Morphology and evolution of vascular plants. W.H. Freeman & Co., Newyork.

Reference Books:

5. Verma P. S. and V. K. Agrawal. 2006. Genetics. S. Chand & Company Ltd., New Delhi.
6. Goodenough V., 1992. Genetics, Saunders College publishing.
7. Kenny *et al.*, Gene regulation and its expression. Plenum press.
8. Lawin, Molecular basis of gene expression. Wiley & Sons.
9. Lewin B. 2002. Genes VII. OxfordUniversity Press, Oxford.
10. Snustad D. P. and M. J. Simmons. 2000. Principles of Genetics. John Wiley &Sons,Inc.,
11. Strickberger M. W. 1990. Genetics (3rd Ed.). Macmillan Publishing Company. USA.
12. Watson J.D. *et al.*, Molecular Biology of the gene. The Benjamin/Cummings.

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Programme Code	B.Sc.,	Programme Title	Bachelor of Science (BOTANY)
Course code	23UBY509	Course Title	2023-2026
		CORE COURSE IX- BIOINFORMATICS	Semester 5
Hrs/Week 5			Credits 5

Course Objective

- To introduce classical bioinformatics theory to students
- To focus computer science techniques used in biological studies
- To motivate the students to take-up research in their career

Course Outcome

K1	CO1	To introduce the biological databases and computer languages
K2	CO2	To understand the sequence analysis techniques
K3	CO3	To analyse the structure of proteins with the help of computers
K4	CO4	To distinguish genomics from proteomics
K5	CO5	To encourage the students to take-up research in Bioinformatics and Drug discovery

Mapping

PO /PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	L	M	H	M	H	H	H	H	H	H
CO2	M	H	H	M	H	H	H	H	H	H
CO3	M	H	H	M	H	H	H	H	H	H
CO4	M	H	H	M	H	H	H	H	H	H
CO5	L	H	H	M	H	H	H	H	H	H

High; M-Medium; L-Low

Unit	Content	Hrs
Unit I	Introduction to computers - components of computers – input devices – output devices - storage devices - operating system - DOS/WINDOWS/LINUX - computer languages - machine language – assembly language - high level languages - translators – compilers.	**15**
Unit II	Computer languages for bioinformatics - HTML – structure – tags – formatting – hyperlink – graphics; C language – history – features of C – structure of C program – character set – key words – data types – constants, variables – statements – functions.	**15**
Unit III	Introduction to internet - data communication concept – LAN / WAN / WWW – e-mail & FTP - Bioinformatics - definition - biological database (generalized & specialized) - nucleic acid database - protein database - genome database - bibliographic resources and literature database - bioinformatics servers.	**15**
Unit IV	Searching techniques – ENTREZ - sequence analysis tools - sequence alignment - pairwise alignment (BLAST) – multiple Sequence alignment (CLUSTAL X) - phylogenetic analysis – treebuilding and tree analysis.	**15**

Unit V	Protein prediction - primary structure prediction - secondary structure prediction – bio molecular visualization (RASMOL) – drug discovery - target and lead discovery - Computer Aided Drug designing (CAD).	**15**

**Self-study topics*

Powerpoint presentation, Seminar, Assignment

Text Books:

1. Lesk A.M., 2002, Introduction to Bioinformatics, Oxford University Press,Oxford.
2. Parthasarathy S., 2008. Essentials of programming in C for life sciences. Ane BooksIndia, New Delhi.
3. Sundararajan S. and R. Balaji, 2002 Introduction to Bioinformatics, Himalaya Publishing House – Mumbai.

Reference Books:

4. Chakraborthy C., 2004, Bioinformatics Approaches and Application. Chawla offsetprinters – Delhi.
5. Westhead D.R., J. Parish and R.M.Twyman, 2003. Bioinformatics (instant notes) Viva books pivate limited – New Delhi.
6. KhanI.A. and A. Khanum, 2002, Emerging trends in Bioinformatics, Ukaaz Publications.

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Programme Code	B.Sc.,	Programme Title	Bachelor of Science (BOTANY)	
Course code	23UBY510	Course Title		2023-2026
		CORE COURSE X- BIOSTATISTICS		Semester 5
Hrs/Week 5				Credits 5

Course Objective

- To acquire knowledge on basic arithmetic and biostatistical methods
- To introduce the application of computers in Biostatistics
- To instill confidence among the students in taking up research and opting for interdisciplinary career options

Course Outcome

K1	CO1	To learn the sampling methods and data collection methods
K2	CO2	To understand the role of statistics in solving biological problems
K3	CO3	To illustrate the different statistical methods to study a population
K4	CO4	To analyze and interpret a sample data using various methods
K5	CO5	To encourage students to take up research and other interdisciplinary courses for their higher studies

Mapping

PO /PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	L	H	H	H	H	H	H	H	H	H
CO2	M	H	H	H	H	H	H	H	H	H
CO3	M	M	H	H	H	H	H	H	H	H
CO4	L	M	H	H	H	H	H	H	H	H
CO5	L	H	H	M	H	H	H	H	H	H

High; M-Medium; L-Low

Unit	Content	Hrs
Unit I	Biostatistics – introduction - applications and scope of biostatistics- -variables – sample, population and sampling techniques – Random sampling and Non- random sampling - data-Collection- Primary and secondary data – Tabulation and presentation of data	**15**
Unit II	Processing of data - classification, tabulation; Frequency distribution; Analysis and Diagrammatic representation - line diagram, bar diagram, pie diagram and cartogram; graphic representation.	**15**
Unit III	Measures of central tendency: mean, median and mode - measures of dispersion: range, standard deviation, standard error- coefficient of variation - correlation –degrees of freedom.	**15**
Unit IV	*Theoretical distribution* – binomial, poisson and normal distribution – *Test of significance* - Chi-square test – test for goodness of fit (2x2 contingency table, Yate‘s correction to be	**15**

	omitted) - Student _t' test – ANOVA (one way classification).	
Unit V	Soft wares for biostatistics –SPSS – MS-Excel: spreadsheet – formula bar – calculating standard deviation – correlation – t- test – Chi square test – ANOVA (one way) – Charts and its types – creating charts.	**15**

Note: Special instruction to question setters: In either or type of questions in sections B andC, one must be a problem and the other will be a question for descriptive answer.

**Self-study topics*

Worksheets, Take home assigments, Seminar, Quiz

Text Books:

1. Gurumani, N., 2005. An introduction to Biostatistics. MJP Publishers, Chennai.
2. Alexis Leon and Mathews Leon, 1999. Introduction to computers. Leon Tech World,Chennai.
3. Kapur J.N., 1988. Mathematical Modeling. Wiley Eastern Limited, New Delhi.

Reference Books:

4. ManicavachagomPillay, T.K., T. Natarajan and K.S. Ganapathy, 2006. Algebra Vol.II. S. Viswanathan (printers & publishers) Pvt Ltd., Chennai.
5. Prasad, S., 2001. Elements of Biostatistics. Rastogi publications, Meerut.
6. Edward Batschlet, 1973. Introduction to mathematics for life sciences. SpringerVerlag, New York.
7. Pranab Kumar Banerjee, 2004. Introduction to Biostatistics. S. Chand & CompanyLtd., New Delhi.
8. Schwartz J.T.,1961. Introduction to matrices and vectors. McGraw Hill Book Company, INC., New York.
9. Simons S., 1964. Vector analysis for mathematicians, scientists and engineers. Pergamon press, The Macmillan Company, New York.

Web References:

http://people.uncw.edu/scharff/courses/Biostats/Coursehttps: //www.easybiologyclass.com/biostatistics-free-lecture-notes https://faculty.ksu.edu.sa/

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Programme Code	B.Sc.,	Programme Title	Bachelor of Science (BOTANY)
Course code	23UBY5E1	Course Title	2023-2026
		DISCIPLINE SPECIFIC ELECTIVE I- MICROBIOLOGY AND PLANT PATHOLOGY	Semester 5
Hrs/Week 4			Credits 5

Course Objective

- To know the microbial biodiversity
- To learn the techniques in bacteriology and immunology
- To know plant diseases and its control

Course Outcome

K1	CO1	To appreciate the diversity of microbes
K2	CO2	To understand the basic defence mechanism and concept of Immunology
K3	CO3	To demonstrate the food and water samples for contamination
K4	CO4	To get hands-on training in culturing microbes
K5	CO5	To summarize the economically important plant disease

Mapping

PO /PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	H	M	M	L	H	H	H	H	H	H
CO2	H	H	M	L	H	H	H	H	H	H
CO3	M	M	H	M	H	H	H	H	H	H
CO4	H	H	H	M	H	H	H	H	H	H
CO5	M	M	M	M	H	H	H	H	H	H

High; M-Medium; L-Low

Unit	Content	Hrs
Unit I	**History and Scope of Microbiology-Bacteriology:** Bacteria - morphology and ultra-structure – major features – nutritional types – bacterial respiration - growth and reproduction – ***economic importance** - culture media and pure culture techniques (spread plate, pour plate and streak plate).	**12**
Unit II	**Virology:** Virus – characteristics - ultra structure, shape, - transmission and reproduction (HIV, Rabies & T4 Phage).	**12**
Unit III	**Immunology:** -Disease triangle; Acquired and innate immunity; antigen, antibody and vaccines – antibiotics (penicillin and streptomycin) control of microorganisms - chemotherapy.	**12**

Unit IV	**Food, soil and water microbiology:** microbial flora of fresh food - food spoilage and poisoning (botulism) - ***food preservation**- microbial flora of milk - pasteurization and dairy products - cheese production- production of ethanol, vinegar and citric acid. NMMicrobiology of soil and water - detection of coliforms - MPN and MFT.	**12**
Unit V	**Plant pathology:** Introduction - brief history - classification of plant diseases - Koch's postulate - symptoms, causal organism and control measures of bacterial (citrus canker), fungal (tikka disease of ground nut, paddy blast, and red rot of sugarcane) and viral (TMV) diseases – Physical, chemical and biocontrol of plant diseases	**12**

**Self study topics*

Powerpoint presentation, Field observation of diseased plants, Quiz, Seminar, Assignment

Text Books:

1. Ananthanarayanan and Jayarampanikar, Textbook of microbiology, 2017 (10thEdn.)Universities press, Hyderabad.
2. Pelczar JR., M.J., R.D. Reid and E.C.S. Chan, 1983. Microbiology (4thed.) TataMcGraw Hill Publishing Company Pvt. Ltd., New Delhi.
3. Purohit, S.S., Microbiology – Fundamentals & applications, 2006, Agro Bios (India)..
4. Sharma, .P.D., Plant Pathology, Deep and Deep Publications, New Delhi.

Reference Books:

1. Atlas R.M., 1996. Principles of Microbiology. Wm.C. Brown Publishers
2. Black, J.G., Microbiology –II Edition, Prentice Hall publications.
3. Churchill, Immunobiology- The Immune System in Health and Disease. Livingstonepublication. New York.
4. Hans G. Schlegel, General Microbiology, 7thed, Cambridge Low Price Edns
5. Kenneth J. Ryan, C. George Ray, Sherris Medical Microbiology: An Introduction toInfectious Diseases.
6. Prescott, L.M., Harley JP and Klein DA., 1990. Microbiology. Wan C.Publishers.
7. Rose, A.H., Chemical Microbiology, 3rded, Butterworth World Student Reprints.
8. Salle.A.J., Fundamental Principles of Bacteriology, Tata McGraw Hill.
9. Stanier R., General Microbiology, 5thed, Macmilan Press ltd.

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Programme Code	B.Sc.,	Programme Title	Bachelor of Science (BOTANY)
Course code	23UBY5E2	Course Title	2023-2026
		DISCIPLINE SPECIFIC ELECTIVE I- HERBAL AND ETHNO BOTANY	Semester 5
Hrs/Week 5			Credits 5

Course Objective

- To understand the history, scope and importance of medicinal plants and ethnobotanical science
- To familiarize with common medicinal plants of this region
- To know herbs, herbal products, phytochemical compounds and their medicinal uses

Course Outcome

K1	CO1	To understand the usage of plants for various purposes including therapeutics
K2	CO2	To explore general, principal of Ethnobotany
K3	CO3	To obtain plant use information of indigenous people
K4	CO4	To conserve endangered and endemic plants
K5	CO5	To obtain comprehensive knowledge of various herbal plants and the medicinal values through primitive culture

Mapping

PO /PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	H	H	M	M	H	H	H	H	H	H
CO2	H	H	M	M	H	H	H	H	H	H
CO3	M	M	L	H	M	H	H	H	H	H
CO4	L	M	L	H	M	H	H	H	H	H
CO5	M	M	M	H	M	H	H	H	H	H

H-High; M-Medium; L-Low

Unit	Content	Hrs
Unit I	Pharmacognosy-Definition and history – A general survey of traditional systems of medicines- Siddha- Ayurveda &Unani- Pharmacology-Bioactive substances of medicinal plants-alkaloids, glycosides, oils, resins and steroids.	**15**
Unit II	Drugs obtained from lower plants- (Morphology and Therapeutic uses)Chlorella, Spirulina, Claviceps, Penicillium, Actinomycetes, Lycopodium, Ginkgo and Pinus	**15**
Unit III	Drugs obtained from higher plants (Morphology and therapeutic uses) whole plants- *Eclipta alba*, Roots- *Withania somnifera*, Leaves- *Ocimum sanctum*, Rhizome- *Curcuma aromatica* and *C. longa*, Flowers- *Eugenia caryophyllata*, Fruits-*Emblica officinalis*	**15**

	Seeds- *Myristica fragrans*.	
Unit IV	Ethnobotany- History development & importance . Centers of Ethnobotanical studies in India (AICRFE & FRLHT)- The plants used in Ethnomedicine-e.g *Trichopus zeylanicus* and *Janakia arayalpatra*-Role of Ethnobotany in conservation and sustainable development –Sacred grooves	**15**
Unit V	Plants used by ethnic groups for food, medicines (Ethnomedicine)- beverages, fodder, fiber, resins, oils, fragrances and other uses -NWFP (Non -Wood Forest Produces) used by Tribal and Folk Communities of India- Traditional/indigenous knowledge and its importance	**15**

**Self-study topics*

Field study, Inventory of Campus vegetation, Powerpoint presentations, Seminar, Assignment

Text Books:

1. S.K. Jain, Manual of Ethnobotany, Scientific Publishers, Jodhpur, 1995.
2. S.K. Jain (ed.) Glimpses of Indian. Ethnobotany, Oxford and I B H, New Delhi – 1981
3. S.K. Jain (ed.) 1989. Methods and approaches in ethnobotany. Society of ethnobotanists, Lucknow, India.
4. S.K. Jain, 1990. Contributions of Indian ethnobotany. Scientific publishers, Jodhpur.
5. Cotton C.M. 1997. Ethnobotany – Principles and applications. John Wiley and sons – Chichester
6. Rajiv K. Sinha – Ethnobotany The Renaissance of Traditional Herbal Medicine – INA – SHREE Publishers, Jaipur-1996
7. Faulks, P.J. 1958. An introduction to Ethnobotany, Moredale pub. Ltd. London
8. Gary J Martin, 2008. Ethnobotany A Methods manual, Earth scan, London.

Reference Books:

1. Traditional plant medicines as sources of new drugs. P J Houghton in Pharmacognosy Trease and Evan's.16 Ed .2009
2. Cunningham, A. B. (2001). Applied Ethnobotany. Earthscan publishers Ltd. London & Sterling, VA, USA Cotton, C.M. (1996).

3. Ethnobotany-Principles and application. John Wiley& Sons Ltd., West Sussex, England

4. In vivo and in vitro assays Glimpses of ethnopharmacology 1994 Eds. P Pushpangadan ,VGeorge and U.Nyman 5. Faulks, P.J. (1958).
5. https://www.youtube.com/watch?v=vOm_nyUcTnM

6. https://www.youtube.com/watch?v=V7CUbyfyq1Y

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Programme Code	B.Sc.,	Programme Title	Bachelor of Science (BOTANY)
Course code	23UBY5E3	Course Title	2023-2026
		DISCIPLINE SPECIFIC ELECTIVE I- HERBAL COSMETICS AND COSMECEUTICALS	Semester 5
Hrs/Week 5			Credits 5

Course Objective

- To understand the role of herbs as a source of natural and safe cosmetics.
- To learn the principles of herbal cosmetics
- To expose the students to prepare home recipes with available herbs

Course Outcome

K1	CO1	To recollect the medicinal herbs and the need for herbal cosmetics
K2	CO2	To comprehend the principles behind herbal cosmetics
K3	CO3	To prepare the selected personal care remedies using herbs
K4	CO4	To identify the local plants that can be used up for herbal cosmetics.
K5	CO5	To encourage the students to start-up a small scale Herbal Cosmetic unit

Mapping

PO /PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	M	M	H	H	M	H	H	H	H	H
CO2	M	H	H	H	M	H	H	H	H	H
CO3	M	L	H	H	M	H	H	H	H	H
CO4	H	M	H	H	M	H	H	H	H	H
CO5	M	M	H	H	H	H	H	H	H	H

igh; M-Medium; L-Low

Unit	Content	Hrs
Unit I	Herbal cosmetics – Introduction – principles – definition – history – Advantages of Herbal cosmetics over synthetics and limitations. Process used in the manufacture of cosmetics-Emulsification, Mixing, compaction, Moulding, Packing. Raw materials used in preparation of herbal cosmetics.	**15**
Unit II	Herbal skin care –Skin structure and function - Basic requirements of skin. Herbal products for skin hydration,whitening and ageing - Herbal skin care products: Creams, Lotions, Lipsticks, face packs. Herbal natural soap production process - herbal glycerine soap.	**15**
Unit III	Herbal hair care: Hair structure and function, Keyhair concerns- Hair fall, breakage,split ends and mechanism to solve these issues Basics of formulation development: Emulsions, Shampoo, Conditioners, Gel, Serums and Oils, hair colorant.	**15**
Unit IV	Study of various herbs used in preparation of formulations:A*loe vera*, Carrot, Turmeric, Neem, Citrus peels, Henna, Shihakai, Amla. Almond oil and Coconut oil. Aromatherapy – Tooth powder& mouth washes.	**15**

Unit V	Herbal Manicure and pedicure. General Principles of Quality control and standardization of cosmetics-Raw material control, Packaging material control, finished product control, Shelf testing.	**15**

**Self-study topics*

Field study, Powerpoint presentations, Seminar, Assignment

Text Books:

1. Panda H, 2015. Herbal Cosmetics - Hand Book- Asia Pacific Business Press; 3rdRevised Edition, New Delhi, India
2. Babu,S.S., 2000. Herbal cosmetics - Pushkal publishers, Mumbai.
3. Asharam,2002.Herbal Indian perfumes and cosmetics, Sri Satguru publications, NewDelhi, India

Reference Books:

1. Sharma.P.P.2018. Cosmetics- Formulation, Manufacturing And Quality Control –Vandama Publications, New Delhi, India

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Programme Code	B.Sc.,	Programme Title	Bachelor of Science (BOTANY)
Course code	23UBY5S3	Course Title	2023-2026
		SKILL ENHANCEMENT COURSE III – FOREST BOTANY	Semester 5
Hr/Week 1			Credits 2

Course Objective

- To impart theoretical and practical knowledge in all the areas of forestry
- To educate the students with conservation practices to protect Biodiversity
- To learn and update the Environmental Acts

Course Outcome

K1	CO1	To know the history and types of forests
K2	CO2	To understand the principle of conservation
K3	CO3	To develop interest in marketing of forest products
K4	CO4	To explain the Environmental acts of India
K5	CO5	To enable students to take up research in Forest Botany

Mapping

PO /PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	H	H	M	M	M	H	H	H	H	H
CO2	M	H	M	M	M	H	H	H	H	H
CO3	M	M	L	M	M	H	H	H	H	H
CO4	M	M	M	M	H	H	H	H	H	H
CO5	H	H	M	H	M	H	H	H	H	H

igh; M-Medium; L-Low

Unit	Content	Hrs
Unit I	History of forest development; Forest types of India, Dendrology, Afforestation, Deforestation and Social forestry.	**3**
Unit II	Fundamentals of Wild Life, Forest Pathology, Forest Ecology, Biodiversity & Conservation	**3**
Unit III	Forests Soils: Classification, factors affecting soil formation; physical, chemical and biological properties. Soil conservation. Role of forests in conserving soils.	**3**
Unit IV	Non-Timber Forest Products (NTFPs)\ - Principles and establishment of herbaria and arboreta. Conservation of forest ecosystems. Clonal parks. Marketing and Trade of Forest Produce	**3**
Unit V	Forest laws, necessity; general principles, Indian Forest Act 1927; Forest Conservation Act, 1980; Wildlife Protection Act 1972.Endangered plants, Endemism and Red Data Books.	**3**

Charts, Powerpoint presentation, Demonstration

Text Books:

1. S. Prabhu K. Manikandan , Indian Forestry A Breakthrough Approach to ForestService 7th Edition , Jain Brothers publications, Rajasthan, India.
2. K. P. Sagreiya, Sharad Singh Negi, Forests and Forestry, National Book Trust, India
3. Sharad Singh Negi · Forest Policy and Law, International Book Distributors,Dehradun-India
4. Ajay.S, Rawath , Indian forestry, A perspective, Indus publishing company, NewDelhi

Reference Books:

1. K.T. Parthiban, N. Krishnakumar, M. Karthick - introduction to Forestry &Agroforestry, Scientific publishers, Jodhpur, India
2. Richard P. Tucker -A Forest History of India,SAGE publications, New Delhi, India

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Programme Code	B.Sc.,	Programme Title	Bachelor of Science (BOTANY)
Course code	23UBY5S3	Course Title	2023-2026
		SKILL ENHANCEMENT COURSE III- MUSHROOM CULTIVATION	Semester 5
Hr/Week 1			Credits 2

Course Objective

- To acquire knowledge on identifying edible mushrooms
- To know the mushroom culture techniques
- To encourage the students to start-up a mushroom culture unit

Course Outcome

K1	CO1	To identify edible mushrooms from poisonous ones
K2	CO2	To understand the mushroom cultivation
K3	CO3	To know-how the mushroom culture techniques
K4	CO4	To create interest in preparing mushroom recipes
K5	CO5	To motivate the students to start-up a mushroom culture unit

Mapping

PO /PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	H	H	H	H	M	H	H	H	H	H
CO2	M	M	H	H	M	H	H	H	H	H
CO3	M	M	H	H	M	H	H	H	H	H
CO4	M	M	H	H	M	H	H	H	H	H
CO5	L	M	H	H	H	H	H	H	H	H

igh; M-Medium; L-Low

Unit	Content	Hrs
Unit I	Introduction to mushroom cultivation: General characters, structure and reproduction of mushrooms – Identification of mushrooms- types of mushroom- Poisonous mushroom.	**3**
Unit II	Uses of mushroom: Nutritive and food value, Medicinal value	**3**
Unit III	Mushroom culture techniques: Mushroom shed construction- spawn preparation - medium preparation -spawn running - incubation. Cultivation methods for Button & Oyster mushrooms - disease and control measures.	**3**
Unit IV	Post- harvest operations: Harvesting – storage and preservation – spoilage of mushrooms - packing – marketing.	**3**
Unit V	Mushroom recipes: Mushroom soup, sandwich, gravy, omelette, mushroom chilly, manchurian and briyani.	**3**

Text Books:

1. Nita bahl, 1988. Hand book of mushrooms, Vol. II, IBH publishers.
2. Kanniyan, 1980. Text book of Mushroom, Today and Tomorrow publishers, Chennai.

Reference Books:

3. Pathak V.N., Yadav N. and Gour M., 2000. Mushroom production and processingtechnology, Agrobios (India) Ltd.
4. Chang S.T. and N.A. Hayer, 2002. The biology and cultivation of edible mushrooms.
5. Reeti Singh and U.C. Singh, 2005. Modern Mushroom cultivation, Agrobios (India)Ltd.

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Programme Code	B.Sc.,	Programme Title	Bachelor of Science (BOTANY)
Course code 23UBY5AL1		Course Title	2023-2026
		ADVANCED LEARNER COURSE - I BIOLOGICAL DISASTER – MITIGATION &MANAGEMENT	Semester 5
Hrs/Week SS			Credits 2

Course Objective

- To teach the causes of biological disasters
- To describe the adverse effects of biological disasters
- To suggest the risk reduction and preparedness measures

Course Outcome

K1	CO1	To introduce and define biological disaster
K2	CO2	To know the types of biological disaster
K3	CO3	To acquire knowledge on management of biological disaster
K4	CO4	To explain the legislation on biological disaster
K5	CO5	To summarize the impact of post disaster management

Mapping

PO /PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	…	PSO1	PSO2
CO1	H	H	H	H	H	H	H		H	H
CO2	H	H	H	M	M	M	S		H	M
CO3	M	M	M	H	H	M	M		H	H
CO4	M	M	M	M	L	L	M		M	L
CO5	H	H	H	H	M	H	H		H	M

H-High; M-Medium; L-Low

Unit	Content	Hrs
Unit I	Biological disaster – Introduction – history – definition and types - **Natural disasters**: Flood, Cyclone, Earthquakes, Landslides etc.; **Man-made disasters:** Fire, Industrial Pollution, Nuclear Disaster, Biological Disasters, Accidents (Air, Sea, Rail & Road), Structural failures(Building and Bridge), War & Terrorism etc.	**SS**
Unit II	Biological disasters: Epidemic & Pandemic – classification – Biosafety level (BSL1, BSL2, BSL3 and BSL4) – Biologics (category I, II & III) – Bioterrorism (bacterial and viral) Agro terrorism (plants and animals) - Zoonosis.	**SS**
Unit III	Biological disaster: Mitigation & Management - Disease surveillance - Isolation and quarantine - Outbreak investigation and source control - Hygiene and infection control - Vaccination and chemoprophylaxis -Risk communication.	**SS**
Unit IV	Biological disaster: Legislation - The Water (Prevention and Control of Pollution) Act (1974); The Air (Prevention and Control of Pollution) Act (1981); The Environmental (Protection) Act (1986) and the Rules (1986); Disaster Management Act (2005).	**SS**

Unit V	Case studies in biological disaster management & rehabilitation/re-settlement – Plague, tuberculosis, influenza, chickenpox, Meningitis – Ebola, HIV/AIDS - Malaria, dengue, filaria, chikungunya – Spanish flue, SARS – nCovid19 (Corona virus).	**SS**

Field study, Powerpoint presentations, Seminar, Assignment

Text Books:

1. Waugh, W.L., 2005. Handbook of Disaster Management, Crest Publishing House, New Delhi.
2. Gandhi, P.J., 2007. Disaster Mitigates and Management, Deep & Deep Pub., New Delhi.
3. Rai N. & Singh A.K. (ed), 2008. Disaster Management in India, New Royal Book Comp., Lucknow.

Reference Books:

1. National Disaster Management Guidelines—Management of Biological Disasters, 2008. A publication of National Disaster Management Authority, Government of India. ISBN 978-81-906483-6-3, July 2008, New Delhi.
2. Jeanne Guillemin, ‑Scientists and the History of Biological Weapons: A Brief Historical Overview of the Development of Biological Weapons in the Twentieth Century,‖ EMBO Reports 7, no. S1 (2006): S45–49.

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Programme Code	B.Sc.,	Programme Title	Bachelor of Science (BOTANY)	
Course code	23UBY611	Course Title		2023-2026
		CORE COURSE XII- PLANT PHYSIOLOGY		Semester 6
Hrs/Week 5				Credits 4

Course Objective

- To know the cellular functions of plants
- To understand the physiological functions of plants
- To comprehend the complete Plant metabolism

Course Outcome

K1	CO1	To know the Plant function and Plant movements
K2	CO2	To understand the concept of water potential, water transport
K3	CO3	To demonstrate photosynthesis and respiration in plants
K4	CO4	To enlist various plant growth regulators and stress physiology of plants
K5	CO5	To summarize the theories and concepts of Plant physiology

Mapping

PO /PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	M	H	H	-	H	H	H	H	H	H
CO2	M	H	H	-	M	H	H	H	H	H
CO3	L	H	H	M	M	H	H	H	H	H
CO4	M	H	H	M	M	H	H	H	H	H
CO5	M	H	H	M	H	H	H	H	H	H

igh; M-Medium; L-Low

Unit	Content	Hrs
Unit I	Water relations - water potential and its components - ***osmosis** - plasmolysis – imbibition - absorption of water – absorption of minerals - mineral nutrition.	**15**
Unit II	Transpiration - significance and factors – Stomatal types – mechanism of stomatal movements - theories of ascent of sap - translocation of solutes - Photosynthesis - light and dark reactions C_3 - C_4 pathways - photorespiration.	**15**
Unit III	Respiration - aerobic - glycolysis - Krebs' cycle – electron transport system (ETS) - anaerobic fermentation - Nitrogen metabolism - nitrogen cycle – biological nitrogen fixation - Biosynthesis of aminoacids – fat metabolism – biosynthesis and degradation of fatty acids.	**15**
Unit IV	Plant growth and development - growth regulators – physiological roles of auxins, gibberellins, kinetins,***ethylene and ABA**. Physiology of flowering - photoperiodism – vernalization	**15**

Unit V	Plant rhythms – biological clocks – Plant movements – phototropism – Hydrotropism - seed dormancy – methods of breaking dormancy – seed germination – senescence – types and mechanism of senescence – plant stress and types of stress.	**15**

Powerpoint presentations, Simple Experiments, Demonstrations, Seminar, Quiz, Assignments

Text Books:

1. Verma 1984. Plant physiology. Allied publishers, New Delhi.
2. Jain V.K., 2008. Fundamentals of Plant Physiology. S. Chand & Company Ltd., RamNagar, New Delhi.

Reference Books:

3. Bidwell R.G.S., 1982. Plant physiology. Collier Mac Million International edn.
4. Devlin R.M., 1969. Plant Physiology. CBS Publishers & Distributors.
5. Salisbury Frank and L.W. Ross, 1986. Plant physiology. CBS Publishers
6. Srivastava, 1982. Plant physiology, CBS Publishers & Distributors.

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Programme Code	B.Sc.,	Programme Title	Bachelor of Science (BOTANY)
Course code	23UBY612	Course Title	2023-2026
		CORE COURSE XIII- BIOTECHNOLOGY & GENETIC ENGINEERING	Semester 6
Hrs/Week 5			Credits 4

Course Objective

- To acquire knowledge on plant tissue culture
- To learn the basic principles, tools and techniques in Genetic engineering
- To update the knowledge on Transgenic plants, DNA finger printing and other applications

Course Outcome

K1	CO1	To introduce the concept of totipotency and micropropagation
K2	CO2	To learn the principle of somatic embryogenesis, haploids, synthetic seeds
K3	CO3	To revisit the molecular tools and vectors in genetic engineering
K4	CO4	To understand the principle of gene transfer, blotting techniques and markers
K5	CO5	To summarize the applications of Biotechnology and Genetic Engineering

Mapping

PO /PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	M	H	M	H	H	H	H	H	H	H
CO2	L	H	M	H	H	H	H	H	H	H
CO3	M	H	M	H	H	H	H	H	H	H
CO4	M	H	M	H	H	H	H	H	H	H
CO5	M	H	M	H	H	H	H	H	H	H

igh; M-Medium; L-Low

Unit	Content	Hrs
Unit I	**Plant Biotechnology**: Introduction to plant tissue culture – concept of totipotency and pluripotency – sterilization techniques – solid & liquid medium (MS medium, Whites medium) – Micropropagation – stages of micropropagation – applications. Callus and cell suspension culture – meristem culture.	**15**
Unit II	Somatic embryogenesis – principle and applications of somaclonal variation & cryopreservation. Haploid production – anther culture — protoplast isolation, fusion and culture– somatic hybridization – cybrids- ***synthetic seeds**.	**15**
Unit III	**Genetic engineering** – scope and history - molecular tools in genetic engineering: restriction endonucleases, ligases, phosphatases, methylases, and kinases. Host cells – vectors- nomenclature – properties of good vector – types of vectors – plasmid (T_i, PBR_{322}), bacteriophage (λ phage) – artificial chromosome vectors (BAC) – transposable elements.	**15**

Unit IV	Gene transfer methods: Natural and Direct – *Agrobacterium* mediated gene transfer – DNA hybridization methods – DNA probes – blotting techniques (southern, northern and western blots) – molecular markers (RAPD, RFLP and SNPs) - selectable markers – Reporter genes.	**15**
Unit V	*****Applications: Transgenic plants – disease resistant (*Bt* cotton) – herbicide resistant (round up soya) – golden rice – *Flavr savr* tomato –DNA Finger printing technique and its applications – DNA barcoding – Biochip- DNA vaccine – recombinant DNA safety guidelines – Intellectual Property Rights (IPR)	**15**

**Self-study topics*

Powerpoint presentation, Quiz, Seminar, Assignment, Case study on the DNA finger printing technique

Text Books:

1. Chawla H.S., 2000. Introduction to Plant Biotechnology, Oxford & IBH PublishingCo. Pvt. Ltd, New Delhi.
2. RamawatK.G., 2001. Plant Biotechnology, S. Chand & Company Ltd, New Delhi.
3. Ignacimuthu S., 1996. Applied Plant Biotechnology, TataMcGraw Hill PublishingCompany Ltd, New Delhi.
4. Satyanarayana U., 2005. Biotechnology. Books and Allied (P) Ltd., Kolkata.
5. Dubey R.C., 1995. A text book on Biotechnology (2nd Ed), S. Chand & Company Ltd.,New Delhi.
6. Gupta P. K., 2001. Elements of Biotechnology, Rastogi Publications. Meerut.

Reference Books:

1. Street H.E., 1977. Plant tissue culture, Blackwell Scientific Publications, London.
2. Trigiano R.N. and Gray D.J., 1996. Plant tissue culture – concepts and laboratory exercises. CRC Press, Newyork. Brown T.A., 1995. Gene Cloning- an introduction. Chapman and Hall Publication (3rd Ed).New York.
3. Desmond S.T. Nicholl, 2004. An Introduction to Genetic Engineering (2nd Ed). CambridgeUniversity Press.
4. Freifelder D., 1994.Molecular Biology, Narosa Pub. Inc., Boston, London.
5. Nicholl Desmond S.T., 2002. An Introduction to Genetic Engineering (SecondEdition), CambridgeUniversity Press.
6. Primrose S.B. and Twyman R.M., 2008. Gene Manipulation. Blackwell Pub. USA.

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Programme Code	B.Sc.,	Programme Title	Bachelor of Science (BOTANY)
Course code	23UBY613	Course Title	2023-2026
		CORE COURSE XIV- HORTICULTURE AND PLANT BREEDING	Semester 6
Hr/Week 5			Credits 4

Course Objective

- To study the basic principles of horticulture
- To learn the techniques of plant propagation
- To know the methods and practices in plant breeding

Course Outcome

K1	CO1	To know the methods of vegetative propagation
K2	CO2	To understand the principle behind plant propagation
K3	CO3	To propagate plants using simple horticultural techniques
K4	CO4	To develop interest in flower arrangement, fruit preservation and vegetables
K5	CO5	To encourage students to do consultancy work in Horticulture or to start up a nursey unit.

Mapping

PO /PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	H	H	H	H	M	H	H	H	H	H
CO2	H	H	M	L	M	H	H	H	H	H
CO3	H	H	H	H	H	H	H	H	H	H
CO4	L	H	H	H	H	H	H	H	H	H
CO5	H	H	H	H	H	H	H	H	H	H

igh; M-Medium; L-Low

Unit	Content	Hrs
Unit I	Scope – divisions of horticulture – methods of vegetative propagation – cutting – layering – grafting – manures – fertilizers – irrigation.	**15**
Unit II	Gardening – types of garden – indoor garden – kitchen garden – public garden – important ornamentals – habits and types – garden components – lawn – glass house – rockery – water garden - topiary.	**15**
Unit III	Production technology – growth regulators in horticulture – plant protection measures for horticultural crops – cultivation of vegetables (Brinjal) – fruits (Banana) – flowers (Jasmine) – plantation crops (Tea) – medicinal plants (Sarpagandha).	**15**
Unit IV	Commercial horticulture – extraction of jasmine concrete – papain – bonsai – flower arrangement – cut flowers – preservation of fruits and vegetables.	**15**
Unit V	Plant breeding – objectives – plant selection – plant introduction – hybridization – hybrid vigour – achievements in crop breeding – sugarcane and paddy.	**15**

Text Books:

1. Mani Bhusan Rao, 1964. Text book of Horticulture. Macmillan India Ltd., Newdelhi.
2. Sharon Pastor *et al.,* 2010. Basics of Horticulture, Oxford Book Company, Jaipur.
3. Singh P., 1996. Plant Breeding. Kalyani publishers, NewDelhi.

Reference Books:

4. Kumar N., 1993. An introduction to horticulture, TNAU, Coimbatore.
5. George Acquaah, 2004. Horticulture – principles and practices. Prentice Hall of IndiaPvt Ltd., New Delhi.
6. Edmond, 1988. Fundamentals of Horticulture. MCGH Publications New Delhi.
7. Shukla R.S. and P.S. Chandal, 1998. Cytogenetics Evolution and Plant Breeding.Chand & Company Ltd. New Delhi.
8. Satya P. 2012. Plant Breeding. Books and allied Pvt Ltd. Kolkatta.

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Programme Code	B.Sc.,	Programme Title	Bachelor of Science (BOTANY)
Course code	23UBY6E4	Course Title	2023-2026
		DISCIPLINE SPECIFIC ELECTIVE II – HABITAT ECOLOGY	Semester 6
Hrs/Week 5			Credits 5

Course Objective

- To know the uniqueness of the varying habitats in the biosphere
- To acquire the knowledge about the structure and functions of different ecosystems
- To learn the techniques for environmental assessment and ecological dynamics.

Course Outcome

K1	CO1	To appreciate the various habitats and their vegetation
K2	CO2	To understand the concept of habitats and succession
K3	CO3	To demonstrate the components of different ecosystems
K4	CO4	To know-how the methods of Environmental audits and Environmental Impact Assessment
K5	CO5	To inventor and manage the natural resources using Remote sensing techniques.

Mapping

PO /PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	H	H	M	M	H	H	H	H	H	H
CO2	M	H	S	M	H	H	H	H	H	H
CO3	M	H	M	M	H	H	H	H	H	H
CO4	M	H	H	H	H	H	H	H	H	H
CO5	M	H	L	M	H	H	H	H	H	H

igh; M-Medium; L-Low

Unit	Content	Hrs
Unit I	Introduction to habitat ecology: historical, ecological & evolutionary perspectives - habitat concepts (edge, ecotones, interspersion and juxtaposition) - units of vegetation – ***succession**.	**15**
Unit II	Ecology of major habitats: forest (tropical rain forest, deciduous and coniferous) – scrub jungle and deserts (hot, dry and cold deserts) – grasslands (temperate and tropical).	**15**
Unit III	Ecology of major habitats: aquatic (fresh water - lentic & lotic) – marine (coasts, estuaries, phytoplankton and phytobenthos, mangroves and coral reefs.) – tundra (arctic and alpine).	**15**
Unit IV	Physical and anthropogenic factors influencing habitats - habitat degradation and fragmentation - Environmental Impact Assessment (EIA) - environmental audits - ***Environmental Legislations and Regulations.**	**15**
Unit V	Inventory of unique habitats and their distribution - Remote Sensing (RS) - Geographical Information System (GIS) –Indian Regional Navigation Satellite System (IRNSS)- principles and	**15**

	applications of remote sensing techniques - cover classification and mapping - use and values of GIS approaches to habitat ecology.	

**Self-study topics*

Field study, Inventory of Campus vegetation, Powerpoint presentations, Seminar, Assignment

Text Books:

1. Odum E.P.(ed), 1971. Fundamentals of Ecology, W.B. Saunders Company,Philadelphia.
2. Sharma P.D., 1997. Ecology and Environment, Rastogi Publications, Meerut.
3. Dash M.C., 1993. Fundamentals of Ecology, Tata McGraw Hill, New Delhi.
4. Agarwal K.C., 1989. Environmental Biology, Agro Botanical Publishers (India),Delhi.
5. Ananthakrishnan T.N., 1987.Bioresources Ecology, Oxford and IBH, New Delhi.
6. Kormondy E.J., 1999. Concepts of Ecology, Prentice Hall, New Delhi.

Reference Books:

7. Leonard Ortolano, 1997. Environmental Regulation and impact Assessment. John Wiley & Sons, Inc.
8. Cadogan A. and G. Best, 1992. Environment and Ecology, Nelson Blackie, Glasgow.
9. Lenihan J. and W.W. Fletcher, 1977. Environment and Man, Vol IV. The Chemical Environment, Blackie, London.
10. Pandian T.J., 2000. Biodiversity: Status and Endeavours of India, UNESCO sponsored international workshop on Biodiversity, Ghent University, Belgium, pp. 3-6
11. Subrahmanyam N.S., and Sambamurthy, A.V.S., 2001. Ecology, Narosa Publishing House, New Delhi.

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Programme Code	B.Sc.,	Programme Title	Bachelor of Science (BOTANY)
Course code	23UBY6E5	Course Title	2023-2026
		DISCIPLINE SPECIFIC ELECTIVE II – BIODIVERSITY AND CONSERVATION	Semester 6
Hrs/Week 5			Credits 5

Course Objective

- To learn the concepts of Plant community, distribution and speciation
- To acquire the knowledge on Biodiversity with special reference to western ghats
- To appreciate and follow various conservation strategies

Course Outcome

K1	CO1	To identify the Biodiversity hotspots of the world
K2	CO2	To identify the ethnobotanical perspectives of conservation
K3	CO3	To apply the conservation strategies to protect the western ghats biodiversity
K4	CO4	To explain the international and national efforts to conserve the biodiversity
K5	CO5	To know the employability in the fields of conservation biology

Mapping

PO /PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	H	H	M	M	H	H	H	H	H	H
CO2	M	H	H	M	H	H	H	H	H	H
CO3	M	H	H	L	M	H	H	H	H	H
CO4	L	H	L	M	M	H	H	H	H	H
CO5	H	H	H	M	H	H	H	H	H	H

igh; M-Medium; L-Low

Unit	Content	Hrs
Unit I	Introduction to plant community concepts – Ecads, Ecotypes - Major biomes – Phytogeography - Speciation – Theories on speciation – Age and area hypothesis, Continental Drift theory, Dispersal and migration barriers, concept of endemism, peninsular and inland flora.	**15**
Unit II	Biodiversity - Concept, values, types, threats and loss; IUCN categories of rare, endangered, threatened, extinct species. Biodiversity hotspots – Hotspots in India. Conservation strategies: In situ: Biosphere reserves, National Parks, Sanctuaries, Sacred groves; Ex situ: Botanical gardens, seed bank, Pollen bank and Biotechnological interventions	**15**
Unit III	Western Ghats Biodiversity -Habitat, Resources: Flora and fauna Nilgiri Biosphere Reserve, Anamalai Tiger Reserve, Potential threats: Habitat degradation, Inventorying and Management of Resources in Western Ghats: - environmental audits – Ecotourism – Ecorestoration	**15**

Unit IV	Ethnobotany – History of conservation – Traditional Botanical knowledge -Ethnic tribes of Tamilnadu – (Kadar, Malayalee, Badugars, Thodars, Pulayars) – Conservation practises from local tribes*. Documentation and Interpretation of traditional knowledge, biopiracy, IPR, benefit sharing.	**15**
Unit V	Organizations associated with biodiversity management-IUCN, UNEP, UNESCO, WWF, – Convention on Biodiversity – ENVIS, NBA, and NBPGR;-Biodiveristy Information System – Integrated Taxonomic Information System – GBIF, Species 2000, Tree of life.	**15**

**Self-study topics*

Field study, Powerpoint presentations, Seminar, Assignment

Text Books:

1. AgrawalK. C., 2009. Biodiversity: Concept Conservation and Management, NidhiPublishers, India
2. Krishnamurthy, K.V. 2004. An advanced textbook on Biodiversity: Principles andpractice. Oxford and IBH. Publ. Co. New Delhi.
3. Singh, J.S., Singh, S.P. & Gupta, S.R. 2006. Ecology, Environment and ResourceConservation. Anamaya Publ., New Delhi.

Reference Books:

4. Chapman, J.L. and Reiss, M.J. 1999. Ecology; Principles and Applications. II Ed.Cambridge University Press. New York.
5. Groombridge, B. (Ed.) 1994. Global Biodiversity – Status of the Earth‘s livingresources. Chapman & Hall, London.
6. Melchias,G. 2001. Biodiversity and Conservation. Oxford IBH. New Delhi.
7. Sharma PD. 2001. Ecology and Environment. Rastogi Publications, Meerut.

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Programme Code	B.Sc.,	Programme Title	Bachelor of Science (BOTANY)
Course code	23UBY6E6	Course Title	2023-2026
		DISCIPLINE SPECIFIC ELECTIVE II – ENVIRONMENTAL BIOTECHNOLOGY	Semester 6
Hrs/Week 5			Credits 5

Course Objective

- To learn the biotechnological intervention in abating pollution
- To acquire the knowledge on EIA, Green audit to ensure sustainable
- To educate the alternative sources of energy

Course Outcome

K1	CO1	To comprehend the quality of air, water and soil as per BIS
K2	CO2	To learn the preparation of documents like EIA, EIS, Green audit
K3	CO3	To illustrate the role of bioindicators in monitoring the environment
K4	CO4	To analyse the concepts of bioremediation and biological detoxification
K5	CO5	To evaluate the production and utility of non- conventional energy resources

Mapping

PO /PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	M	H	H	H	H	H	H	H	H	H
CO2	L	H	H	M	H	H	H	H	H	H
CO3	H	H	M	M	H	H	H	H	H	H
CO4	M	H	M	H	H	H	H	H	H	H
CO5	M	H	M	H	H	H	H	H	H	H

igh; M-Medium; L-Low

Unit	Content	Hrs
Unit I	Environmental Biotechnology – Introduction – Scope of Biotechnology in pollution abatement – quality criteria for air, water, soil and noise (BIS) – biological treatment of sewage and solid wastes – biofilters - **Role of Government in pollution control**	**15**
Unit II	Environmental Impact Assessment (EIA) – Risk analysis – EIS – Environmental planning and management – Green audit - Carbon budget- Remote sensing and GIS for resource mapping and management	**15**
Unit III	Biotechnology for pollution assessment and monitoring- biomonitoring – biosensors – biofilms – biochip in Environmental analysis – Bioindicators in pollution monitoring (Bacteria, Algae Lichens and higher plants) – cytotoxicity tests.	**15**
Unit IV	Biodegradation of hazardous wastes (Plastics, microplastics) – xenobiotic compounds and radioactive wastes – bioremediation –	**15**

	phytoremediation – bioleaching – biosorption – biological detoxification	
Unit V	Biomass energy – Biofuels – Biogas – Biological hydrogen production–Solar energy* – wind energy – Tidal energy – Ocean Thermal Energy – Geothermal Energy – Energy audits	**15**

**Self-study topics*

Field study, Powerpoint presentations, Seminar, Assignment, Group Discussion

Text Books: .

1. Chatterji, A.K. 2007. Introduction to Environmental Biotechnology, 2nd ed.Prentice Hall Pvt. Ltd, New Delhi.
2. Indu Shekhar Thakur. 2019. Environmental Biotechnology: Basic concepts andApplications (2nd ed.) Dreamtech Press, Delhi

Reference Books:

1. Ritmann, B. E. and McCarty, P.L. 2020. Environmental Biotechnology: Principlesand Applications (2nd Ed), McGraw Hill, New York.
2. Sunil Khanna and Krishna Mohan (Eds). 1995. Wealth from Waste. Tata EnergyResearch Institute, New Delhi.

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Programme Code	B.Sc.,	Programme Title	Bachelor of Science (BOTANY)
Course code	23UBY6E7	Course Title	2023-2026
		DISCIPLINE SPECIFIC ELECTIVE III – BIOPROSPECTING	Semester 6
Hrs/Week 4			Credits 5

Course Objective

- To understand the current practices in Bioprospecting
- To know the basics and concepts of pharmaceutical bioprospecting
- To learn the marine and microbial metabolites and its applications

Course Outcome

K1	CO1	Understand the basic concepts of bioprospecting
K2	CO2	Learn the assays in medical bioprospecting
K3	CO3	Recognize the value of marine bioresources
K4	CO4	Analyse the techniques and applications of microbial populations
K5	CO5	Summarize the significance of forest products in day-to-day life

Mapping

PO /PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	H	H	M	M	H	H	H	H	H	H
CO2	H	M	M	L	M	H	H	H	H	H
CO3	M	M	M	L	H	H	H	H	H	H
CO4	M	M	M	M	H	H	H	H	H	H
CO5	H	H	M	M	M	H	H	H	H	H

igh; M-Medium; L-Low

Unit	Content	Hrs
Unit I	Bioprospecting: Definition – Introduction - Current practices in Bioprospecting for conservation of Biodiversity and Genetic resources. Bioprospecting Act: Introduction - Phases of Bioprospecting- Exemption to Act. Fields of Bioprospecting.	**12**
Unit II	Medicinal Plants Bioprospecting/ Pharmaceutical Bioprospecting: for new drugs - assays in bioprospecting. Antioxidant assay – NO free radical scavenging assay - Antigenotoxicity assay – MTT assay - Antiviral activities of plants – SRB assay.	**12**
Unit III	Marine Bioprospecting: Sources of marine planktons and their bioprospecting - isolation and cultivation of marine bioresources - isolation of marine yeast and its industrial applications - bioactive chemicals from seaweeds and their applications*.	**12**
Unit IV	Microbial Bioprospecting: Isolation of microbial metabolites and their bio-activity. Endophytic microbial products as antibiotics.	**12**
Unit V	Research Methodology: Separation of secondary metabolites, Pharmacognostic procedures, Authentication of specimens, Preservation of plants and plants products.	**12**

**Self-study topics*

Powerpoint presentations, Seminar, Assignment

Text Books:

1. Thakur, R.S., Puri, H.S. and Husain, A. (1969). Major medicinal plants of India,Central Institute of medicinal and aromatic plants, Lucknow.
2. Swaminathan, M.S. and Kocchar, S.L. (Es.) (1989). Plants and Society, MacMillanPublication Ltd.,
3. Sharma, O.P. (1996). Hills Economic Botany, Tata McGraw Hill co., Ltd., NewDelhi,
4. Kocchar, S.L. (1998). Economic Botany of the tropics, II Edn. MacMillan India Ltd.,

Reference Books:

5. Arora, R.K. and Nayar, E.R. (1984), Wild relatives of crop plants in India, NBPGRScience Monograph No.7.
6. Baker, H.G. (1978), Plants and civilization. Ill Ed. (A. Wadsworth, Belmount).
7. Bole, P.V. and Vaghani, Y. (T986). Field guide to common Indian trees, OxfordUniversity Press, Mumbai.
8. CSIR (1986), the useful plants of India Publication and Information directorate,CSIR^ New Delhi.
9. CSIR (1948 - 1976) the wealth of India, 53

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Programme Code	B.Sc.,	Programme Title	Bachelor of Science (BOTANY)
Course code	23UBY6E8	Course Title	2023-2026
		DISCIPLINE SPECIFIC ELECTIVE III – BIOFERTILIZERS	Semester 6
Hrs/Week 5			Credits 5

Course Objective

- To learn about the bioavailability of plant nutrients
- To comprehend the principles of Nitrogen fixation and Phosphate solubilization
- To learn the utility of Biofertilizers in organic farming

Course Outcome

K1	CO1	To know the microbes that are useful in the production of Biofertilizers
K2	CO2	To understand the various microbial metabolisms in fixing Nitrogen
K3	CO3	To learn know-how techniques of mass production of Biofertilizers
K4	CO4	To realize the role of VAM in Phosphate mobilisation
K5	CO5	To identify the government initiatives in the mass production of Biofertilizers

Mapping

PO /PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	H	H	H	H	H	H	H	H	H	H
CO2	H	M	M	H	H	H	H	H	H	H
CO3	H	M	H	H	H	H	H	H	H	H
CO4	H	M	H	H	H	H	H	H	H	H
CO5	M	H	H	H	H	H	H	H	H	H

igh; M-Medium; L-Low

Unit	Content	Hrs
Unit I	Biofertilizers – Introduction – advantages - factors affecting the efficiency of biofertilizers- carrier materials – inoculants – general account on microbes as biofertilizers.	**15**
Unit II	Nitrogen fixers – Blue Green Algae - Nitrogen fixation by *Anabaena*, *Nostoc*, *Oscillatoria*, *Tolyopthrix* – *Azolla- anabaena* association – Nitrogen fixation – *Azolla* in rice cultivation.	**15**
Unit III	Nitrogen fixers -Bacteria – Symbiotic -*Rhizobium*, *Azospirillum* – *Azospirillum* – isolation and mass multiplication; Rhizobium – Identification, isolation and mass multiplication; Free-living *Azotobacter*, *Klebsiella* – *Azotobacter* – inoculum, mass production.	**15**
Unit IV	Phosphate solubilizers – factors affecting phosphate solubilisation – *Pseudomonas*, *Bacillus megaterium*; Mycorrhizal association – types – occurrence, colonization and inoculum production of VAM – effect on plant growth	**15**

Unit V	Biofertilizers – Application and Marketing– seed treatment, root dipping, soil applications –Role of Government initiatives in promotion of Biofertilizers* - National Project on Development and use of Biofertilizers (NPDB) – Integrated nutrient management.	**15**

**Self-study topics*

Field study, Powerpoint presentations, Seminar, Assignment, Industrial visits

Text Books:

1. Arun K. Sharma, 2004. Biofertilizers for Sustainable Agriculture. Agrobios IndiaLtd, JodhPur.
2. Dahama A.K., 2009. Organic farming for Sustainable Agriculture. Agrobios IndiaLtd,Jodhpur.
3. Mahendra K. Rai, 2005. Hand book of Microbial biofertilizers, The HaworthPress, Inc. NewYork.

Reference Books:

1. Amitava Rakshit, Vijay Singh Meena, Manoj Parihar, H.B. Singh and A.K. Singh.2022.
2. Biofertilizers: Volume 1: Advances in Bio-inoculants. ELSEVIER, WoodheadPublishing, UK.
3. Bhoopander Giri, Ram Prasad, Qiang-Sheng Wu. 2019. Biofertilizers for SustainableAgriculture and Environment. Springer.
4. NIIR Board, 2012. The Complete Technology Book on Bio-Fertilizer and OrganicFarming, II Ed, NIIR Project Consultancy Services, New Delhi.
5. Subbarao, N.S. 2017. Bio-fertilizers in Agriculture and Forestry, IV Ed, Medtech,USA.

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Programme Code	B.Sc.,	Programme Title	Bachelor of Science (BOTANY)
Course code	23UBY6E9	Course Title	2023-2026
		DISCIPLINE SPECIFIC ELECTIVE III – SEED TECHNOLOGY	Semester 6
Hrs/Week 5			Credits 5

Course Objective

- To understand the seed physiology, seed testing and seed storage
- To acquire knowledge on the seed certification procedures
- To learn the role of national agencies in seed development

Course Outcome

K1	CO1	Learn the development of a seed
K2	CO2	Understand the testing procedures for seed purity
K3	CO3	Classify the quality of seeds and certification
K4	CO4	Acquire skills on seed marketing
K5	CO5	Summarize the role of national agencies in seed development

Mapping

PO /PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	H	H	M	M	H	H	H	H	H	H
CO2	H	H	M	M	M	H	H	H	H	H
CO3	M	H	H	L	M	H	H	H	H	H
CO4	M	M	M	M	H	H	H	H	H	H
CO5	H	M	M	M	H	H	H	H	H	H

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

Unit	Content	Hrs
Unit I	Seed technology - history, concepts and scope – types of seed – seed development programme - Role of National seed corporation (NSC), Tarai development corporation (TDC), and State farm corporation (SFC) agencies in development of Indian seed industry.	**15**
Unit II	Seed- Fertilization – embryo genesis and seed formation – development and maturation – seed structure and composition – seed quality characteristics- Seed Farm Management – Breeders seed – terminator seed – seed bank	**15**
Unit III	Seed testing – principles and importance heterogeneity and genuineness – Seed purity test – seed germination test – seed viability test – seed vigour test – seed health test – seed moisture test.	**15**
Unit IV	Seed processing – concepts and principles – methods of seed conditioning – Seed drying and cleaning – Seed treatment – advantages and kinds – Seed storage - principles and methods – factors affecting seed storage – Seed marketing.	**15**

Unit V	Seed Certification – objectives and concepts – function of seed certification agency - General certification standards – Essential qualities of certified seeds - Classes of seed - Seed legislation in India – Seed act – Seed control order – Essential commodity act – Requirement for sale of seeds	**15**

**Self-study topics*

Field study, Powerpoint presentations, Seminar, Assignment

Text Books:

1. Sumati Narayan Rajeev Kumar, Sushil Kumar Swarnkar, Sunil Kumar Singh , 2016.A Text book of seed technology, Kalyani publishers.
2. Phundan Singh, 2013. Principles of seed technology, Kalyani Publications.
3. Agarwal R.L., 2022. Seed technology, 2nd edition, Oxford publishers, NewDelhi.

Reference Books:

1. Amarjit S. Basra, 2008. Handbook of seed science and technology, CRC Press.
2. Jana B.L., 2015. Principles of seed technology, Aavishkar publishers, Jaipur.

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Programme Code	B.Sc.,	Programme Title	Bachelor of Science (BOTANY)
Course code	23UBY614	Course Title	2023-2026
		CORE COURSE LAB III- (for V sem theory papers)	Semester 6
Hrs/Week 2			Credits 4

Course Objective

- To learn the plant systematics and herbarium techniques
- To study the physiological processes in the plant system
- To acquire practical knowledge on plant tissue culture and genetic engineering

Course Outcome

K1	CO1	To appreciate the diversity of flowering plants and their identification in their natural habit
K2	CO2	To get hands-on training in culturing bacteria
K3	CO3	To illustrate the economically important plant diseases
K4	CO4	To solve biological problems using mathematics
K5	CO5	To create interest in learning the applications of Genetic Engineering
K6	CO6	To obtain working knowledge in creating a word document, powerpoint, excel

Mapping

PO /PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	…	PSO1	PSO2
CO1	H	H	M	M	H	H	H	H	H	H
CO2	H	H	M	M	M	H	H	H	H	H
CO3	M	H	H	L	M	H	H	H	H	H
CO4	M	M	M	M	H	H	H	H	H	H
CO5	H	M	M	M	H	H	H	H	H	H

igh; M-Medium; L-Low

Unit	Content	Hrs
Unit I	**Taxonomy of Angiosperms** Detailed study, description of floral parts of the plant families included in theory paper. Field trip, collection of plants and submission of herbarium 20 sheets.	**6**
Unit II	**Genetics and Evolution:** Solving problems on Mendelian inheritance and interaction of genes; charts and diagrams from genetics and evolution.	**6**
Unit III	**Bioinformatics** 1. Programming using HTML 2. Designing and editing of web page 3. Writing programs using C. 4. Searching and retrieval of biological database. 5. Bibliographic searching using ENTREZ 6. Sequence alignment 7. Gene finding 8. Protein prediction 9. Molecular visualization	**6**

Unit IV	**Mathematics for Biologists:** Simple problems on 1. Manipulating numbers 2. Units and conversion 3. Molarities and dilutions 4. Areas and volumes 5. Exponents and logs 6. Matrices and determinants. **Bio- Statistics:** 1. Collection, analysis and graphical representation of data 2. Measures of central tendency - mean, median and mode 3. Measures of dispersion: range, standard deviation, coefficient of variation correlation 4. Test of significance - Chi-square test and Student_t' test. **Application of software in Biostatistics:** 1. Simple exercises in MS- Word 2. Presentation in MS-Powerpoint 3. Statistical calculations and chart preparation in MS-Excel 4. Creation of database in MS-Access.	
Unit V	#**Microbiology &Plant pathology** **Demonstrations:** 1. Microscopy ; 2. Culture media preparation 3. Pure culture techniques (streak, pour and spread plate) **Individual experiments** 1. Smear preparation; 2. Simple staining 3. Differential staining; 4. Hanging drop experiment ***Charts***: Ultra structure of bacterium, HIV, rabies, T_4 phage, antigen and antibody and food and industrial microbiology related charts. Specimens/charts/ of diseases: 1. Citrus canker; 2. Red rot of sugar cane 3. Tikka disease of ground nut; 4. Paddy blast; 5. TMV #**Ethno Botany** 1. Collection, processing and preservation of ethnobotanical specimens 2. Identify and document plant parts used in preparation of crude drugs/herbal formulations #**Herbal Cosmetics and Cosmeceuticals** 1. Preparation of herbal skin care products 2. Preparation of herbal hair care products 3. Herbs used in cosmetics and aroma therapy.	

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Programme Code	B.Sc.,	Programme Title	Bachelor of Science (BOTANY)	
Course code	23UBY615	Course Title		2023-2026
		CORE COURSE LAB IV - (for VI sem theory papers)		Semester 6
Hrs/Week 2				Credits 4

Course Objective

- To acquire basic knowledge in mathematics & biostatistics
- To create programs for bioinformatics
- To understand bioinformatics tools

Course Outcome

K1	CO1	To compare the physiological functions of plants under different environmental conditions
K2	CO2	To know the economically important plants and their produces
K3	CO3	To create interest in rearing plants *in vitro*
K4	CO4	To learn the bioinformatics tools to analyse the protein structure
K5	CO5	To study the vegetation using Quadrat and line transect method

Mapping

PO /PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	H	H	M	M	H	H	H	H	H	H
CO2	H	H	M	M	M	H	H	H	H	H
CO3	M	H	H	L	M	H	H	H	H	H
CO4	M	M	M	M	H	H	H	H	H	H
CO5	H	M	M	M	H	H	H	H	H	H

igh; M-Medium; L-Low

Unit	Content	Hrs
Unit I	**Plant physiology** **Individual experiments:** 1. Estimation of water potential (DPD) by liquid immersion method and plasmolytic method. 2. Estimation of osmotic pressure by plasmolysis. 3. Determination of respiration by respiroscope 4. Determination of stomatal frequency and index. 5. Determination of rate of transpiration - Cobalt chloride, Ganongs potometer. 6. Determination of rate of photosynthesis under different Co_2 concentrations & different light intensities using wilmots bubbler **Plant physiology demonstration experiments:** 7. Light screen experiment 8. Amylase activity 9. Soil nitrification 10. Determination of respiratory quotient	**6**
	11. Essentiality of mineral elements on plant growth – Hydroponics	

Unit II	**Biotechnology & Genetic Engineering:** Charts/spotters on Genetic Engineering and biotechnology Demonstration 1. Media for plant tissue culture 2. Callus induction 3. Regeneration of plantlet 4. Synthetic seeds **Horticulture and Plant Breeding** • Charts and specimens • Demonstration on propagation techniques • Demonstration on fruit/vegetable preservation	**6**
Unit III	**# Habitat Ecology** 1. Vegetation study by Quadrat and Line transect method 2. Estimation of plant biomass 3. Determination of dissolved oxygen 4. Estimation of CO_2 in selected water samples 5. Determination of Total Dissolved Solids 6. Spotters and charts on Habitat ecology. **# Biodiversity and its Conservation** 1. Biosphere reserves 2. Hotspots 3. Sacred groves **# Environmental Biotechnology** 1. Bioindicators 2. Green auditing 3. Biofuels 4. Remote sensing	**6**
Unit IV	**# Bioprospecting** 1. Marine bioproducts 2. Microbial bioproducts 3. Anti-oxidant assay **# Biofertilizers** 1. Mass culture of *Azolla, Rhizobium and Nostoc* 2. Identification and isolation of microbial inoculants **# Seed Technology** 1. Simple tests on seed purity, vigor, viability, germination and moisture content. 2. Seed processing and storage methods	**6**
Unit V	**Internship/ Project** –Short term training/ mini project in the field of entrepreneurial botany and submission of a report.	**6**

Optional papers

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Programme code	B.Sc.,	Programme Title	Bachelor of science (BOTANY)
Course code 23UBY6S4		Course title	2023-2026
		SKILL ENHANCEMENT COURSE-IV: NAN MUDHALVAN ENTREPRENEURIAL BOTANY	Semester 6
Hours/week: 2			Credits 2

Course objectives

- To provide an understanding the essentials of entrepreneurship.
- To introduce organizations and agencies that can backup entrepreneurial initiatives.
- To expose students to various business opportunities emerging around the study of plants.
- To encourage students to built proposals and projects to become an entrepreneur.

Course outcome

K1	CO1	Pragmatically asses the scope of using the knowledge gained in learning Botany for gainful applications by starting own business ventures.
K2	CO2	Evaluate the feasibility designing projects of their own in the model of the various case studies they have investigated in this course.
K3	CO3	work out the breakeven of small scale business ventures and evaluate the feasibility of value additions in the project the break grounds for achieving cost effectiveness
K4	CO4	Tap agencies that can possibly provide full or partial support to kick start their projects that stabilize the same for making their livelihood
K5	CO5	Assess the market worth of their entrepreneurial exercise and clearly rate the viability considering the opportunities and risks matching it with that of their peers and competitors on real time basis.

Mapping

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	H	H	H	H	H	M	H	H	H	H
CO2	H	H	M	H	H	M	H	H	H	M
CO3	H	H	M	L	M	L	M	L	M	L
CO4	H	H	H	H	M	H	M	M	M	L
CO5	H	H	M	H	L	H	H	M	H	M

H-High; M-Medium; L-Low

Unit	Content	Hrs
Unit I	Introduction: Need – definition and concept – Types and characterization – entrepreneurial values – motivation and barriers – entrepreneurship as innovation, risk assessment and solutions.	**6**
Unit II	Bioventure: Industry – overview of Spirulina, Pleurotus sajor-caju, Ganoderma, Lentinusedodes, drumstick and coconut – Straight Vegetable Oil (SVO) and Pure Plant Oil (PPO) - methods and marketing – fresh and dry flowers for aesthetics.	**6**

Unit III	Value added products: Canning of fruits – process and equipment – fruit and vegetable based products (squash) – ready to serve (RTS) (syrup, pulp, paste, ketchup, soup, vegetable sauces, jam and jellies) –bio-fuel production – Bamboo and cane based products – virgin coconut oil, jasmine oil production – nutraceuticals – standards and quality management.	**6**
Unit IV	Organizations and agencies: TIIC, DIC, NABARD, MICROSTAT, DBT – case study – sarvodaya – SIDCO – Micro Small and Medium Enterprises – support structure for promoting entrepreneurship – various government schemes.	**6**
Unit V	Entrepreneurial opportunities: Understanding a market and assessment – selection of an enterprise – business planning – mobilization of resources – Break Even Analysis – project proposal (guidelines, collection of information and preparation of project report) – steps in filing patents – trademarks and copyright – Intellectual Property Rights – export and import license	**6**

Text books

1. Khanna, S.S., 2016. Entrepreneurial development. S.Chand company limited, New Delhi. ISBN:9788121918015.
2. Manohar, D., 1989. Entrepreneurship of small scale industries, vol.III. Deep and deeppublication, New Delhi. ISSN: 09735925.
3. Taneja, S. and Gupta, S.L., 2015. Entrepreneurship development, New venture creation, Galgehapublication company, New Delhi. ISSN: 2321-8916.

Reference Books

1. Desai, V., 2015. Entrepreneurship development, First edition. Himalaya publication house,Mumbai. ISBN: 9789350973837.
2. Lal, G., Siddhapa, G.S. and Tandon, G.L., 1988. Preservation of fruits and vegetables. IndianCouncil of Agricultural Research (ICAR). ISSN: 0101-2061.
3. Ranganna, S., 2001. Hand book of analysis and quality control of fruits and vegetable products,Second edition, Tata mcgraw hill, New Delhi. ISBN: 9780074518519.
4. Cruses, W.V. and Fellows, P.J., 2000. Commercial fruits and vegetable processing. CRC press,United States. ISBN: 9780849308871.

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Programme code	B.Sc.,	Programme Title	Bachelor of science (BOTANY)
Course code 23UBY6S4		Course title	2023-2026
		SKILL ENHANCEMENT COURSE-IV: NAN MUDHALVAN BOTANY FOR COMPETITIVE EXAMINATION	Semester 6
Hours/week: 2			Credits 2

Course Objectives

- To compare different groups of plants and evaluate their economic importance
- To describe the general characters of higher plants.
- To design eco -friendly approaches to protect earth and generate new conservation
- To give knowledge on the different cell organelles with their functions.
- To Identify the cause and solve environmental related issues.

Course outcome

K1	CO1	Identify and define different groups of plants with their taxonomic position Compare the different groups of plants and evaluate their economic importance
K2	CO2	Describe the general characters of Bryophytes, Pteridophytes and Gymnosperms
K3	CO3	Analyze different modifications of plant organs.
K4	CO4	Evaluate the significance of cell division. Justify the cause for the sex linked inheritance
K5	CO5	Elaborate the cause and solution of environmental issues

Mapping

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	H	H	H	H	H	M	H	H	H	H
CO2	H	H	M	H	H	M	H	H	H	M
CO3	H	H	M	L	M	L	M	L	M	L
CO4	H	H	H	H	M	H	M	M	M	L
CO5	H	H	M	H	L	H	H	M	H	M

H-High; M-Medium; L-Low

Unit	Content	Hrs
Unit I	Plant World- Plant science and its branches. Five kingdom classification. Outline of Kingdom plantae General characters and Economic importance of Algae, Fungi and Lichens.	**6**
Unit II	General Characters of Plant Groups-General characters and Economic importance of Bryophytes, Pteridophytes and Gymnosperms Palaeobotany- Types of fossils, Geological time scale, Fossil beds of Tamil Nadu.	**6**
Unit	Plant Morphology and Taxonomy-Root system and shoot system.	**6**

III	Pollination – types, Seed dispersal – types, Seed Germination types. Taxonomy – definition. Types of classification- Taxonomic hierarchy, ICN, Binomial nomenclature and BSI. Herbarium and Major Herbaria of the world.	
Unit IV	Cytology and Genetics- Cell –Prokaryotic and Eukaryotic – Cell organelles with functions. DNA and RNA (Basic concepts) -Cell division and its significance - Mitosis and Meiosis (outline) Mendelism – Monohybrid and Dihybrid cross, Sex linked inheritance.	**6**
Unit V	Ecology and Biodiversity- Ecosystem – abiotic and biotic components. Energy flow in an ecosystem, Afforestation, Deforestation- Chipko movement –-Forest Conservation act- Pollution types and effects- Eutrophication, Global warming, Ozone depletion, Climate change. Endangered plants and Red data Book. Rio -Earth summit. Biodiversity Management Policies - IUCN, UNEP, WWF, ICSU, WCMC.	**6**

Text books

1. Morris, P., Therivel, R. Methods of Environmental Impact Assessment. UCL Press, London,1995.
2. Therivel, R. and Partidario, M.R. The Practice of Strategic Environmental Assessment, Earthscan, London, 1996.
3. Rau, J.G., Wooten, D.C. Environmental Impact Assessment. McGraw Hill Pub. Co., New York,1996.
4. Petts, J. 1999. Handbook of Environmental Impact Assessment, volume 1 and 2, BlackwellScience, Oxford.

Reference Books

1. Jain, R.K., Urban, L.V., Stracy, G.S. Environmental Impact Analysis. Van Nostrand ReinholdCo., New York, 1991.
2. Petts, J. Handbook of Environmental Impact Assessment- Volume 1 and 2. Blackwell Publishers,UK. 2005.
3. Kulkarni, V. and Ramachandra, T.V. Environmental Management, Capital Pub. Co. NewDelhi,2006.
4. Glasson, J. Therivel., R. and Chadwick. A. Introduction to Environmental Impact Assessment.Routledge, London. 2006.

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Programme Code	B.Sc.,	Programme Title	Bachelor of Science (BOTANY)
Course code 23UBY5AL2		Course Title	2023-2026
		ADVANCED LEARNER COURSE - II BIONANOTECHNOLOGY	Semester 6
Hrs/Week: SS			Credits 2

Course Objective

- To impart basic knowledge on the nano level integration of chemistry, physics and biology.
- To learn the concept of biomaterials and biomolecules as bases for inorganic structures.
- To know the role biomolecules as nano widgets.
- To study the diversity of application of nanodevices

Course Outcome

K1	CO1	To study the fundamentals of bionanotechnology.
K2	CO2	To learn the role of biomolecules at nano scale.
K3	CO3	To study the nanomaterials and devices and their functions at cellular level.
K4	CO4	To acquire knowledge on mimicking the biological systems.
K5	CO5	To inculcate the role of nanobots and their diversified application.

Mapping

PO /PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	…	PSO1	PSO2
CO1	H	H	H	H	H	H	H		H	H
CO2	H	M	M	H	H	H	H		M	M
CO3	H	H	H	M	M	M	M		M	M
CO4	M	M	M	L	L	L	M		M	M
CO5	H	H	H	H	H	H	H		H	H

igh; M-Medium; L-Low

Unit	Content	Hrs
Unit I	Introduction to Nanotechnology and Bionanotechnology – Cellular Machines: - Nanomaterials (nanoparticles, nanotubes, nanowires, manocrystals, block co-polymers) and Biomacromolecules (Nucleic acid and protein structure, MAGE).	**SS**
Unit II	Fundamentals of biological systems and bionanotechnology - Sensors - optics, acoustics: ion selective electrodes – gas and enzyme & protein based sensing principles – DNA Amplification, DNA probes and arrays, DNA application and liposomes, fluidics, nanomachining – Biomimetics/biomimicry (superhydrophobic structures-lotus effect)	**SS**
Unit III	Bionanomaterial production - Fabrication techniques, imaging and manipulation tools at the Nanoscale - nanoscale devices and circuits e.g. carbon nanotubes, FETs Quantum dots.	**SS**
Unit IV	Bionano robotics-nano/molecular-communication nano-navigation-nano –scale manipulation and control, nano robots.	**SS**

Unit V	Application of Bionanotechnology- Medicine-pharmaceuticals-Agriculture-Food-Cosmoceutical-Environment.	**SS**

Field study, Inventory of Campus vegetation, PowerPoint presentations, Seminar, Assignment

Text Books:

1. K.K.Jain, Nano Biotechnology, Horizions Biosciences, 2006.
2. Introduction to Nanotechnology, Charles P. Poole, Jr.Frank J. Owens, A John Wiley 81Sons, Inc., Publication, (2003).

Reference Books:

3. Nanobiotechnology: Concepts,Applications and Perspectives (2004),Christof M.Niemeyer (Editor), Chad A. Mirkin (Editor), Wiley VCH.
4. Nanotechnology 101, John Mongillo, Greenwood Press, (2007).

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