

Progressive Education Society's
Modern College of Arts, Science and Commerce (Autonomous),
Shivajinagar, Pune 5

(An Autonomous College Affiliated to Savitribai Phule Pune University)

Framework and Syllabus For

S.Y.B.Sc. (Botany)

(Based on NEP 2020 framework)

(To be implemented from the Academic Year 2025-26)

Level:- 5.0 (Second Year) Sem:III

Course Type	Course Code	Course Title	Credits		Teaching Scheme Hr/Week		Evaluation Scheme and Max Marks		
			TH	PR	TH	PR	CE	EE	Total
Major Core T(2+2 or 4), (T/P)(2)	24ScBotU3101	Archegoniate	2		2		20	30	50
	24ScBotU3102	Reproductive Biology of Angiosperms	2		2		20	30	50
	24ScBotU3103	Lab Course on 24ScBotU3101 & 24ScBotU3102		2		4	20	30	50
VSC P(2)	24ScBotU3501	Herbal Technology		2		4	20	30	50
IKS (T/P)(2)	24ScBotU3901	Ayurvedic Science of Nutrition and Diet	2		2		20	30	50
FP P(2)	24ScBotU3002	Field Project I		2		4	20	30	50
Minor (T/P)(2+2 or 4)	24ScBotU3301	Morphology of Angiosperms	2		2		20	30	50
	24ScBotU3302	Lab Course on 24ScBotU3301		2		4	20	30	50
GE/OE (T/P) (2)	24ScBotU3401	Herbal Medicine		2		4	20	30	50
AEC T(2)	24CpCopU3703	English Communication Skills II	2		2		20	30	50
CC T(2)	24CpCopU3001	Online Course on Yoga	2		2		20	30	50
Total			12	10	12	20			550

Level:- 5.0 (Second Year) Sem:IV

Course Type	Course Code	Course Title	Credits		Teaching Scheme Hr/Week		Evaluation Scheme and Max Marks		
			TH	PR	TH	PR	CE	EE	Total
Major Core T(2+2 or 4), (T/P)(2)	24ScBotU4101	Plant Morphology	2		2		20	30	50
	24ScBotU4102	Plant Anatomy	2		2		20	30	50
	24ScBotU4103	Lab Course on 24ScBotU4101 & 24ScBotU4102		2		4	20	30	50
VSC P(2)	24ScBotU4501	Lab Course on Plant Tissue Culture		2		4	20	30	50
CEP P(2)	24ScCopU4003	Community Engagement Project		2		4	20	30	50
Minor (T/P)(2+2 or 4)	24ScBotU4301	Plant Ecology	2		2		20	30	50
	24ScBotU4302	Lab Course on 24ScBotU4301		2		4	20	30	50
GE/OE (T/P) (2)	24ScBotU4401	Wine Technology	2		2		20	30	50
SEC T(2)	24ScBotU4601	Lab Course on Fruit and Vegetable Processing and Preservation		2		4	20	30	50
AEC T(2)	24CpCopU4701 / 24CpCopU4702	MIL-II (Hindi) / MIL-II (Marathi)	2		2		20	30	50
CC T(2)	24CpCopU4001	Health and Wellness	2		2		20	30	50
Total			12	10	12	20			550

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Second Year of B.Sc. Botany
(2024 Course under NEP 2020)

Course Code: 24ScBotU3101

Teaching Scheme: TH: 2 Hours/Week

Examination Scheme: CIE: 20 Marks

Course Name: Archegoniate (Theory)

Credit: 02

End-Sem: 30 Marks

Pre-requisite: A student should have a basic knowledge about group bryophyte, pteridophyte and gymnosperms 10+2 level.

Course Objectives:

- To understand diversity in gametophytes and sporophytes of bryophytes
- To study diversity of sporophytes of pteridophytes
- To analyse evolution in steles of pteridophytes, heterospory and seed habit.
- To study life cycles of selected gymnosperm members
- To compare life cycles of bryophytes, pteridophytes and gymnosperms

Course Outcomes:

On completion of this course, students will be able to:

- Understand ecological and economical value and importance of archegoniates
- Understand the diversity in gametophyte and sporophyte of bryophytes
- Distinguish the sporophytes of members of pteridophytes
- Compare the life cycles of archegoniate members
- Explain evolution in steles in pteridophyte members
- Analyse diversity and evolution in reproduction of members of gymnosperms

Course Contents:

Unit 1	Introduction to Archegoniate	1 Lecture
	1.1. Unifying features of archegoniate	
Unit 2	Bryophytes	2 Lectures
	2.1. General characteristics 2.2. Adaptations to land 2.3. Classification	
Unit 3	Diversity and importance of Bryophytes	4 Lectures
	3.1. Diversity in gametophyte and evolution in sporophyte. 3.2. Ecological and economic importance of bryophytes. 3.3. Alternation of generations.	

Unit 4	Pteridophytes	2 Lectures
	4.1. General characteristics 4.2. Classification 4.3. Early land plants (<i>Cooksonia</i> and <i>Rhynia</i>).	
Unit 5	Diversity and importance of Pteridophytes	7 Lectures
	5.1. Diversity of external morphology of sporophytes 5.2. Stelar diversity and evolution 5.3. Reproduction in homosporous and heterosporous pteridophytes. 5.4. Heterospory and seed habit 5.5. Telome theory 5.6. Ecological and economic importance. 5.7. Alternation of generations.	
Unit 6	Gymnosperms	14 Lectures
	6.1. General characteristics 6.2. Classification, morphology, anatomy and reproduction of <i>Cycas</i> , <i>Pinus</i> and <i>Gnetum</i> (Developmental details not to be included) 6.3. Ecological and economic importance. 6.4. Alternation of generations. 6.5. Diversity of external morphology of sporophytes	

Suggested readings:

1. B.R. Vashishta, A.K. Sinha, Adarsh Kumar (2018). Bryophyte (S.Chand & Company Ltd.)
2. Parihar, N.S. (1991). An introduction to Embryophyta: Vol. I. Bryophyta. Central Book Depot. Allahabad.
3. Rashid, A. (2010). An Introduction to Bryophyta. Vikas Publishing House Pvt. Ltd, India.
4. Vanderpoorten, A. & Goffinet, B. 2010. Introduction to Bryophytes. Cambridge University Press, U.K.
5. Watson, E.V. (1967). The structure and life of Bryophytes. Hutchinson University Library, U.K.
6. Ganguly H.C. and Kar A.K. (1999). Botany for Degree Students –Pteridophyta (vascular cryptogams) College Botany. Vol. 2
7. Sharma, O P (2012). Pteridophyta
8. Rashid, A (1999). Pteridophyta
9. Vashistha, P.C., Sinha, A.K., Kumar, A. (2010). Pteridophyta. S. Chand. Delhi, India.
10. Bhatnagar, S.P. & Moitra, A. (1996). Gymnosperms. New Age International (P) Ltd Publishers, New Delhi, India.
11. Raven, P.H., Johnson, G.B., Losos, J.B., Singer, S.R. (2005). Biology. Tata McGraw Hill, Delhi.

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Second Year of B.Sc. Botany
(2024 Course under NEP 2020)

Course Code: 24ScBotU3102

**Course Name: Reproductive Biology of
Angiosperms**

Teaching Scheme: TH: 2 Hours/Week

Credit: 02

Examination Scheme: CIE: 20 Marks

End-Sem: 30 Marks

Pre-requisite: Students should have a foundational understanding of plant biology, including plant anatomy, physiology, and reproductive structures, as well as basic knowledge of cell biology and genetics. Familiarity with laboratory techniques, such as microscopy and slide preparation, is essential. A basic understanding of plant development and reproduction will help students grasp advanced concepts in reproductive biology.

Course Objectives:

- To introduce students to the fundamental concepts of reproductive biology in angiosperms, including flower structure and types of reproduction.
- To provide an in-depth understanding of anther and pollen biology, including microsporogenesis, microgametogenesis, and palynology.
- To explore the structure, development, and organization of the ovule and female gametophyte.
- To study pollination, fertilization, and adaptations in angiosperms, including the process of double fertilization.
- To understand the development of embryos, endosperm, and seeds, as well as the significance of polyembryony and apomixis in plant reproduction.

Course Outcomes:

On completion of this course, students will be able to:

- Describe the structure and function of floral parts and explain the types of reproduction in angiosperms.
- Gain a detailed understanding of anther and pollen biology, including the processes of microsporogenesis and microgametogenesis.
- Analyze the structure and development of the ovule and female gametophyte, including megasporogenesis and megagametogenesis.
- Explain the mechanisms of pollination, fertilization, and adaptations in angiosperms, including the significance of double fertilization.
- Understand the development of embryos, endosperm, and seeds, and appreciate the applications of polyembryony and apomixis in plant breeding and agriculture.

Course Contents:

Unit 1	Introduction to Reproductive Biology of Angiosperms	2 Lecture
	1.1. Types of reproduction 1.2. Scope of reproductive biology 1.3. Structure of a flower	
Unit 2	Anther and Pollen Biology	7 Lectures
	2.1. Anther wall: Structure and functions 2.2. Microsporogenesis, callose deposition, and its significance 2.3. Microgametogenesis; MGU (male germ unit) structure 2.4. NPC system 2.5. Palynology and scope (a brief account)	
Unit 3	Ovule	7 Lectures
	3.1. Structure and types of ovules 3.2. Special structures: endothelium, obturator, aril, caruncle, and hypostase 3.3. Female gametophyte: megasporogenesis (monosporic, bisporic, and tetrasporic) 3.4. Megagametogenesis (details of Polygonum type) 3.5. Organization and ultrastructure of mature embryo sac	
Unit 4	Pollination and Fertilization	5 Lectures
	4.1. Pollination types and significance 4.2. Adaptations for pollination 4.3. Structure of stigma and style 4.4. Path of pollen tube in pistil; double fertilization	
Unit 5	Embryo, Endosperm, and Seed	5 Lectures
	5.1. Structure of dicot and monocot embryo 5.2. Endosperm development 5.3. Seed structure and importance	
Unit 6	Polyembryony and Apomixis	4 Lectures
	6.1. Introduction 6.2. Classification 6.3. Causes of polyembryony and apomixis 6.4. Applications of polyembryony and apomixis	

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Second Year of B.Sc. Botany
(2024 Course under NEP 2020)

Course Code: 24ScBotU3103

**Course Name: Lab on 24ScBotU3101
and 24ScBotU3102**

Teaching Scheme: PR: 4 Hours/Week

Credit: 02

Examination Scheme: CIE: 20 Marks

End-Sem: 30 Marks

Pre-requisite: Students should have a basic understanding of plant biology, including plant anatomy, morphology, and reproduction. Familiarity with microscopy techniques and laboratory procedures is also recommended.

Course Objectives:

- To develop a comprehensive understanding of the morphology, anatomy, and reproductive structures of lower and higher plants.
- To study the diversity of plant life cycles, including bryophytes, pteridophytes, gymnosperms, and angiosperms.
- To gain practical skills in observing and analyzing floral morphology, pollen viability, and seed dispersal mechanisms.
- To understand the classification and functional significance of plant reproductive structures, such as ovules, placentation, and embryos.
- To explore the NPC system of pollen classification and its application in plant taxonomy.
- To enhance field observation skills and report-writing abilities through hands-on field visits and practical experiments.

Course Outcomes:

On completion of this course, students will be able to:

- Identify and describe the morphological and anatomical features of *Riccia*, *Anthoceros*, *Funaria*, *Psilotum*, *Selaginella*, *Equisetum*, *Marsilea*, *Cycas*, *Pinus*, and *Gnetum*.
- Demonstrate proficiency in analyzing floral structures, pollen germination, and pollen viability using appropriate laboratory techniques.
- Classify and explain the types of placentation, ovules, endosperms, and plant embryos.
- Apply the NPC system to classify pollen and understand its significance in plant systematics.
- Evaluate the mechanisms of seed dispersal and the role of propagules in plant reproduction.
- Develop field observation skills and produce detailed reports based on their practical and field experiences.

Course contents:

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|--|----|
| 1. Study of <i>Riccia</i> , <i>Anthoceros</i> and <i>Funaria</i> | 1P |
| 2. Study of <i>Psilotum</i> and <i>Selaginella</i> | 1P |
| 3. Study of <i>Equisetum</i> and <i>Marsilea</i> | 1P |
| 4. Study of <i>Cycas</i> | 1P |
| 5. Study of <i>Pinus</i> | 1P |

6. Study of <i>Gnetum</i>	1P
7. Study of floral morphology and types of flowers	1P
8. Study of in vitro pollen germination	1P
9. Testing pollen viability with suitable method	1P
10. Study of placentation, types of ovules and endosperms	1P
11. Study of types of plant embryo	1P
12. Study of NPC system of pollen classification	1P
13. Study of types of propagules	1P
14. Study of seed dispersal mechanisms	1P
15. Field visit and submission of report	1P

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Second Year of B.Sc. Botany
(2024 Course under NEP 2020)

Course Code: 24ScBotU3501

**Course Name: Lab course in Herbal
Technology**

Teaching Scheme: TH: 4 Hours/Week

Credit: 02

Examination Scheme: CIE: 20 Marks

End-Sem: 30 Marks

Prerequisite Courses: A student should have a thorough background of Biology learnt at 10+2 level.

Course Objectives:

- Study the active principles from medicinal plants with respect to composition and effects
- Provide hands-on training on preparation of herbal formulations
- Get knowledge of plants used in herbal formulations
- Know the uses of medicinal plants
- Acquire knowledge of chemical components present in medicinal plants
- Gain knowledge about commercial methods of herbal formulations

Course Outcomes:

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

- Obtain knowledge of medicinal plants with respect to their basic applications in day to day life
- Identify plants required in making herbal formulations
- Learn the functions of active principles present in medicinal plants
- Gain knowledge of certain home remedies for some diseases
- Prepare certain basic herbal formulations
- Receive the information about the methodologies followed for commercial herbal formulations

Course Contents:

- | | |
|---|----|
| 1. Introduction to herbal formulation preparation | 1P |
| 2. Preparation of <i>Dantamanjan</i> | 1P |
| 3. Preparation of <i>Churna</i> | 1P |
| 4. Preparation of <i>Leha</i> | 1P |
| 5. Preparation of Lip balm | 1P |
| 6. Preparation of face mask | 1P |
| 7. Preparation of oils | 1P |
| 8. Preparation of <i>Kajal</i> | 1P |
| 9. Preparation of <i>Asava</i> | 1P |
| 10. Preparation of <i>Arishta</i> | 1P |
| 11. Preparation of herbal face mask | 1P |
| 12. Preparation of <i>Aloe vera</i> gel | 1P |
| 13. Preparation of tonic | 1P |
| 14. Visit to Herbal/Ayurvedic product industry/ institute | 2P |

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Second Year of B.Sc. Botany
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Course Code: 24ScBotU3901

**Course Name: Ayurvedic Science of
Nutrition and Diet**

Teaching Scheme: TH: 2 Hours/Week

Credit: 02

Examination Scheme: CIE: 20 Marks

End-Sem: 30 Marks

Prerequisite Courses: A student should have a background of Biology learnt at 10+2 level

Course Objectives:

This course explores the principles of Ayurveda in relation to food and nutrition. Students will learn about the fundamental concepts of Ayurveda, the classification of food, and their impact on physical and mental well-being. The course emphasises the practical application of Ayurvedic principles in dietary choices and lifestyle for optimal health.

Course Outcomes:

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

- Explain the fundamental principles of Ayurveda and its perspective on nutrition and holistic health.
- Understand the six tastes (Rasa) and their effects on doshas, as well as dietary recommendations based on individual constitution (Prakriti).
- Analyze the role of Agni in digestion and identify common digestive imbalances and their Ayurvedic management.
- Apply Ayurvedic dietary guidelines, including seasonality, food combining, and dosha-specific recommendations, to promote balance and well-being.
- Evaluate the Ayurvedic approach to weight management, digestive disorders, and nutritional imbalances, and recommend appropriate dietary and lifestyle modifications.
- Develop mindful eating practices and understand the role of Ayurveda in detoxification, healthy ageing, and maintaining vitality throughout life.

Course Contents

Unit 1	Introduction to Ayurveda and its approach to nutrition	3 Lectures
	1.1. Overview of Ayurveda: History, principles, and concepts 1.2. Ayurvedic perspective on nutrition and its role in holistic well-being	

	1.3. Understanding the three doshas (Vata, Pitta, Kapha) and their influence on digestion and metabolism	
Unit 2	Ayurvedic principles of food classification	3 Lectures
	2.1. The six tastes (Rasa) and their qualities: Sweet, sour, salty, bitter, pungent, astringent 2.2. Effects of tastes on doshas and overall balance 2.3. Concept of Prakriti (individual constitution) and dietary recommendations	
Unit 3	Digestion in Ayurveda	3 Lectures
	3.1. Agni (digestive fire): Types, functions, and importance 3.2. Factors affecting digestion and assimilation 3.3. Common digestive imbalances and their Ayurvedic management	
Unit 4	Ayurvedic dietary guidelines	3 Lectures
	4.1. The importance of seasonality and eating according to the doshic influence 4.2. Balanced meals and the art of food combining 4.3. Dietary recommendations for each dosha and individual constitution	
Unit 5	Ayurveda and weight management	3 Lectures
	5.1. Understanding the Ayurvedic approach to weight management 5.2. Factors influencing weight gain or loss according to doshas 5.3. Ayurvedic dietary and lifestyle recommendations for maintaining a healthy weight	
Unit 6	Ayurveda and digestive disorders	3 Lectures
	6.1. Ayurvedic perspective on common digestive disorders (e.g., indigestion, bloating, constipation) 6.2. Herbal remedies, dietary modifications, and lifestyle practices for digestive health	
Unit 7	Ayurveda and mindful eating	3 Lectures
	7.1. Mind-body connection in Ayurveda	

	7.2. The role of emotions, mindfulness, and consciousness in eating 7.3. Ayurvedic practices for mindful eating and developing a healthy relationship with food	
Unit 8	Ayurvedic detoxification and cleansing	3 Lectures
	8.1. Principles and benefits of Ayurvedic detoxification 8.2. Ayurvedic cleansing techniques (Panchakarma) 8.3. Post-detoxification dietary and lifestyle guidelines	
Unit 9	Ayurveda and nutritional imbalances	3 Lectures
	9.1. Ayurvedic approach to common nutritional imbalances (e.g., deficiencies, excesses) 9.2. Identification of imbalances based on symptoms and doshic influence 9.3. Ayurvedic dietary modifications and holistic approaches to restore balance	
Unit 10	Ayurveda and optimal ageing	3 Lectures
	10.1. Ayurvedic perspectives on ageing and longevity 10.2. Ayurvedic dietary and lifestyle practices for healthy ageing 10.3. Role of nutrition in maintaining vitality and well-being during different life stages	

Suggested readings:

Sanjeev Rastogi, Ayurvedic Science of Nutrition and Diet, Springer-Verlag New York.

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Second Year of B.Sc. Botany
(2024 Course under NEP 2020)

Course Code: 24ScBotU3301 Course Name: Morphology of Angiosperms (Theory)
Teaching Scheme: TH: 2 Hours/Week Credit: 02
Examination Scheme: CIE: 20 Marks End-Sem: 30 Marks

Prerequisite Courses: A student should have a thorough background of Biology learnt at 10 + 2 level.

Course Objectives:

- To study morphology of angiospermic plants
- To learn technical terms to describe morphological features

Course Outcomes:

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

- Understand plant morphology
- Demonstrate proficiency in identifying and describing the various parts of an angiospermic plant.
- Appreciate the significance of morphological modifications of plant parts
- Understand the basics of floral morphology
- Classify seeds and fruits based on their structure and describe their parts and methods of dispersal
- Understand how plant morphology relates to plant reproduction

Course Contents:

Unit 1	Introduction to Plant Morphology	1 Lecture
	1.1. Importance of plant morphology 1.2. Parts of an angiospermic plant and their functions	
Unit 2	Morphology of root	3 Lectures
	2.1. Characteristics of roots 2.2. Types of root system 2.3. Regions of the root 2.4. Modifications of root	
Unit 3	Morphology of stem	4 Lectures
	3.1. Characteristics of stem 3.2. Forms of stem 3.3. Bud and its modifications 3.4. Habit of the plant, parasitic, mycoheterotrophic, epiphytic, carnivorous, mangroves	

	3.5. Modifications of stem 3.6. Types of branching	
Unit 4	Morphology of leaf	5 Lectures
	4.1. Parts of a leaf, types of leaves, types of stipules and their modifications, leaf blade w.r.t. apex, margin, and shape 4.2. Venation 4.3. Simple and compound leaves 4.4. Modifications of leaves 4.5. Phyllotaxy	
Unit 5	The inflorescence	4 Lectures
	5.1. Definition 5.2. Classification of inflorescences 5.3. Racemose and its types 5.4. Cymose and its types	
Unit 6	The flower	7 Lectures
	6.1. Flower as a modified shoot, structure of flower, types of flower, thalamus, bracts 6.2. Symmetry of flower 6.3. Calyx and its modifications 6.4. Forms of corolla 6.5. Androecium: Parts of stamen, cohesion of stamens, adhesion of stamens, length of stamens 6.6. Gynoecium: Parts of carpel, simple and compound gynoecium, cohesion of carpels, placentation and its types	
Unit 7	The fruit	4 Lectures
	7.1. Definition 7.2. Parts of fruit 7.3. Classification of fruits 7.4. Dispersal of fruits and seeds	
Unit 8	The seed	2 Lectures
	8.1. Definition 8.2. Parts of dicotyledonous and monocotyledonous seeds 8.3. Seed germination and its types	

Suggested readings:

1. Dutta, A. C. (Year). *Botany for degree students*. Oxford University Press.

2. Sundararajan, S. (Year). *Morphology and economic botany of angiosperms*. Anmol Publications Pvt. Ltd.
3. Eames, E. J. (Year). *Morphology of vascular plants*. Standard University Press.
4. Naik, V. N. (Year). *Taxonomy of angiosperms*. Tata McGraw-Hill Publishing Company.
5. Singh, V., & Jain, D. K. (Year). *Taxonomy of angiosperms*. Rastogi Publications.
6. Pandey, B. P. (Year). *A text book of botany: Angiosperms*. S. Chand and Company Ltd.
7. Bendre, A., & Kumar, A. (Year). *A text book of practical botany II*. Rastogi Publications.
8. Lawrence, G. H. M. (Year). *Taxonomy of vascular plants*. Scientific Publishers.

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Second Year of B.Sc. Botany
(2024 Course under NEP 2020)

Course Code: 24ScBotU3302

Teaching Scheme: PR: 4 Hours/Week

Examination Scheme: CIE: 20 Marks

Course Name: Lab on 24ScBotU3301

Credit: 02

End-Sem: 30 Marks

Prerequisite: A student should have a thorough background in Biology learnt at 10 + 2 level.

Course Objectives:

- To learn the vegetative and reproductive structures of angiospermic plants and their functions and modifications.

Course Outcomes:

Upon completion of the course, students will be able to:

- Able to identify various morphological features of angiospermic plants and understand the relationship between the structure and function of plant organs.

Course Contents:

- | | |
|---|----|
| 1. Study of root and its modifications | 1P |
| 2. Study of stem and its modifications | 1P |
| 3. Study of leaf and its modifications | 1P |
| 4. Study of inflorescences | 1P |
| 5. Study of flowers | 3P |
| 6. Study of fruits and their dispersal mechanisms | 2P |
| 7. Study of seeds and their dispersal mechanisms | 2P |
| 8. Types of seed germination | 1P |
| 9. Description of herbaceous plant | 1P |
| 10. Plants on the campus | 1P |
| 11. Field visit | 1P |

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Second Year of B.Sc. Botany
(2024 Course under NEP 2020)

Course Code: 24ScBotU3401

Teaching Scheme: TH: 2 Hours/Week

Examination Scheme: CIE: 20 Marks

Course Name: Herbal Medicine

Credit: 02

End-Sem: 30 Marks

Prerequisite Courses: A student should have a background of Biology learnt at 10+2 level.

Course Objectives:

- To inculcate the importance and scope of the herbal medicine.
- To develop a scientific aptitude among the students.
- To develop skills and make them practical oriented to establish their own unit based on herbal medicine.
- To aware the students about conservation of medicinal plants.

Course Outcomes:

- On completion of the course, students will be able to–
- Remember the names of medicinal plants.
- Describe different parts of medicinal plants.
- Identify medicinal plants.
- Understand the methods of preparation of herbal medicines
- Utilize medicinal plants for herbal and cosmetic product preparation.
- Create awareness about herbal medicine for human health.

Course Contents:

Unit 1	Introduction of medicinal plants	6 Lectures
	1.4. Definition, history, present and future needs 1.5. Introduction of plant parts: fruit, leaves stem, root, seeds and their modification 1.6. Role in human health and balanced diet 1.7. Precautions while using herbal medicinal products	
Unit 2	Important Indian medicinal plants-I	6 Lectures
	4.1. Plant parts used as a powder: Amla (<i>Phyllanthus emblica</i>), Harad (<i>Terminalia chebula</i>), Turmeric (<i>Curcuma longa</i>), Cinnamon (<i>Cinnamomum verum</i>), Black pepper (<i>Piper nigrum</i>), Ashwagandha (<i>Withania somnifera</i>), Behra (<i>Terminalia bellerica</i>).	

	4.2. Plant parts used in juices/decoction: Ginger (<i>Zingiber officinale</i>), Giloy (<i>Tinospora cordifolia</i>), Neem (<i>Azadirachta indica</i>), Onion (<i>Allium cepa</i>), Dudhi bhopala (<i>Lagenaria siceraria</i>)	
Unit 3	Important Indian Medicinal plants-II	6 Lectures
	6.1. Plant part used as a lotions and ointments: <i>Aloe vera</i> , calendula (<i>Calendula officinalis</i>). 6.2. Plant parts used as oil: Clove (<i>Syzygium aromaticum</i>), Nilgiri leaf (<i>Eucalyptus</i>), Coconut (<i>Cocos nucifera</i>) 6.3. Plant parts used as surgical fibres, sutures and dressings: Cotton (<i>Gossypium</i> sp.), and Jute (<i>Corchorus capsularis</i>). 6.4. Plant parts used as poultice: Garlic (<i>Allium sativum</i>), Aak (<i>Calotropis</i> sp.), Dhatura (<i>Datura</i> sp.).	
Unit 4	Simple herbal products	6 Lectures
	8.1. Methods of preparation of herbal products 8.2. Preparation of Triphala churna, chavanprash, amla candy, herbal tea, herbal perfumes	
Unit 5	Herbal cosmetics	6 Lectures
	10.1. Methods of preparation of herbal cosmetic products: Hair oil/ hair tonic, skincare, and face pack	

Suggested readings:

1. Panda, H. (Year). *Handbook of ayurvedic medicine*. National Institution of Industrial Research.
2. Brahamvarchas. (2004). *Ayurved ka pran, vanoshadhi vigyan*. Vedmata Gayatri Trust.
3. Chadhari, R. D. (Year). *Herbal drug industry*. Eastern Publication.
4. Atal, & Kapoor. (1982). *Cultivation and utilization of medicinal plants*. RRL Jammu Tavi.
5. Ikan, R. (1991). *Natural products: A lab guide* (2nd ed.). Academic Press.
6. Dutt, A. (Year). *An introduction to medicinal plants*. Adhyayan Publishers and Distributors.

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Second Year of B.Sc. Botany
(2024 Course under NEP 2020)

Course Code: 24ScBotU4101

Teaching Scheme: TH: 2 Hours/Week

Examination Scheme: CIE: 20 Marks

Course Name: Plant Morphology

Credit: 02

End-Sem: 30 Marks

Prerequisite Courses: A student should have a thorough background of Biology learnt at 10 + 2 level.

Course Objectives:

- To study morphology of angiospermic plants
- To learn technical terms to describe morphological features
- To study the internal organisation of various plant organs
- To study the basics of embryology and reproduction in angiosperms

Course Outcomes:

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

- Understand vegetative and reproductive aspects of angiosperm morphology
- Understand the basics of floral morphology
- Correlate between flower morphology and methods of reproduction in angiosperms
- Understand the significance of morphological modifications of plant parts
- Identify various plant tissues and tissue systems and basic architecture of plant organs
- Understand the nature and need of secondary growth in angiosperms

Course Contents:

Unit 1	Introduction to Plant Morphology	1 Lecture
	1.1. Importance of plant morphology 1.2. Parts of an angiospermic plant and their functions	
Unit 2	Morphology of root	3 Lectures
	2.1. Characteristics of roots 2.2. Types of root system 2.3. Regions of the root 2.4. Modifications of root	
Unit 3	Morphology of stem	4 Lectures
	3.1. Characteristics of stem 3.2. Forms of stem 3.3. Bud and its modifications	

	3.4. Habit of the plant, parasitic, mycoheterotrophic, epiphytic, carnivorous, mangroves 3.5. Modifications of stem 3.6. Types of branching	
Unit 4	Morphology of leaf	5 Lectures
	4.1. Parts of a leaf, types of leaves, types of stipules and their modifications, leaf blade w.r.t. apex, margin, and shape 4.2. Venation 4.3. Simple and compound leaves 4.4. Modifications of leaves 4.5. Phyllotaxy	
Unit 5	The inflorescence	4 Lectures
	5.1. Definition 5.2. Classification of inflorescences 5.3. Racemose and its types 5.4. Cymose and its types	
Unit 6	The flower	7 Lectures
	6.1. Flower as a modified shoot, structure of flower, types of flower, thalamus, bracts 6.2. Symmetry of flower 6.3. Calyx and its modifications 6.4. Forms of corolla 6.5. Androecium: Parts of stamen, cohesion of stamens, adhesion of stamens, length of stamens 6.6. Gynoecium: Parts of carpel, simple and compound gynoecium, cohesion of carpels, placentation and its types	
Unit 7	The fruit	4 Lectures
	7.1. Definition 7.2. Parts of fruit 7.3. Classification of fruits 7.4. Dispersal of seeds and fruits	
Unit 8	The seed	2 Lectures
	8.1. Definition 8.2. Parts of dicotyledonous and monocotyledonous seeds 8.3. Seed germination and its types	

Suggested readings:

1. Dutta, A. C. (Year). *Botany for degree students*. Oxford University Press.
2. Sundararajan, S. (Year). *Morphology and economic botany of angiosperms*. Anmol Publications Pvt. Ltd.
3. Eames, E. J. (Year). *Morphology of vascular plants*. Standard University Press.
4. Naik, V. N. (Year). *Taxonomy of angiosperms*. Tata McGraw-Hill Publishing Company.
5. Singh, V., & Jain, D. K. (Year). *Taxonomy of angiosperms*. Rastogi Publications.
6. Pandey, B. P. (Year). *A textbook of botany: Angiosperms*. S. Chand and Company Ltd.
7. Bendre, A., & Kumar, A. (Year). *A text book of practical botany II*. Rastogi Publications.
8. Lawrence, G. H. M. (Year). *Taxonomy of vascular plants*. Scientific Publishers.

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Second Year of B.Sc. Botany
(2024 Course under NEP 2020)

Course Code: 24ScBotU4102

Teaching Scheme: TH: 2 Hours/Week

Examination Scheme: CIE: 20 Marks

Course Name: Plant Anatomy

Credit: 02

End-Sem: 30 Marks

Prerequisite Courses: A student should have a thorough background of Biology learnt at 10 + 2 level.

Course Objectives:

- To study morphology of angiospermic plants
- To learn technical terms to describe morphological features
- To study the internal organisation of various plant organs
- To study the basics of embryology and reproduction in angiosperms

Course Outcomes:

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

- Understand vegetative and reproductive aspects of angiosperm morphology
- Understand the basics of floral morphology
- Correlate between flower morphology and methods of reproduction in angiosperms
- Understand the significance of morphological modifications of plant parts
- Identify various plant tissues and tissue systems and basic architecture of plant organs
- Understand the nature and need of secondary growth in angiosperms

Course Contents:

Unit 1	The cell	4 Lectures
	1.1. Structure of plant cell 1.2. Functions of plant cell 1.3. The cell wall 1.4. Growth, thickening, chemical nature, and changes in the cell wall	
Unit 2	Plant Tissues	6 Lectures
	2.1. Meristematic tissue and its types 2.2. Structure of shoot and root apical meristem 2.3. Simple and complex tissues 2.4. Secretory tissues 2.5. General account of adaptations in hydrophytes and xerophytes	
Unit 3	Epidermal tissue system	4 Lectures

	3.1. Structure and functions of epidermis 3.2. Structure of stomata, types of stomata 3.3. Epidermal outgrowths and their types	
Unit 4	Mechanical tissue system	3 Lectures
	4.1. Types of mechanical tissues 4.2. Principles of their distribution	
Unit 5	Anatomy of stem	2 Lectures
	5.1. Internal structure of young and mature dicot stem 5.2. Internal structure of monocot stem	
Unit 6	Anatomy of root	2 Lectures
	6.1 Internal structure of young dicot and monocot root	
Unit 7	Anatomy of leaf	2 Lectures
	7.1. Internal structure of dorsiventral leaf and isobilateral leaves	
Unit 8	Secondary growth	7 Lectures
	8.1. Nature and need of secondary growth 8.2. Vascular cambium- Structure and function 8.3. Normal secondary growth in dicot stem 8.4. Wood- Heart wood and sap wood 8.5. Anomalous secondary growth in dicot and monocot stem 8.6. Secondary growth in root	

Suggested readings:

1. Lawrence, G. H. M. (Year). *Taxonomy of vascular plants*. Scientific Publishers.
2. Singh, V., Pande, A. C., & Jain, D. K. (Year). *Anatomy of angiosperms*. Rastogi Publications.
3. Singh, Pande, & Jain. (Year). *Anatomy and embryology of angiosperms*. Rastogi Publications.
4. Tayal, M. S. (Year). *Plant anatomy*. Rastogi Publications.
5. Pandey, B. P. (Year). *Plant anatomy*. S. Chand and Company Ltd.
6. Esau, K. (Year). *Anatomy of seed plants*. John Wiley and Sons.
7. Roy, P. (Year). *Plant anatomy*. New Central Book Agency (P) Ltd.
8. Chandurkar, P. J. (Year). *Plant anatomy*. Oxford and IBH Publishing Co. Pvt. Ltd.

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Second Year of B.Sc. Botany
(2024 Course under NEP 2020)

Course Code: 24ScBotU4103	Course Name: Lab on 24ScBotU4101 and 24ScBotU4102
Teaching Scheme: PR: 4 Hours/Week	Credit: 02
Examination Scheme: CIE: 20 Marks	End-Sem: 30 Marks

Prerequisite: A student should have a thorough background in Biology learnt at 10 + 2 level.

Course Objectives:

- To learn the vegetative and reproductive structures of angiospermic plants and their functions and modifications.
- To study the internal structure of various parts of the angiospermic plant.

Course Outcomes:

Upon completion of the course, students will be able to:

- Able to identify various morphological features of angiospermic plants and understand the relationship between the structure and function of plant organs.
- Differentiate various parts of the angiospermic plant based on internal organization

Course Contents:

Section I

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| 1. Study of root and its modifications | 1P |
| 2. Study of stem and its modifications | 1P |
| 3. Study of leaf and its modifications | 1P |
| 4. Study of inflorescences | 1P |
| 5. Study of flower | 3P |
| 6. Study of fruits and their dispersal mechanisms | 1P |
| 7. Study of seeds and seed dispersal mechanisms | 1P |
| 8. Description of plant twig in botanical terms | 2P |
| 9. Preparation of artificial keys based on vegetative and reproductive characters | 3P |
| 10. Field visit | 1P |

Section II

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|--|----|
| 1. Handling of students' microscope, stains and staining procedures. | 1P |
| 2. Study of simple and complex plant tissues w.r.t. structure and distribution. | 1P |
| 3. Study of epidermal trichomes | 1P |
| 4. Study of stomata and its types | 1P |
| 5. Study of mechanical tissue system | 1P |
| 6. Study of types of vascular bundles | 1P |
| 7. Anatomical adaptations in hydrophytes- <i>Eichhornia</i> and <i>Hydrilla</i> | 1P |
| 8. Anatomical adaptations in xerophytes- <i>Asparagus</i> , <i>Nerium</i> , <i>Aloe</i> and <i>Portulaca</i> | 1P |
| 9. Maceration of suitable stem material to study xylem and phloem elements | 1P |
| 10. Study of RLS and TLS of suitable stem | 1P |

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| 11. Comparative study of dicot and monocot stem and root | 2P |
| 12. Study of normal and abnormal secondary growth in stem. | 3P |

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Second Year of B.Sc. Botany
(2024 Course under NEP 2020)

Course Code: 24ScBotU4501	Course Name: Lab course on Plant Tissue Culture
Teaching Scheme: PR: 4 Hours/Week	Credit: 02
Examination Scheme: CIE: 20 Marks	End-Sem: 30 Marks

Prerequisite: Students should have a foundational understanding of plant biology, including plant anatomy, physiology, and cell biology, as well as basic knowledge of genetics and the roles of plant growth regulators in development. Familiarity with aseptic techniques, laboratory safety protocols, and the use of basic laboratory equipment, such as microscopes, is essential for successful experimentation in plant tissue culture. .

Course Objectives:

- To familiarize students with the preparation and use of stock solutions and culture media, such as MS medium, for various tissue culture applications.
- To develop practical skills in inducing and maintaining callus, suspension cultures, and somatic embryogenesis from suitable plant explants.
- To understand the principles and techniques of micropropagation, including shoot initiation, root induction, and hardening of plantlets.
- To explore advanced techniques such as embryo culture, synthetic seed preparation, and haploid production through anther culture.
- To study the production of secondary metabolites in suspension cultures and their applications in biotechnology.
- To provide exposure to commercial tissue culture practices through visits to relevant institutions or laboratories.

Course Outcomes:

Upon completion of the course, students will be able to:

- Prepare stock solutions and culture media for different tissue culture applications.
- Gain hands-on experience in inducing and maintaining callus, suspension cultures, and somatic embryogenesis.
- Demonstrate proficiency in micropropagation techniques, including shoot initiation, root induction, and acclimatization of plantlets.
- Understand and perform advanced techniques such as embryo culture, synthetic seed preparation, and haploid production.
- Analyze the production of secondary metabolites in suspension cultures and their significance in industrial applications.
- Gain insights into commercial tissue culture practices and their role in agriculture and horticulture through institutional visits.

Course Contents:

1. Preparation of Stock Solutions required for MS (Murashige and Skoog) Medium	1P
2. Preparation and sterilisation of MS (Murashige and Skoog) Medium	1P
3. Induction of callus and suspension culture from suitable explants	2P
4. Study of embryo culture	1P
5. Initiation of shoots from nodal explants of suitable plants	1P
6. Induction of roots from in vitro shoots	1P
7. Hardening of in vitro plantlets	1P
8. Micropropagation of suitable ornamental plants	1P
9. Demonstration induction of somatic embryogenesis	1P
10. Preparation of synthetic seeds	1P
11. Study of <i>in vitro</i> seed germination	1P
12. Demonstration of haploid production through anther culture	1P
13. Production of secondary metabolite in suspension culture	1P
14. Visit to a commercial plant tissue culture laboratory/institution	1P

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Second Year of B.Sc. Botany
(2024 Course under NEP 2020)

Course Code: 24ScBotU4301

Teaching Scheme: TH: 2 Hours/Week

Examination Scheme: CIE: 20 Marks

Course Name: Plant Ecology

Credit: 02

End-Sem: 30 Marks

Prerequisite Courses: A student should have a thorough background of Biology learnt at 10+2 level.

Course Objectives:

- Develop an understanding of the differences in the structure and function of different types of ecosystems.
- Become familiar with the variety of ways organisms interact with both the physical and the biological environment.
- Obtain knowledge of ecological principles
- Get the knowledge of various environments in which plants grow
- Acquire information about the biodiversity of organisms
- Understand the problems related to pollution

Course outcomes: On completion of the course, students will be able to–

- To learn various ecological concepts and principles
- Understand organism's functions in ecosystems
- Understand the changes in the vegetation occurring due to various environmental factors
- Develop realization towards the conservation of biodiversity
- Learn about the consequences of relationship between organism and the environment
- Accomplish foundations of phytogeography

Course Contents:

Unit 1	Introduction to Ecology	3 Lectures
	1.1. Concept and Definition 1.2. Ecological principles 1.3. The Environment: Physical environment; biotic environment; biotic and abiotic interactions. 1.4. Habitat and Niche: Concept of habitat and niche, types of niche	
Unit 2	Ecosystem	5 Lectures

	2.1. Structure and function of some Indian ecosystems: terrestrial (forest, grassland) and aquatic (fresh water, marine, estuarine) 2.2. Energy flow trophic organisation 2.3. Food chains and food webs 2.4. Ecological pyramids production and productivity 2.5. Biogeochemical cycling; Cycling of carbon, nitrogen and phosphorous	
Unit 3	Adaptations	6 Lectures
	3.1. Concept 3.2. Ecological grouping of plants: Hydrophytes, mesophytes, xerophytes and halophytes	
Unit 4	Ecological Succession	4 Lectures
	4.1. Types and mechanisms 4.2. Changes involved in succession 4.3. Concept of climax	
Unit 5	Species Interactions	1 Lectures
	5.1. Types of interactions 5.2. Interspecific competition, herbivory, carnivory, pollination, symbiosis, parasitism, tri-trophic interactions, growth-defence trade-off	
Unit 6	Phytogeography	4 Lectures
	6.1. Phytogeographical zones of India 6.2. Endemism, biodiversity hotspots, IUCN categories	
Unit 7	Applied Ecology	2 Lectures
	1.1. Biodiversity: status, monitoring, major drivers of biodiversity change, and biodiversity management approaches 1.2. EIA, carbon credit and carbon sequestration	

Suggested Readings

1. Pratiyogita Darpan. (Year). *Environmental ecology, biodiversity & climate change*. Pratiyogita Darpan.
2. Arihant. (Year). *Environment and ecology*. Arihant Publications.
3. Rajagopalan, R. (Year). *Environmental studies: From crisis to cure*. Oxford University Press.
4. Odum, E. P. (Year). *Fundamentals of ecology*. Saunders College Publishing.
5. Singh, B. B. (Year). *Objective environmental sciences*. Kalyani Publishers.

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Second Year of B.Sc. Botany
(2024 Course under NEP 2020)

Course Code: 24ScBotU4302

Course Name: Lab course on
24ScBotU4301

Teaching Scheme: PR: 4 Hours/Week

Credit: 02

Examination Scheme: CIE: 20 Marks

End-Sem: 30 Marks

Pre-requisite: A student should have a thorough background of Biology and basic knowledge of laboratory techniques learnt at 10+2 level

Course Objectives:

- Student will become familiar with the variety of ways that organisms interact with both the physical and the biological environment
- To learn various methods used to study ecological parameters
- Grasp the knowledge of aquatic flora
- Make the student familiar with the instruments used for various ecological studies
- Create awareness about the identification of polluted and disturbed ecosystems
- Gain the knowledge about adaptations plants acquire while living in various habitats

Course Outcomes:

On completion of this course, students will be able to:

- Analyse ecological data
- Draw inferences about the relationship between organisms and the environment
- Comment on the status of the ecosystem
- Derive conclusions about the type of vegetation
- Find remedial measures for the restoration of Ecosystem
- Learn the biodiversity of organisms

Course Contents:

1. Study of instruments used to measure microclimatic variables: Soil thermometer, maximum and minimum thermometer, anemometer, hair hygrometer 1P
2. Determination of pH, and analysis of soil samples for carbonates, chlorides, nitrates, sulphates, organic matter and base deficiency by rapid field test. 1P
3. Study of hydrophytes and xerophytes 2P
4. Demonstration of methods used in quantification of biodiversity 1P
5. Determination of minimal quadrat size for the study of herbaceous vegetation by Species area curve method. (Species to be listed) 2P
6. Determination of density, abundance, and frequency by list count quadrat method. 1P
7. Determination of BOD from given sample 1P
8. To study the phytoplankton communities in a fresh water ecosystem. 2P
9. To estimate the productivity of a pond ecosystem using Light and Dark Bottle Method 2P
10. Visit to a forest/ river/ wetland ecosystem. 2P

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Second Year of B.Sc. Botany
(2024 Course under NEP 2020)

Course Code: 24ScBotU4401

Teaching Scheme: PR: 2 Hours/Week

Examination Scheme: CIE: 20 Marks

Course Name: Wine Technology

Credit: 02

End-Sem: 30 Marks

Prerequisite Courses: A student should have the subject Biology at 10+2 level.

Course Objectives:

By the end of the course, students should be able to:

- Understand the basic principles of grape cultivation and vineyard management.
- Comprehend the science behind fermentation and the different types of wine production.
- Analyse the factors influencing wine quality, including grape varieties and environmental conditions.
- Gain insights into the historical and cultural aspects of wine.
- Explore the business and industry aspects of the wine sector.

Course Outcomes:

On completion of this course, students will be able to:

- Understand the historical and cultural significance of wine, tracing its evolution and recognizing its diverse importance across cultures.
- Describe key factors influencing grape cultivation, encompassing grape varieties, soil types, climate, and the unique concept of terroir.
- Apply and explain the sustainable and organic vineyard practices, demonstrating an understanding of environmentally friendly approaches in vineyard management.
- Analyze and describe the wine production process, scrutinizing stages like harvesting, crushing, fermentation, and aging, identifying critical points impacting quality.
- Develop and/or describe strategies for mitigating wine faults, troubleshooting issues, and improving overall quality using knowledge of wine chemistry and analysis.
- Evaluate the impact of emerging trends in wine technology, considering innovations and sustainable practices, to make informed decisions in the wine business and industry.

Course Content:

Unit 1	Introduction to Wine Technology	3 Lectures
	1.1. Overview of the wine industry 1.2. Fruit wines 1.3. Historical and cultural significance of wine	
Unit 2	Grape Cultivation and Vineyard Management	5 Lectures

	2.1. Grape varieties and their characteristics 2.2. Soil, climate, and terroir 2.3. Sustainable and organic vineyard practices	
Unit 3	Wine Production Process	6 Lectures
	3.1. Harvesting and crushing 3.2. Fermentation and yeast selection 3.3. Aging and maturation	
Unit 4	Factors Influencing Wine Quality	4 Lectures
	4.1. Wine chemistry and analysis 4.2. Wine faults and troubleshooting	
Unit 5	Wine Styles and Varieties	1 Lectures
	5.1. Red, white, rosé, sparkling wines 5.2. Regional wine styles and appellations	
Unit 6	Wine Business and Industry	4 Lectures
	6.1. Wine marketing and branding 6.2. Distribution and sales 6.3. Wine tourism	
Unit 7	Emerging Trends in Wine Technology	2 Lectures
	7.1. Innovations in winemaking 7.2. Sustainable and biodynamic practices	
Unit 8	Practical sessions	5 Lectures
	7.1. Visit to vineyard and/ winery 7.2. Wine tasting session 7.3. Lab experiments in fermentation and analysis	

Suggested readings:

1. Harding, G. O. (Year). *Principles and practices of winemaking*. Springer.
2. Jackson, R. S. (Year). *Wine science: Principles and applications*. Academic Press.
3. Johnson, H., & Robinson, J. (Year). *The world atlas of wine*. Mitchell Beazley.

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Second Year of B.Sc. Botany
(2024 Course under NEP 2020)

Course Code: 24ScBotU4601

**Course Name: Lab Course on Fruit and
Vegetable Processing and Preservation**

Teaching Scheme: PR: 4 Hours/Week

Credit: 02

Examination Scheme: CIE: 20 Marks

End-Sem: 30 Marks

Prerequisite Courses: The student should have competed FYBSc Science

Course Objectives:

- To develop basic skill in methods used processing and preservation of fruits and vegetables
- To get knowledge and skill to prepare processing and preservation of fruits and vegetables products like sauce, squash, pickles,
- Train to be eligible for job opportunities in processing and preservation of fruits and vegetables industries
- Should be able to start own small scale business
- Learn methods of quality testing like acidity and TSS (total soluble salts)
- Visit to processing and preservation of fruits and vegetables unit or industry will give actual overview of outcome of skill-based course

Course outcomes: On completion of the course, students will be able to–

- Understand basics of necessity and economic importance of processing and preservation of fruits and vegetables
- gain knowledge of different basic methods of fruit and vegetable processing and preservation
- learn different methods of processing and preservation of fruits and vegetables
- Get acquainted with techniques used in processing and preservation of fruits and vegetables
- Obtain knowledge of value-added products
- Get acquainted with quality testing methods like PH, acidity and Total soluble salt TSS methods

Course Contents

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| 1. Study of selection of fruits and vegetables for processing | 1P |
| 2. Demonstration of machineries and equipment used in processing and preservation of fruits and vegetables | 1P |
| 3. Determination of pH, acidity content and TSS content of fruits and vegetables | 1P |
| 4. Preparation and preservation of jam and jelly and analysis of product | 1P |
| 5. Preparation and preservation of squash and syrup and analysis of product | 1P |
| 6. Preparation and preservation of tomato sauce and analysis of product | 1P |

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|---|----|
| 7. Study of fruit/vegetable preservation by using salt and analysis of product by | 1P |
| 8. Demonstration of preservation of fruits and vegetables by drying and dehydration techniques | 1P |
| 9. Study of fruits and vegetables canning | 1P |
| 10. Study of different types of preservatives in preservation of fruits and vegetables and the products | 1P |
| 11. Demonstration of different packaging techniques of processed and preserved fruits and vegetables | 1P |
| 12. Visit to fruits and or vegetable processing industry | 1P |