Sir P. T. Sarvajanik College of Science

(Autonomous, Affiliated with VNSGU, Surat)

Re-Accredited 'A+' with CGPA 3.35

PROPOSED SYLLABUS

FOR

SEM III & IV

Program: B.Sc.

Course: Botany

From

Academic year

2025-2026

(NEP-2020)

(To be effective from June, 2025)

Acknowledgement

At the outset, I would like to thank Principal Dr. Pruthul R. Desai for his guidance and support during the curriculum restructuring process. I am also grateful to all the esteemed members of the Board of Studies, for their constructive suggestions and contributions.

Above all, I am deeply indebted to all the young and vibrant colleagues in the Department of Botany for the long and arduous work they have put in during the compiling of the restructured syllabus.

Dr Anjali V Varshney
Chairperson
Board of Studies in Botany

Graduate Attributes

After the successful completion of modules in different courses of B.Sc. BOTANY, the learner will be able to:

GA 1: Understand the basic concepts of botany and structural and functional aspects of plants.

GA 2: Perceive the significance of microbes and plants for the animal life and human welfare, and structural and functional aspects of plants.

GA 3: Demonstrate experiments related to plant sciences, analyse data and interpret them with theoretical knowledge.

GA 4: Create awareness about the diversity of lower plants, their classification, structure and growth.

GA 5: Acquaint with the fundamentals and present understanding of the mechanisms associated with the development, differentiation and structure of different plant organs and the metabolic and physiological changes occurring in them.

GA 6: Effectively discuss and communicate scientific ideas both orally and in writing.

Programme Specific Outcomes

PO - 1 To build a strong academic bridge between students and stake holders

PO - 2 To proactively adapt to the changing needs of students and the society.

PO - 3 To provide opportunities for multidisciplinary activities.

PO -4 To mould individuals who would nurture the cultural heritage of our country and contribute to the betterment of the society.

Board of studies in Botany

Undergraduate & Postgraduate

	Name	Designation	Institute/Industry
Head of the Department			
1	Dr. Anjali V Varshney	Chairperson	Sir P T Sarvajanik College of Science, Surat
Faculty of the specialisation			
1	Dr. Jayshri D Chaudhari	Assistant Professor	Sir P T Sarvajanik College of Science, Surat
2	Dr. Vibhavari K Vyas	Adhyapak Sahayak	Sir P T Sarvajanik College of Science, Surat
3	Dr. Jagruti S Rana	Adhyapak Sahayak	Sir P T Sarvajanik College of Science, Surat
Subject Expert nominated by Vice-Chancellor Subject experts			
1	Dr. Meghna Adhwaryu	Head of the Department	Govt Arts, Commerce & Science College, Limbayat, Surat
Representative from Industry/corporate sector/allied area			
1	Ms. Prabhuta Patel	Director – Vision & Robotics	At Po. Ambach, F. Vaghshar, Ta. Pardi, Dist. Valsad, Gujarat
Meritorious Alumnus			
1	Dr. Minoo H. Parabia	Start-up	Retired professor VNSGU 12/1768 A, Vakil Street, Shahpore, Surat
Three experts from other than the parent University			
1	Dr Lolly M. Jain	Professor	K. J. Somaiya College of Science and Commerce, Mumbai
2	Prof. Bandu Konde	Professor	Wilson College (Autonomous), Mumbai
3.	Dr. Bhupendrasinh A. Jadeja	Associate Professor	M. D. Science College, Porbandar

Sr. No	Semester	Course number	Course Code	Course title
Core Course (CC)				
1.	**III**	CC V [MJ]	BOTMJ-S3P5-2CR25	Economic Botany
2.		CC VI [MJ]	BOTMJ-S3P6-2CR25	Plant Pathology
3.		CC VII [MJ]	BOTMJ-S3P7-4CR25	Cell Biology
4.		PRACTICAL-V [MJ]	BOTMJ-S3PR5-2CR25	Practical (MJ)-V
5.		PRACTICAL-VI[MJ]	BOTMJ-S3PR6-2CR25	Practical (MJ)-VI
6.		MDC	BOTMDC-S3P1-4CR25	Food Science and Technology
7.		PRACTICAL (SEC)	BOTSEC-S3P1-2CR25	Practical (SEC)-1 Art and Craft with Plants
8.		IKS	BOTIKS- S3P1-2CR25	Ancient Botany-I
1.	**IV**	CC VIII [MJ]	BOTMJ-S4P8-2CR25	Ecology
2.		CC IX [MJ]	BOTMJ-S4P9-2CR25	Plant Biochemistry
3.		CC X [MJ]	BOTMJ-S4P10-4CR25	Genetics and Plant Breeding
4.		PRACTICAL-VII [MJ]	BOTMJ-S4PR7- 2CR25	Practical (MJ)- 8
5.		PRACTICAL-VIII [MJ]	BOTMJ-S4PR8- 2CR25	Practical (MJ)- 9
6.		CC III [MN]	BOTMN-S4P3-2CR25	Advanced Botany
7.		PRACTICAL-III [MN]	BOTMN-S4PR3-2CR25	Botany Practical III (MN)
8.		SEC	BOTSEC-S4P1-2CR25	Practical (SEC)-1 Food Adulteration and Pharmacognostic Analysis
9.		IKS	BOTIKS- S3P1-2CR25	Ancient Botany-II

Content

Detailed B.Sc. Botany Syllabus

S. Y. B.Sc. Syllabus with effect from the Academic year 2025-2026

Course No.	Course Name	Course Code	Credits	Hour	Module	Lectures per module (1 Hr)	Examination		
							Internal Marks	External Marks	Total Marks
SEMESTER III									
Major Courses THEORY									
V	Economic Botany	BOTMJ-S3P5-2CR25	2	30	2	15	35	35	70
VI	Plant Pathology	BOTMJ-S3P6-2CR25	2	30	2	15	35	35	70
VII	Cell biology	BOTMJ-S3P7-4CR25	4	60	4	30	50	50	100
Major Courses PRACTICAL									
V	Practical (MJ)-V	BOTMJ-S3PR5-2CR25	2	30	1	15	15	15	30
VI	Practical (MJ)-VI	BOTMJ-S3PR6-2CR25	2	30	1	15	15	15	30
Multidisciplinary (MDC) THEORY									
II	Food Science and Technology	BOTMDC-S3P1-4CR25	4	60	4	30	50	50	100
Skill Enhancement Course (SEC) PRACTICAL									
II	Art and Craft with Plants	BOTSEC-S3P1-2CR25	2	30	2	30	25	25	50
Indian Knowledge System (IKS)									
I	IKS (Ancient Botany-I)	BOTIKS-S3P1-2CR25	2	30	2	15	25	25	50

SEMESTER IV									
Major Courses THEORY									
VIII	Ecology	BOTMJ-S4P8-2CR25	2	30	2	15	35	35	70
IX	Plant Biochemistry	BOTMJ-S4P9-2CR25	2	30	2	15	35	35	70
X	Genetics and Plant breeding	BOTMJ-S4P10-4CR25	4	60	4	30	50	50	100
Major Courses PRACTICAL									
VIII	Botany Practical -VII	BOTMJ-S4PR7-2CR25	2	30	1	15	15	15	30
IX	Botany Practical –VIII	BOTMJ-S4PR8-2CR25	2	30	1	15	15	15	30
Minor Courses THEORY									
III	Advanced botany	BOTMN-S4P3-2CR25	2	30	2	15	20	20	50
Minor Courses PRACTICAL									
III	Botany minor Practical- III	BOTMN-S4PR3-2CR25	2	30	2	30	25	25	50
Skill Enhance Course (SEC) PRACTICAL									
II	Food Adulteration and Pharmacognostic Analysis	BOTSEC-S4P1-2CR25	2	30	2	30	25	25	50
Indian Knowledge System (IKS)									
II	IKS (Ancient Botany-II)	BOTIKS-S4P1-2CR25	2	30	2	15	25	25	50

B.Sc. (BOTANY) SEMESTER- III

CORE COURSE- V

MAJOR COURSE (THEORY)

COURSE TITLE: ECONOMIC BOTANY

COURSE CODE: BOTMJ-S3P5-2CR25 **[CREDITS - 02]**

Course learning outcome		
After the successful completion of the Course, the learner will be able to: 1. Acquire comprehensive knowledge on different aspects related to the economic importance of plants. 2. Ascertain latest developments in the field of plant-based products with a practical approach. 3. Think independently and critically discuss sustainable vitality of plants.		
Module 1	**Food drugs and Industrial products**	**[15L]**
Learning objectives: The module is intended to ● Highlight the relationship between plants and human. ● Apply knowledge of economic botany to identify plant products and their uses. ● Develop observational and identification skill for food plant species and their uses.		
Learning outcomes: After the successful completion of the module, the learner will be able to 1. Comprehend the economic importance of plants in different industries. 2. Identify and classify various plant products such as Food, drugs, fibre and paper. 3. Develop skills in identifying plant species, including their morphological characteristics and uses.		
1.1	➢ **Introduction Economic Botany** ➢ **Cereals, Millets and Small Grains: plants-products-used as Food.** ● **Cereals: Major (Wheat, Maize & Rice), Minor (Oat, Barley & Rye) and Small Grains (Sorghum)** Cultivation, morphology and uses. ● **Millets (Foxtail millet, Bread millet & Finger millet** Cultivation, morphology and uses.	[8L]

1.2	➢ **Plants and plants products of industrial value:** • **Fiber and Fiber yielding plants:** Types & Classification Textile fibre: Cotton, Jute. • **Rubber and its Products:** Properties and uses of rubber. • **Medicinal Plants and Drugs:** Classification of drugs and drugs obtained from whole plant and plant parts	[7L]
Module 2	**Oils, Gum, Resin and Dyes**	**[15L]**
Learning objectives: This module is intended to • Know the chemical composition, properties and uses of different oils, gums and resins. • Discuss the different plants parts which are used in the preparation of Dyes		
Learning outcome: On the successful completion of the module, the learner will be able to 1. Understand the classification of algae based on the structure, reproduction and life cycles. 2. Evaluate the economic and social impact of Fatty oils and essential oils 3. Identify plant sources of fatty oils, Vegetables oils, Essential oils, gum resins and dyes.		
2.1	➢ **Fatty oils and Vegetable fats** • Drying and Semi Drying oil: Sunflower • Non-drying oil: Castor, Ground nut, Sesame • Vegetable oil (Fixed oil) ➢ **Essential oils:** extraction and applications • Sandalwood oil • Clove oil • Eucalyptus oil	[7L]
2.2	➢ **Gum and Resins:** • Gum: *Acacia nilotica, Butea monosperma* • Resin: Asafoetida (*Ferula assfoetida*), *Dipterocarpus turbinatus.* ➢ **Dyes:** • Dyes obtained from bark: *Madhuca indica* • Dyes obtained from wood: *Acacia catechu,* • Dyes obtained from leaves: *Indigofera tinctora* • Dyes obtained from flower: *Butea monosperma*	[8L]

References:

- Singh, Pandeya and Jain (2017). Economic Botany, Rastogi Publication Meerut
- Kochher S.L. (2012). Economic Botany in Topic Macmillan & Co New Delhi.
- Wicken G.E. (2001). Economic Botany: Principal & Practices. Kulwer Academic publishers, The Netherlands.
- Das, Gangulee and Mukhrjee (2011) College Botany 6th Edition.
- B Baruah (2017) Economic Botany, Kalyani Publisher. New Delhi.
- Samba Murty and Subrahmanyam (2011). Text Book of Modern Economic Botany, CBS Publishers and Distributors, New Delhi.
- Hill, Albert F (2016) Economic Botany: A Text book of useful plants and Plant

Mapping of CLOs and PSOs

Course Learning Outcomes	Programme Outcomes					
	1	2	3	4	5	6
1 Understand the Concept of economic botany and its importance in human societies.	X	X				
2. Explain the role of plants in human economies, including their uses agriculture, industry and trade.		X	X			
3. Identify and describe plants that economically important for food, fibre, medicine, and other products.		X	X	X		
4 Develop sustainable practices for plant use and conservation.		X	X	X		

Question Paper Template

B. Sc. (BOTANY) SEMESTER III

Core Course- V

COURSE TITLE: Economic Botany

COURSE CODE: BOTMJ-S3P5-2CR25 **[CREDITS - 02]**

Module	Remembering/ Knowledge	Understanding	Applying	Analysing	Evaluating	Creating	Total marks
I	20%	30%	20%	30%	-	-	100%
II	20%	30%	20%	30%	-	-	100%
III	20%	30%	20%	30%	-	-	100%

B.Sc. (BOTANY) SEMESTER III

Core Course- VI

MAJOR COURSE THEORY

COURSE TITLE: PLANT PATHOLOGY

COURSE CODE: BOTMJ-S3P6-2CR25 [CREDITS - 02]

Course learning outcome		
After the successful completion of the Botany Minor Course, the learner will be able to: 1. Identify and classify major groups of plant pathogens and plant diseases. 2. Elaborate the preventive and control measures for plant diseases.		
Module 1	**Introduction and Symptoms of Plant Pathology**	**[15L]**
Learning objectives: The module is intended to ● Impart skills to diagnose common diseases in plants. ● Elaborate the classification of plant diseases according to major causal organisms. ● Glimpses of the history of plant pathology in India.		
Learning outcomes: After the successful completion of the module, the learner will be able to 1. Explain the history and progress of plant pathology in India. 2. Identify the symptoms of plant diseases. 3. Classify plant diseases according to major causal agents.		
1.1	➢ History and progress of Plant Pathology in **India.** ➢ Classified according to major causal agents.	[5L]
1.2	➢ Symptoms of plant diseases by microorganisms. ➢ Differentiation between Bacterial, Viral and Fungal diseases using morphological characters.	[10L]
Module 2	**Control of Plant diseases**	**[15L]**
Learning objectives: This module is intended to • Elaborate on defense mechanisms of plant disease. • Discuss integrated disease management strategies to control plant disease. • Acquire knowledge of effect of environmental factors and nutrition on plant diseases. • Gain knowledge about methods of studying plant diseases. • Spread awareness about the management of plant diseases.		

Learning outcome:

After the successful completion of the module, the learner will be able to

1. Discuss the defence mechanisms of plant against disease causing organisms.
2. Explain management of plant diseases.
3. Identify types of plant diseases.

2.1	➢ General account of defence mechanism of Plants.	[4L]
2.2	➢ Effect of environmental factors and nutrition on plants.	[5L]
2.3	➢ Methods of control of Plant diseases.	[3L]
2.4	➢ Integrated Pest Management (IPM).	[3L]

References:

- V. N. Pathak, (2007). Fundamentals of Plant Pathology. Updesh Purohit for Agrobios (India) Jodhpur.
- B. P. Pandey, (2011). Plant Pathology Pathogen and Plant Disease. S. CHAND & COMPANY LTD.
- P. D. Sharma, (2006). Plant Pathology. Narosa Publishing House.
- R. S. Mehrotra, (2003). Plant Pathology. Tata McGraw-Hill Publishing Company Limited, NEW DELHI.

Mapping of CLOs and PSOs

Course Learning Outcomes	Programme Outcomes					
	1	2	3	4	5	6
1. Understand the symptoms of plant pathology.	X	X				
2. Grasp the identification of plant pathogens.	X	X				
3. Ascertain implement knowledge of management of plant disease.		X	X	X		
4. First-hand knowledge on plant pathogens, symptoms and management of plant diseases.	X	X	X	X		

Question Paper Template

F.Y. B. Sc. (BOTANY) SEMESTER III

Core Course- VI

MAJOR BOTANY (THEORY)

COURSE TITLE: PLANT PATHOLOGY

COURSE CODE: BOTMJ-S3P6-2CR25 [CREDITS - 02]

Module	Remembering / Knowledge	Understanding	Applying	Analysing	Evaluating	Creating	Total marks
I	20%	30%	20%	30%	--	--	100%
II	20%	30%	20%	30%	--	--	100%

B.Sc. (BOTANY) SEMESTER- III

CORE COURSE- VII

MAJOR COURSE (THEORY)

COURSE TITLE: CELL BIOLOGY

COURSE CODE: BOTMJ-S3P7-4CR25 [CREDITS - 04]

Course learning outcome
After the successful completion of the Course, the learner will be able to: 1. Identify the different cell organelles. 2. Establish relationships between intracellular structures and the functions they perform. 3. Relate the functions carried out by the different intracellular organelles. 4. Discuss the role of cellular components in mitotic cell division.

Module 1	Cell Biology	[15L]

Learning objectives:

The module is intended to

- Discuss cell biology in Plants science with a practical approach.
- Equip students to think independently and critically to discuss different aspects of plant life.

Learning outcomes:

After the successful completion of the module, the learner will be able to

1. Elaborate on the structures and purpose of basic components of prokaryotic and eukaryotic cells, membranes, and organelles.
2. Appreciate the role of cellular components in generation and utilization of energy in cells.

3. Enlist the contribution of national and international Botanists.		
1.1	**Introduction to Cell Biology** ➢ Definition and scope of cell biology ➢ History and development of cell theory. ➢ Classification of cells**:** prokaryotic vs. eukaryotic cells ➢ Microscopy techniques: Light microscope, Introduction to the Electron microscopy. ➢ Introduction to national and international Cell biologists, who have contributed/contributing to Botany and Life Sciences as a mark of tribute to earlier and modern biology.	[7L]
1.2	➢ **Structure of the Cell** • Structure and function of prokaryotic and eukaryotic cells. ➢ Cell membrane: structure and function. ➢ Cell wall (in plants, fungi, and bacteria) ➢ Cytoplasm: structure and role. ➢ Nucleus: structure, nuclear envelope, nucleolus, chromatin, and nuclear pore.	[8L]
Module 2	**Cell Organelles**	**[15L]**
Learning objectives: This module is intended to • Impart basic knowledge about plant cell organelles.		
Learning outcome: After the successful completion of the module, the learner will be able to 1. Understand about different types of models of plasma membrane. 2. Evaluate active and passive transport. 3. Differentiate between all cell organelles.		

2.1	➢ **Membrane Dynamics and Transport** ➢ Fluid mosaic model of the plasma membrane. ➢ Active and passive transport (Diffusion, osmosis, facilitated transport). ➢ Endocytosis and exocytosis. ➢ Membrane potentials and ion channel	[7L]
2.2	➢ **Cell Organelles and Their Functions** • Structure and functions of Chloroplast. ➢ **Endoplasmic Reticulum (ER)**: Rough and smooth ER, protein synthesis and transport. ➢ **Golgi Apparatus**: Structure, function in protein sorting and modification. ➢ **Mitochondria**: Structure, role in cellular respiration, ATP production. ➢ **Lysosomes**: Function in digestion and recycling. ➢ **Peroxisomes**: Role in lipid metabolism and detoxification. ➢ **Ribosomes**: Structure and protein synthesis. ➢ **Cytoskeleton**: Microtubules, actin filaments, intermediate filaments, and their role in cell shape, movement, and divisions. ➢ **Centrosomes and Centrioles**: Role in cell division. ➢ Structural organization and functions of **Lysosome.**	[8L]

Module 3	Cell Division	[15L]
Learning objectives: This module is intended to ● Introduction about cell division and cell cycle.		
Learning outcomes: After the successful completion of the module, the learner will be able to 1. Explain how cell division proceeds in reproduction, growth, and repair. 2. Describe the major events of eukaryotic cell division.		
3.1	➢ **Cell Cycle:** Interphase, G1 phase, S phase and G2 phase ➢ **Mitosis**: Phases (prophase, metaphase, anaphase, telophase) ➢ Significance of mitosis.	[7L]
3.2	➢ **Meiosis**: Phases (prophase I, metaphase I, anaphase I, telophase I, prophase II, metaphase II, anaphase II, telophase II) ➢ **Meiosis**: Difference with mitosis. ➢ Genetic recombination ➢ Significance of meiosis.	[8L]
Module 4	**Nucleic Acids**	**[15L]**
Learning objectives: This module is intended to ● Introduce a vision to look at the different types of nucleic acid.		
Learning outcomes: After the successful completion of the module, the learner will be able to 1. Nucleic acids are large biomolecules that play essential roles in all cells and viruses.		

2. A major function of nucleic acids involves the storage and expression of genomic information.
3. Deoxyribonucleic acid, or DNA, encodes the information cells need to make proteins.

4.1	➢ Types and Chemical structure and base composition of DNA. ➢ Watson and Crick model of DNA. ➢ DNA supercoiling, ➢ Chromatin organization, ➢ Structure of chromosomes.	[7L]
4.2	➢ RNA structures ➢ Types of RNA ➢ Replication of DNA (E. Coli) ➢ Transcription of RNA ➢ Translation of RNA	[8L]

References:

- K. Sahoo (2017) Biomolecules and Cell Biology. Kalyani Publishers, New Delhi.
- Copper, G.M. and Hausan, R.E. 2009 The Cell: A Molecular Approach. 5th edition. ASM Press & Sunderland, Washington, DC. Sinauer Associates, MA.
- Becker, W.M. Kleinsmith, L.J., Hardin. J. and Bertoni, G.P. 2009. The World of cell. 7th edition. Pearson Benjamin Cummings Publishing, San Francisco.

Mapping of CLOs and PSOs

Course Learning Outcomes	Programme Outcomes					
	1	2	3	4	5	6
1. Understand the structures and functions of cells	X	X				
2. Explain all phases of cell division.		X	X			
3. Acquire ability to describe the cell cycle.	X	X		X		
4. Understand Nucleic acids.		X	X	X		

Question Paper Template

B. Sc. (BOTANY) SEMESTER III

CORE COURSE- VII

COURSE TITLE: Cell Biology

COURSE CODE: BOTMJ-S3P7-4CR25 **[CREDITS - 04]**

Module	Remembering/ Knowledge	Understanding	Applying	Analysing	Evaluating	Creating	Total marks
I	20%	30%	20%	30%	-	-	100%
II	20%	30%	20%	30%	-	-	100%
III	20%	30%	20%	30%	-	-	100%

B.Sc. (BOTANY) SEMESTER III

COURSE TITLE: PRACTICAL MJ-V

COURSE CODE: BOTMJ-S3PR5-2CR25 [CREDITS- 02]

Course Learning Outcome
After the successful completion of the Course, the learner will be able to: 1. Identify cereals, legumes, spices, fibre and oil crop plants and their useful parts on the basis of them characteristic morphological features through herbarium specimens 2. Specify the type of nutritive content such as proteins, sugars, fats, cellulose present in provided plant sample such as seed, fruit and leaves via Biochemical tests 3. Differentiate between mitosis and meiosis.

PRACTICAL – I	
1.	**Study of Food plants through Specimens:** i. Wheat ii. Rice iii. Maize iv. Sorghum **v.** Bajra
2.	**Biochemical Test for cereals:** i. Carbohydrate Test
3.	Study of legumes through Specimens.
4.	Biochemical Test for Protein.
5.	**Study of Fiber Yielding Crops:** i. Cotton ii. Jute iii. Linen iv. Sunn hemp v. Cannabis vi. Coir vii. Cotton/ Kapok.
6.	**Macro & Microscopic Study of Fibers:**

	i. Biochemical Test for Cellulose
7.	**Study of Oil Yielding Crops:** i. Mustard ii. Groundnut iii. Soyabean iv. Coconut v. Sunflower
8.	**Biochemical Test for Oil:** i. Qualitative test for lipid. ii. A test for iodine number in given oil sample.
9.	Study of **Gums and Resins**
10.	**Study of chemical nature of vegetable tannin:** i. *Acacia nilotica* (Babool) ii. *Camellia sinensis* (Tea) *iii.* *Terminalia bellirica* (Baheda)
11.	Biochemical test for **tannin.**
12.	**Chemical Nature of Natural Dyes:** i. *Curcuma longa* (Turmeric) ii. *Indigofera tinctoria* (Indigo) *iii.* *Bixa orellana* (Sindoori)
13.	Study of Black Pepper, Clove through Specimens.
14.	Study of meiosis from Onion buds.
15.	Study of mitosis in Onion root tip.

- All the candidates shall complete a laboratory course by the regulations issued from time to time by the Academic Council on the recommendation of the Board of Studies.
- All the candidates shall record observations directly in the laboratory journal. The journals shall be signed periodically.
- At the end of the semester candidates shall produce a certified journal at the time of practical examination.

B.Sc. (BOTANY) SEMESTER I

COURSE TITLE: PRACTICAL MJ-VI

COURSE CODE: BOTMJ-S3PR6-2CR25 [CREDITS- 02]

Course Learning Outcome	
After the successful completion of the Course, the learner will be able to: 1. Diagnose common diseases of agricultural and horticultural crops. 2. Know about organisms and causal factor responsible for plant diseases. 3. Familiarize with some common plant diseases of India.	
PRACTICAL – II	
1.	Preparation of media for pathogen isolation.
2.	Isolation of a Plant pathogen from plant tissue.
3.	Calibration of microscope and measurement of any two plant pathogens.
4.	Systematic position and identification of important plant pathogenic fungi in infected plant material. i. Pythium ii. Aspergillus iii. Penicillium
5.	To study following Bacterial diseases (Causal Organism, symptoms and disease control) i. Bacterial Blight of Rice. ii. Citrus Canker. iii. Angular Leaf Spot of Cotton.
6.	To study following Viral diseases (Causal Organism, symptoms and disease control) i. Bunchy Top of Banana. ii. Leaf curl of Tomato iii. Tobacco mosaic.
7.	To study following Fungal diseases (Causal Organism, symptoms and disease control) i. Late Blight of Potato.

	ii. Tikka Disease of Groundnut. iii. Red Rot of Sugarcane.
8.	To study following Nematode diseases (Causal Organism, symptoms and disease control) i. Root-Knot Disease. ii. Ear-Cockle Disease of Wheat.
9.	To study following Mycoplasma diseases (Causal Organism, symptoms and disease control) i. Little Leaf of Brinjal. ii. Grassy Shoot Disease of Sugarcane.
10.	To study following Phanerogamic parasitic diseases (Causal Organism, symptoms and disease control) i. Dodder (*Cuscuta campestris*) ii. Broomrape (*Orobanche ramose*)
11.	Collect any two plant disease samples and preserve in the glass bottle following wet preservation protocol.
12.	Prepare herbarium specimens of at least two sample diseases with details noted on in it.
13.	Select any two infected plants by any pathogens, observe their characteristics, and after that, apply any organic treatment to control plant disease and submit a report.

- All candidates shall complete a laboratory course by the regulations issued from time to time by the Academic Council on the recommendation of the Board of Studies.
- All candidates shall record observations directly in the laboratory journal. Every journal shall be signed periodically.
- At the end of the semester candidates shall produce a certified journal at the time of practical examination.

B.Sc. (BOTANY) SEMESTER III

Multidisciplinary

COURSE TITLE: FOOD SCIENCE AND TECHNOLOGY

COURSE CODE: BOTMDC-S3P1-4CR25 [CREDITS - 04]

Course Learning Outcome		
After the successful completion of the Course, the learner will 1. Establish the relationship between food, nutrition and health. 2. Elaborate on different food groups and a balanced diet. 3. Discuss the function of various nutrients and their sources 4. Impart knowledge of preservation and processing technique of food. 5. Highlight the role of water for human health.		
Module 1	**Food science and Nutrition-I**	**[15L]**
Learning objectives: The module is intended to ● Impart basic knowledge about food and its nutritional values. ● Create awareness about of uses and preparation of different types of foods ● Discuss about the different sources and classification of food.		
Learning outcomes: After the successful completion of the module, the learner will be able to 1. Define basic terms used in study of food and its nutritional status. 2. Comprehend the relationship between food, nutrition and health. 3. Describe the importance of food.		
1.1	Definition of Food, Nutrition and Nutrients. Classifications of Food Types, Importance of Food	[5L]
1.2	Nutritive Value and sources of Food Groups. (i) Cereals, (ii) Pulses (iii) Fats and Oil. (iv) Fruits, Nuts and Vegetables	[10L]

	(v) Milk (vi) Sugar and Jaggery.	
Module -2	**Food Chemistry:**	**[15L]**
Learning objectives: The module is intended to • Impart basic knowledge about different sources of food. • Understand the classification of food. • Create awareness about different sources of food in forms of vitamins and mineral deficiency symptoms.		
Learning outcomes: After the successful completion of the module, the learner will be able to 1. Explain basic values of food and supplements, vitamins and minerals. 2. Describe the classification and sources of food, importance of the role of vitamins and minerals in human health.		
2.1	➢ Classification, sources, functions, deficiencies, nutritional significance. of ● Carbohydrates ● lipids ● Proteins	[8L]
2.2	➢ **Minerals:** ● Calcium, iron, iodine, fluorine, copper and zinc ➢ **Vitamins:** ● Fat soluble vitamins-A, D, E and K ● Water soluble vitamins – thiamin, riboflavin, niacin, pyridoxine, folate, vitamin B12 and vitamin C	[7L]
Module 3	**Balance Diet**	**[15L]**
Learning objectives: This module is intended to ● Impart basic knowledge about BMI and human health ● Create awareness about the balanced diet according to RDI. ● Understand the Functions of food.		

Learning outcome: After the successful completion of the module, the learner will be able to 1. Describe BMI. 2. Develop skills to plan a balanced diet for different age groups. 3. Explain physiological, psychological and social functions of food.		
3.1	➢ BMI -Definition ➢ Concept of Balanced Diet, use of food groups in planning a balanced diet. ➢ Use of recommended dietary intake (RDIs) in planning a balanced diet, factors affecting RDIs.	[7L]
3.2	➢ Functions of food-physiological, psychological and cultural associated food. ➢ Food Pyramid, exchange list, Nutritional requirements for different age groups. Disorders of malnutrition. ➢ Water: As a nutrient, requirements, and functions.	[8L]
Module-4	**Food Processing and Preservation Technology**	**[15L]**
Learning objectives: This module is intended to ● Impart knowledge of methods of cooking, ● Gain knowledge about preservation and processing technology.		
Learning outcome: After the successful completion of the module, the learner will be able to 1. Develop skills to prepare food in different ways. 2. Develop skills to preserve food by processing technology.		
4.1	➢ **Cooking**: Dry, moist, frying steam and and microwave cooking, Advantages, disadvantages and the effect of different methods of cooking on foods. ➢ **Food Processing and Preservation;** ➢ General principles of food processing, preservation by high and low temperature, drying irradiation, sugar, salt etc. **Dehydration of foods and Vegetables:** • Sun drying & mechanical dehydration, vacuum frying-freeze drying process variation for fruits and vegetables, packing and storage.	[7L]

4.2	➢ **Jam:** • Constituents, selection of fruits, processing & technology**,** ➢ **Jelly:** • Essential constituents (Role of pectin, ratio), Theory of jelly formation, Processing & technology, defects in jelly, ➢ **Marmalades:** • Types, processing & technology, defects. ➢ **juices and squashes:** • Canning and Bottling of Fruits and	[8L]

Reference

1. Bamji MS, Krishnaswamy K, Brahmam GNV (2009). Textbook of Human Nutrition, 3rd Edition. Oxford and IBH Publishing Co. Pvt. Ltd.
2. Srilakshmi, (2007). Food Science, 4th Edition. New Age International Ltd.
3. Srilakshmi, (2005), Dietetics, Revised 5th edition. New Age International Ltd.
4. Wardlaw MG, Paul M Insel Mosby 1996). Perspectives in Nutrition, Third Edition.
5. Codex Guidelines on Nutrition Labelling (CAC/GL 2_1985) (Rev.1_1993). Rome, Food and Agriculture Organisation of the United Nations / World Health Organisation, 1993.
6. Food Safety and Standards Authority of India portal, Government of India
7. Gopalan, C., (1990). NIN, ICMR. Nutritive Value of Indian Foods.
8. Seth V, Singh K (2005). Diet planning through the Life Cycle: Part 1. Normal Nutrition. A Practical Manual, Fourth edition, Elite Publishing House Pvt Ltd.

Mapping of CLOs and PSOs

Course Learning Outcomes	Programme Outcomes					
	1	2	3	4	5	6
1. The relationship between food and human health.	x	X				
2. The types and functions of food	x					
3. Explain the importance of water and various nutrients and their sources of food	x	X	x			
4. Familiarize to plan balance diet according to RDIs	x		x			
5. Illustrate the preservation and processing technique of food.	x		x			

Question Paper Template

B. Sc. (BOTANY) SEMESTER III

Multidisciplinary

COURSE TITLE: FOOD SCIENCE AND TECHNOLOGY

COURSE CODE: BOTMDC-S3P1-4CR25 **[CREDITS - 04]**

Module	Remembering/ Knowledge	Understanding	Applying	Analysing	Evaluating	Creating	Total marks
I	20%	40%	40%	-	-	-	100%
II	20%	40%	40%	-	-	-	100%
III	20%	40%	40%	-	-	-	100%
IV	20%	40%	40%	-	-	-	100%

B.Sc. (BOTANY) SEMESTER III

Skill Enhancement Course

COURSE TITLE: ART AND CRAFT WITH PLANTS (Practical)

COURSE CODE: BOTSEC- S3P1-2CR25 [CREDITS- 02]

Course Learning Outcome	
After the successful completion of the Course, the learner will be able to: 1. Identify different plant materials, understand their properties, uses and limitations in artistic and craft contexts. 2. Create original artworks using plant materials, applying techniques like pressing, drying, weaving, or sculpting with plant fibers. 3. Gain proficiency in techniques such as botanical illustration, plant-based sculpture, and eco-friendly crafting. 4. Use plants as a medium of self-expression, demonstrating creative thinking and unique design approaches to artistic projects. 5. Develop an understanding of art and craft business management (finance, marketing and personnel).	
PRACTICAL Module- I	
1.	Study different plant parts in different fields of art and craft.
2.	Make various items of bamboo.
3.	Make items of different plant fibres.
4.	Make jewellery from dry plant material.
5.	Make jewellery from live plant material
6.	Prepare Colourful painting through plant parts.
PRACTICAL Module- II	
1.	Prepare wall art from dry leaves and flowers.
2.	Make musical instruments from plant material.
3.	Make a dye and prepare a painting with this dye.
4.	Make a different rangoli powder from plant material.
5.	Visit the art and craft unit and submit the report.
6.	Making a model from your own ideas using plant materials.

- All candidates shall complete a laboratory course by the regulations issued from time to time by the Academic Council on the recommendation of the Board of Studies.
- All candidates shall record observations directly in the laboratory journal. Every journal shall be signed periodically.
- At the end of the semester candidates shall produce a certified journal during the practical examination.

Mapping of CLOs and PSOs

Course Learning Outcomes		Programme Outcomes					
		1	2	3	4	5	6
1	To apply innovative and creative approaches to their work, incorporating plant materials in unique ways that reflect personal style and current design trends.			X	X		X
2	Understanding of sustainable practices in art and crafts, focusing on ethical sourcing, recycling and working with renewable plant materials in eco-friendly ways.		X	X			X
3	Will gain knowledge of the cultural and historical significance of plants in art, crafts and design.		X	X			X
4	Ability to work collaboratively on projects that incorporate plants and may integrate cultural, social or environmental themes.		X	X			

B.Sc. (BOTANY) SEMESTER III

Core Course- I

IKS THEORY

COURSE TITLE: ANCIENT BOTANY-I

COURSE CODE: BOTIKS-S3P1-2CR25 [CREDITS - 02]

Course learning outcome		
After the successful completion of the Botany Minor Course, the learner will be able to: 1 Demonstrate a comprehensive understanding of ancient botanical knowledge including the classification use and cultivation of plants in ancient civilization. 2 Analyze the role of plants in ancient culture their medicinal, nutritional and spiritual significance. 3 Explore the historical evolution of botanical science and its relationship with ancient philosophies religious trades and early scientific methods.		
Module 1	**Introduction to Ancient Botany**	**[15L]**
Learning objectives: The module is intended to • understand the origins and evolution of botanical knowledge. • explore ancient plant classification. • study the role of plants in ancient civilizations, medicine, and culture. • examine early botanical texts and their contributions.		
Learning outcomes: After the successful completion of the module, the learner will be able to • Understand the classification and uses and cultivation of plants in ancient time. • Examine early botanical text and their contribution. • Apply ancient botanical knowledge about the role of plants in ancient civilization.		
1.1	Definition and scope of ancient botany • Importance of ancient botanical knowledge in modern science. • Early human interactions with plants: foraging, agriculture, and domestication. Ancient Plant Classification Systems • Classification of plants in Vedic texts (Rigveda, Atharvaveda) • Theophrastus' classification: Father of Botany • Pliny the Elder's Natural History (Historia Naturalis)	[8L]

	• Early Chinese plant classifications (Shennong Ben Cao Jing)	
1.2	Ethnobotany and Medicinal Plants in Antiquity • Sacred and medicinal plants in ancient Egypt, Greece, India, and China • Ayurveda and Unani plant-based medicines • Uses of plants in religious and cultural rituals (Soma, Lotus, Sacred Fig) • Role of plants in ancient traditional healing practices.	[7L]
Module 2	**Botanical Writings and Texts of Ancient Bharat**	**[15L]**
Learning objectives: This module is intended to • Understand the concept of Indian medicinal botany. • Remember the agricultural text of rome. • Elaborate the historical evolution of botanical science.		
Learning outcome: After the successful completion of the module, the learner will be able to • Describe the ancient Chinese pharmacopoeias. • Compare the ancient and modern technique of cultivation of plants.		
2.1	Old manuscripts • Charaka Samhita, Sushruta Samhita and Vagbhatt (Indian medicinal botany) • De Materia Medica by Dioscorides • Agricultural texts of Rome (Cato, Varro, Columella) • Ancient Chinese pharmacopoeias (Compendium of Materia Medica) • Nighantu Adarsh Vol I,II	[7L]
2.2	Ancient Agricultural and Horticultural Practices • Early cultivation techniques in Mesopotamia, Egypt, and the Indus Valley • Traditional irrigation and soil conservation methods • Ancient grafting and propagation techniques • Influence of ancient botany on modern agriculture.	[8L]

References:

- Shah Vaidya Bapalal G., (1927), Nighantu Adarsha.
- V. Singh, P.C. Pandey and D.K. Jain, A text book of botany.
- Dr. Shrikrushna, Vruxaaryuveda, Banaras Aaryuved Series-6.
- Chunekar K.C, Pandey G.S. (2020), Bhaprakash Nigantu, Varansi India. Chakrakhambha Bharti publisher and distributor.

Mapping of CLOs and PSOs

Course Learning Outcomes	Programme Outcomes					
	1	2	3	4	5	6
1 Understand the origins and evolution and the concept of Indian medicinal botany.	X	X				
2. Describe the ancient Chinese pharmacopoeias		X	X			
3. Apply ancient botanical knowledge about the role of plants in ancient civilization		X				
4. Understand and explain the historical evolution of botanical science.	X					

Question Paper Template

S.Y. B. Sc. (BOTANY) SEMESTER III

Core Course- VI

IKS (THEORY)

COURSE TITLE: ANCIENT BOTANY-I

COURSE CODE: BOTIKS-S3P1-2CR25 **[CREDITS - 02]**

Module	Remembering / Knowledge	Understanding	Applying	Analysing	Evaluating	Creating	Total marks
I	20%	40%	40%	-	-	-	100%
II	20%	40%	40%	-	-	-	100%

B.Sc. (BOTANY) SEMESTER- IV

CORE COURSE- VIII

MAJOR COURSE (THEORY)

COURSE TITLE: ECOLOGY

COURSE CODE: BOTMJ-S4P8-2CR25 [CREDITS - 02]

Course learning outcome		
After the successful completion of the Course, the learner will be able to 1. Discuss the ecological principles, the community structure and ecosystem function. 2. Elaborate on the different types of ecosystems and plant communities.		
Module 1	**Ecological and Physiographic factors**	**[15L]**
Learning objectives: This module is intended to introduce: ● The scope of ecology. ● Review the nature of science and ecology as a branch of natural sciences. ● Outline the history and expansion of ecology.		
Learning outcome: After the successful completion of the module, the learner will be able to 1. Identify the distinguishing physical properties of soil. 2. Analyse the main types and adaptations of hosts to minimize impacts of parasites. 3. Identify characteristics of mutualism and discuss this as a type of symbiosis beneficial to both species. 4. Investigate the differences and similarities between symbiotic and nonsymbiotic mutualisms.		
1.1	➢ **Ecology-** ● Definition, Ecology and its divisions, different fields of ecology, Plant ecology and other branches of science, Application of plant ecology. ➢ **Ecological factors:** ● **Climatic factors**-light, temperature, precipitation and atmospheric humidity, air and microclimate.	[7L]
1.2	● **Soil edaphic factors:** soil components and their effects on vegetation ● **Physiographic factors** ● **Biotic factors:** Interaction between plants, animals and micro-organisms.	[8L]

Module 2	Ecosystem and plants Succession	[15L]

Learning objectives:

This module is intended to:

- Discuss the principles of global biome distribution, biodiversity and functional ecology of different tropical and temperate biomes under the climate change scenario.
- Analyse the interactions among organisms within an ecosystem.
- Elaborate on climate and distribution of global tropical and temperate biomes, their diversity, ecosystem functioning and conservation needs.
- Elaborate the different types of aquatic and terrestrial environment, interaction of living and non-living things and adaptations.

Learning outcome:

After the successful completion of the module, the learner will be able to:

1. Discuss the climate and distribution of global tropical and temperate biomes, their diversity, ecosystem functioning and conservation needs.
2. Elaborate the different types of aquatic environment, interaction of living and non-living things and adaptations.
3. Outline the different ecosystems, components and interactions and the energy flows through an ecosystem
4. Distinguish the living and non-living components that make up an ecosystem.

2.1	• **Ecosystem:** Definition, structure, components, function of ecosystem, food chain and food web, ecological pyramids, trophic levels, energy flow in ecosystem., biogeochemical cycles- Water, C, N, O, P, S.	[7L]
2.2	• Grassland ecosystem, Forest ecosystem, Pond ecosystem, Desert ecosystem. • **Plant Succession:** Definition, types, Process, Hydrosere and xerosere.	[8L]

REFERENCES:

1. Smith, TM and Smith RL 2015. Elements of Ecology, Pearson Education, India.
2. Cain, ML, Bowman, WD and Hacker SD 2011. Ecology, 2nd Edition, Sinauer Associates Inc.
3. Odum, E. P. (2004). Fundamentals of Ecology, Oxford and IBH Publishing Co. Pvt. Ltd.
4. Miller.G.T., Jr. 2014. Environmental Science. 14th Edition,Thomson, California.
5. Singh, J.S., Singh, S.P. & Gupta, S.R. 2014. Ecology, Environmental Science and Conservation. S. Chand & Company Pvt. Ltd., New Delhi. 929p.
6. Archibold, O.W. 1995. Ecology of World Vegetation. Chapman & Hall, London.
7. Verma & Agarwal (1995). Environmental Biology (Principles of ecology) Chand & co.,New Delhi
8. Ambhast, R. S. (1998) A Text Book Of Plant Ecology. (9th edition),
9. Barbour, M.G.,Pits, W.D., and Burk, J. H. (1967) Terrestrial Plant Ecology, Addison-Wesley Publisher.
10. P.D. Sharma, Ecology and Environment: Rastogi Publication
11. Pandya, Puri and Singh (1968) Research Methods in Plant Ecology, Asia publishing House, New Delhi.
12. Subrahmanyam and Sambamurthy (2000) Ecology, Narosa Publising House, New Delhi
13. Yadav, P. R., and Mishra, S. R. (2004) Environmental biology, Discovery publication, New Delhi.

Mapping of CLOs and PSOs

Course Learning Outcomes	Programme Outcomes					
	1	2	3	4	5	6
1. Understand the ecological principles, effects of ecological factors on ecosystems.	X	X				
2. Remember the biogeochemical cycles, structure and components of ecosystem.	X	X				
3. Compare the effect of biological factors on vegetation.	X	X	X			
4. Analyse the different types of plant communities according to ecosystem type and geographical distribution.	X	X		X		

Question Paper

B. Sc. (BOTANY) SEMESTER IV

Core Course- VIII

COURSE TITLE: ECOLOGY

COURSE CODE: BOTMJ-S4P8-2CR25 **[CREDITS - 02]**

Module	Remembering/ Knowledge	Understanding	Applying	Analysing	Evaluating	Creating	Total marks
I	20%	30%	20%	30%	-	-	100%
II	20%	30%	20%	30%	-	-	100%

B.Sc. (BOTANY) SEMESTER- IV

CORE COURSE- IX

MAJOR COURSE (THEORY)

COURSE TITLE: PLANT BIOCHEMISTRY

COURSE CODE: BOTMJ-S4P9-2CR25 [CREDITS - 02]

Course learning outcome		
After the successful completion of the Course, the learner will be able to: 1. Acquire knowledge on structural and functional properties of carbohydrates, proteins, lipid, and Vitamins. 2. Discuss the various mechanisms of enzyme action and interpret the plots of enzymatic kinetics. 3. State the laws of thermodynamics		
Module 1	**Carbohydrates and lipids**	**[15L]**
Learning objectives: The module is intended to ● Provide an overview of classification, structure and properties of Carbohydrates, Lipids and Vitamin. ● Acquaint with the fundamental mechanisms associated with the development, differentiation and structure of different plant organs.		
Learning outcomes: After the successful completion of the module, the learner will be able to 1. Describe structure and properties of Carbohydrates Lipids, and Vitamins. 2. Classify plant primary metabolites.		
1.1	➢ **Carbohydrates** ● Introduction, classification, structure and properties of- monosaccharides (aldose and ketose sugars) ● oligosaccharides (reducing and non-reducing sugars) ● polysaccharides (storage- starch, inulin; structural- cellulose, pectin, chitin, aminoglycans, peptidoglycans, glycoprotein, glycolipids).	[8L]

1.2	➢ **Lipids:** • classification, structure (saturated and unsaturated); simple lipids, compound lipids and derived lipids. • Properties of - fatty acids and fats. • Waxes; Phospholipids; Glycoprotein; Lipo-Protein. • Derived lipids(steroids); importance of Lipids.	[7L]
Module 2	**Protein and Enzyme**	**[15L]**
Learning objectives: The module is intended to • Provide an overview of classification, structure and properties of Amino Acids, and Proteins. • Discuss the fundamental mechanisms associated with the development, differentiation and structure of different plant organs.		
Learning outcomes: After the successful completion of the module, the learner will be able to 1. Describe structure and properties of Amino acids, Proteins, and Enzymes. 2. Classify plant primary metabolites.		
2.1	➢ **Amino acids:** • classification, structure and properties of amino acids, essential and non-essential amino acids. ➢ **Proteins:** • classification, structural organization of proteins, biological roles of proteins.	[8L]
2.2	➢ **Enzymes:** • Introduction, Occurrence, Nomenclature and classification, mode of action, aspects of enzyme kinetics (Michaelis-Menten constant), enzyme inhibition, factors affecting catalytic efficiency of enzyme. ➢ **Bioenergetics:** • Laws of thermodynamics, concept of Gibb's free energy in plants; redox reactions; high energy rich compounds.	**[7L]**

References:

1. Katherine and Joseph (2007) Foundation of General, Organic and Biochemistry, McGraw Hill.
2. Biochemistry Demystified, Sharon Walker and David McMohan, McGraw Hill.
3. David Nelson and Michel M.Cox (2021) Lehninger Principles of Biochemistry, WH free Man.
4. Fundamentals of Biochemistry: Life at the Molecular Level, Donald Voet, Judith G. Voet,
5. Charlotte W. Pratt, Wiley. Fundamentals of biochemistry, Jain, S. Chand publication.

Mapping of CLOs and PSOs

Course Learning Outcomes	Programme Outcomes					
	1	2	3	4	5	6
1. About structure of primary metabolites	X	X				
2. Explain the classification of Carbohydrates, protein, amino acid.		X	X			
3. Students will be able to get knowledge of structure primary metabolites and classify it.		X	X	X		
4. Students will be able to explain reaction kinetics, thermodynamics of the molecules.			X	X		

Question Paper Template

S.Y. B. Sc. (BOTANY) SEMESTER IV

Core Course- IX

COURSE TITLE: PLANT BIOCHEMISTRY

COURSE CODE: BOTMJ-S4P9-2CR25 **[CREDITS - 02]**

Module	Remembering/ Knowledge	Understanding	Applying	Analysing	Evaluating	Creating	Total marks
I	20%	30%	20%	30%	-	-	100%
II	20%	30%	20%	30%	-	-	100%
III	20%	30%	20%	30%	-	-	100%

B.Sc. (BOTANY) SEMESTER- IV

CORE COURSE- X

MAJOR COURSE (THEORY)

COURSE TITLE: GENETICS AND PLANT BREEDING

COURSE CODE: BOTMJ-S4P10-4CR25 [CREDITS - 04]

Course learning outcome		
After the successful completion of the Course, the learner will be able to: 1. Discuss Fundamentals of Genetics. 2. Evaluate non-Mendelian inheritance and Pedigree analysis. 3. Describe different methods of Plant breeding and importance of selection.		
Module 1	**Science of Genetics**	**[15L]**
Learning objectives: The module is intended to • Understanding Genetics and Mendelism & Chromosome Theory. • Plant breeding is the science of manipulating plant traits to create new varieties with desired characteristics, aiming to improve crop quality and yield.		
Learning outcomes: After the successful completion of the module, the learner will be able to 1. Explain genetic principles governing inheritance. 2. Analyze chromosome theory of heredity.		
1.1	➢ **Science of Genetics** • An overview of modern history of Genetics before 1860, 1860-1900, and Present, about 3 general areas of Genetics (Classical, Molecular & Evolutionary). • Mendelism & Chromosome Theory. • Mendel's principles, Chromosome Theory of Heredity (Sutton-Boveri), Inheritance patterns, phenomenon of Dominance.	[8L]
1.2	➢ **Mendelian inheritance** • Extension of Mendelism – Deviation from Mendel's Dihybrid phenotype, Linkage, Sutton's view on linkage, Morgan's view on linkage, Bateson & Punnet's Coupling & Repulsion hypothesis. ➢ Linkage and crossing over, Chromosome theory of Linkage, kinds of linkage, linkage groups, types of Crossing over, theories about the mechanism of Crossing over, significance of Crossing over.	[7L]

Module 2	Non-Mendelian Inheritance	[15L]
Learning objectives: This module is intended to • Understand about non-Mendelian inheritance and Pedigree analysis		
Learning outcome: After the successful completion of the module, the learner will be able to 1. Understand Chromosomal variation in Number & Structure. 2. Understand Pedigree analysis.		
2.1	➢ Non-Mendelian inheritance – Evidences for Cytoplasmic factors, cytoplasmic inheritance, extranuclear inheritance (mitochondrial, chloroplast), non-chromosomal inheritance, maternal inheritance, uniparental inheritance.	[7L]
2.2	➢ Chromosomal variation in Number & Structure – Euploidy, Non-disjunction & Aneuploidy, Polyploidy in Plants. ➢ Induced Polyploidy, applications of Polyploidy, Chromosomal Mosaics, Polytene chromosome, Deletion, Duplication, Inversion and Translocation.	[8L]
Module 3	**Plant Breeding**	**[15L]**
Learning objectives: This module is intended to • Understand about history and scope of plant breeding		
Learning outcome: After the successful completion of the module, the learner will be able to 1. Understand objectives, history of plant breeding and mode of reproduction. 2. Understand about types and mode of pollination.		
3.1	➢ Definition, aim, objectives and scope of plant breeding ➢ History and development of plant breeding, scientific contributions of eminent scientists, landmarks in plant breeding. ➢ Modes of reproduction – asexual reproduction (vegetative reproduction and apomixis) and sexual reproduction – their classification and significance in plant breeding.	[7L]
3.2	➢ Modes of pollination. ➢ Classification of crop species on the basis of mode of pollination, self-pollination, mechanisms promoting self-pollination. ➢ Cross-pollination, mechanisms promoting cross-pollination.	[8L]

Module 4	Applications and Challenges in Plant Breeding	[15L]
Learning objectives: This module is intended to • Understand about crop improvement and heterosis.		
Learning outcome: After the successful completion of the module, the learner will be able to 1. Understand conventional breeding method. 2. Understand about Genetic modification and transgenic crops.		
4.1	➢ Method of plant breeding, classification of plant breeding methods, methods of breeding for self-pollinated, cross-pollinated, and asexually propagated species, a brief account of breeding methods. ➢ Plant introduction, primary introduction and secondary introduction, history of plant introduction.	[7L]
4.2	➢ Plant introduction agencies in India, National Bureau of Plant Genetic Resources (NBPGR) and its activity, the procedure of plant introduction, the purpose of plant introduction, merits and demerits of plant introduction, germplasm collections, genetic erosion, gene sanctuaries. ➢ Selection, natural and artificial selection, basic principles of selection, basic characteristics and requirements of selection, selection intensity, selection differential, heritability, genetic advance.	[8L]

References:

1. Gardner, E. J., Simmons, M. J., & Snustad, D. P. (2005). *Principles of Genetics* (8th Ed.). Wiley.
2. Hartl, D. L., & Ruvolo, M. (2019). *Genetics: Analysis of Genes and Genomes* (9th Ed.). Jones & Bartlett Learning.
3. Acquaah, G. (2015). *Principles of Plant Genetics and Breeding* (2nd Ed.). Wiley-Blackwell.
4. Singh, B. D., & Singh, A. K. (2023). *Plant Breeding: Principles and Methods* (12th Ed.). Kalyani Publishers.
5. Chahal, G. S., & Gosal, S. S. (2002). *Principles and Procedures of Plant Breeding: Biotechnological and Conventional Approaches.* Alpha Science International.

Mapping of CLOs and PSOs

Course Learning Outcomes	Programme Outcomes					
	1	2	3	4	5	6
1. Understand Mendelism and Chromosome theory.	X	X				
2. Explain the Linkage and crossing over.		X	X			
3. Students will be able to understand Allelic variation and gene function.		X	X	X		
4. Students will be able to understand chromosome mapping.		X	X	X		

Question Paper Template

B.Sc. (BOTANY) SEMESTER- IV

CORE COURSE- X

MAJOR COURSE (THEORY)

COURSE TITLE: GENETICS AND PLANT BREEDING

COURSE CODE: BOTMJ-S4P10-4CR25 [CREDITS - 04]

Module	Remembering / Knowledge	Understanding	Applying	Analysing	Evaluating	Creating	Total marks
I	20%	30%	20%	30%	--	--	100%
II	20%	30%	20%	30%	--	--	100%

B.Sc. (BOTANY) SEMESTER IV

COURSE TITLE: PRACTICAL MJ-VII

COURSE CODE: BOTMJ-S4PR7-2CR25 [CREDITS- 02]

Course Learning Outcome
After the successful completion of the Course, the learner will be able to: 1. Understanding the processes that shape the distribution and abundance of organisms. 2. modern tools and techniques and their appropriate use to conduct research.

PRACTICAL – I	
1.	To study communities by quadrat method and to determine % frequency, Density and Abundance.
2.	To measure the temperature of the soil and air.
3.	To study the texture of a given soil sample.
4.	To estimate the porosity of different soil samples.
5.	To find out the moisture content of the soil.
6.	To determine water-holding capacity of a given soil sample.
7.	To determine the Soil pH.
8.	To study the biotic components of a pond.
9.	To measure the amount of dissolved oxygen in pond water.
10.	To estimate the amount of chloride of different water samples.
11.	To study some common hydrophytes and xerophytes.
12.	To determine the Biochemical Oxygen Demand (BOD) of water.
13.	To determine Chemical Oxygen Demand (COD) of water.
14.	To study the effect of polluted water on seed germination of any crop.

15.	Study of ecological Instruments a. Psychrometer b. Prismatic compass c. Rain Gauge d. Soil thermometer

- Every candidate shall complete a laboratory course by the regulations issued from time to time by the Academic Council on the recommendation of the Board of Studies.
- Every candidate shall record observations directly in the laboratory journal. Every journal shall be signed periodically.
- At the end of the semester candidates shall produce a certified journal during the practical examination.

B.Sc. (BOTANY) SEMESTER IV

COURSE TITLE: PRACTICAL MJ-VIII

COURSE CODE: BOTMJ-S4PR8-2CR25 [CREDITS- 02]

Course Learning Outcome	
After the successful completion of the Course, the learner will be able to: 3. Assign the plants to their respective family based on morphological characteristics. 4. Describe plant morphology with live specimens.	
PRACTICAL – II	
1.	Identification of different laboratory equipment
2.	Identification of different laboratory glassware.
3.	Preparation of Buffer solution and pH measurement.
4.	Preparation of different solutions and reagents.
5.	To perform qualitative tests on carbohydrates.
6.	Estimation of starch by Anthrone Reagent.
7.	To perform qualitative tests on amino acids and proteins.
8.	Estimation of total free amino acids by ninhydrin method.
9.	Determination of soluble protein content by Lowry method.
10.	Estimation of free fatty acids
11.	Separation of chlorophyll by Paper chromatography
12.	TLC demonstration for Amino acid and separation of amino acids by Paper chromatography.

13.	Estimation of Ascorbic Acid.

- Every candidate shall complete a laboratory course by the regulations issued from time to time by the Academic Council on the recommendation of the Board of Studies.
- Every candidate shall record observations directly in the laboratory journal. Every journal shall be signed periodically.
- At the end of the semester candidates shall produce a certified journal during the practical examination.

B.Sc. (BOTANY) SEMESTER IV

Minor Botany

COURSE TITLE: ADVANCED BOTANY

COURSE CODE: BOTMN-S4P3-2CR25 [CREDITS - 02]

Course learning outcome		
After the successful completion of the Course, the learner will be able to: 1. Understand delimits and scopes of Cell biology and Genetics plant breeding. 2. Learn to identify the useful medicinal plants and crop plants found around you. 3. Effectively communicate scientific ideas both orally and in writing. 4. Collect crude drugs from field/market and test their genuineness and quality.		
Module 1	**Plant physiology and Biochemistry**	**[15L]**

Learning objectives:

The module is intended to

- Equip students to think independently and critically to discuss different aspects of life.
- Provide an overview of classification, structure and properties of Carbohydrates, Lipids and Vitamin.
- Be acquainted with the fundamental mechanisms associated with the development, differentiation and structure of different plant organs.

Learning outcomes:

After the successful completion of the module, the learner will be able to

1. Understand the different mechanism of physiological process in Plants. 2. Describe the importance of physiological process in Plants 3. Describe structure and properties of Carbohydrates Lipid, and Vitamin. 4. Classify plant primary metabolites.		
1.1	➢ **Definition, mechanism and importance of:** 1. Imbibition 2. Osmosis 3. Plasmolysis 4. Plant Movement 5. Transpiration 6. Guttation	[7L]
1.2	➢ **Carbohydrates** • Introduction, classification, structure and properties ➢ **Amino acids:** • classification, structure and properties of amino acids. ➢ **Proteins:** • classification, structural organization of proteins, biological roles of proteins. ➢ **Nucleic acids:** • Nucleotide, Structure of DNA and RNA	[8L]
Module 2	**Cell biology and Genetics**	**[15L]**
Learning objectives: The module is intended to • Introduction about cell division and cell cycle. • Understanding Genetics is the study of heredity and the genetic basis of individual variation. It provides the foundation for the study of all living organisms. • Plant breeding is the science of manipulating plant traits to create new varieties with desired characteristics, aiming to improve crop quality and yield.		
Learning outcomes: After the successful completion of the module, the learner will be able to		

1. Understand the structures and purposes of basic components of prokaryotic and eukaryotic cells, membranes, and organelles.
2. Understand how these cellular components are used to generate and utilize energy in cells.
3. Learn about national and international Botanists.

2.1	➢ **The Cell** ● Introduction; Brief History of cell; Type of cells; Structure of cell under Electron Microscope, ● Cell organelles: Cell wall, Plastid, Mitochondria, Nucleus, Golgi complex, Endoplasmic reticulum, Vacuoles, Ribosomes	[7L]
2.2	➢ **Genetics** ● Introduction. ● Mendel's principle, Allele, Genotype and Phenotype. ● Mendel's Law of inheritance. ● Law of segregation, law independent assortment, incomplete dominance and codominance, Lethal alleles.	[8L]

Reference:

- K. Sahoo (2017) Biomolecules and Cell Biology. Kalyani Publishers, New Delhi.
- Copper, G.M. and Hausan, R.E.(2009) The Cell: A Molecular Approach. 5th edition. ASM Press & Sunderland, Washington, DC. Sinauer Associates, MA.
- Becker, W.M. Kleinsmith, L.J., Hardin. J. and Bertoni, G.P. (2009) The World of cell. 7th edition. Pearson Benjamin Cummings Publishing, San Francisco.
- S.K. Varma, Mohit Varma (1995) A textbook of Plant Physiology, Biochemistry and Biotechnology, S Chanda.
- V. K. Jain (2017) Fundamentals of Plant Physiology, S Chand.
- Katherine and Joseph (2007) Foundation of General, Organic and Biochemistry, McGraw Hill.
- David Nelson and Michaal M.Cox (2021) Lehninger Principles of Biochemistry, WH free Man.

- Fundamentals of Biochemistry: Life at the Molecular Level, Donald Voet, Judith G. Voet, Charlotte W. Pratt, Wiley.
- Fundamentals of biochemistry, Jain, S. Chand publication.
- Dr. S.K. Verma and Mohit Verma (2008) A textbook of Plant Physiology Biochemistry and Biotechnology, S. Chand and Co.
- A.C. Datta (1989) College Botany, 3rd Edi., Oxford Bombay.

Mapping of CLOs and PSOs

Course Learning Outcomes	Programme Outcomes					
	1	2	3	4	5	6
1. Understand the different systems of Medicine.	X	X				
2. Explain the different types of plants' traditional uses and pharmacognosy.		X	X			
3. Students will be able to cultivate crop plants and medicinal plants and make an ethno medicine.		X	X	X		
4. Students will be able to use minor and major products of plants.	X	X	X	X		

Question Paper Template

B. Sc. (BOTANY) SEMESTER IV

Minor Botany

COURSE TITLE: ADVANCED BOTANY

COURSE CODE: BOTMN-S4P3-2CR25 **[CREDITS - 02]**

Module	Remembering / Knowledge	Understanding	Applying	Analysing	Evaluating	Creating	Total marks
I	20%	40%	40%	-	-	-	100%
II	20%	40%	40%	-	-	-	100%
III	20%	40%	40%	-	-	-	100%
IV	20%	40%	40%	-	-	-	100%

BSc. (BOTANY) SEMESTER IV

COURSE TITLE: PRACTICAL(MN)-III

COURSE CODE: BOTMN-S4PR3-2CR25 [CREDIT- 02]

Course Learning Outcome	
After the successful completion of the Course, the learner will be able to: 1. Understand the Physiological experiments. 2. Differentiate the sporophytic and gametophytic structure.	
PRACTICAL	
1.	Perform Physiological experiments to demonstrate: A. Force imbibition. B. Osmosis by thistle funnel method. C. Geotropic movement in plant. D. Hydrotropic movement in plant. E. Phototropic movement in plant. F. Stomatal transpiration by four leaves method. G. Phenomenon of transpiration (bell jar method).
2.	To study the phenomenon of plasmolysis.
3.	To observe streaming movement (cyclosis) of the protoplasm.
4.	To study the effect of natural light on photosynthesis.
5.	Effect of CO_2 concentration on photosynthesis.
6.	To study the effect of different light on photosynthesis.
7.	Identification of different laboratory equipment.
8.	Preparation of different solutions and reagents.
9.	To perform qualitative tests on carbohydrates.
10.	To perform qualitative tests on Protein and Amino acid.
• Every candidate shall complete a laboratory course by the regulations issued from time to time by the Academic Council on the recommendation of the Board of Studies. • Every candidate shall record observations directly in the laboratory journal. Every journal shall be signed periodically. • At the end of the semester candidate shall produce a certified journal during the practical examination.	

S.Y. BSc. (BOTANY) SEMESTER IV

Skill Enhancement Course (Practical)

COURSE TITLE: FOOD ADULTERATION AND PHARMACOGNOSTIC ANALYSIS

COURSE CODE: BOTSEC-S4P1-2CR25 [CREDIT- 02]

Course Learning Outcome	
After the successful completion of the Course, the learner will be able to: 1. Identify common adulterants in different food products. 2. Use scientific knowledge and critical thinking skills to address issues related to food safety, quality control and adulteration. 3. Compare traditional methods with modern pharmacognostic techniques. 4. Understand, analyze and communicate the value of their professional roles in society, like health care professionals, promoters of health, educators, managers, employers, employees.	
PRACTICAL Module – I	
1.	study the types of food adulteration.
2.	Adulterants detection test and effect of health in **Milk and Milk products.** a. Water b. Detergent c. Starch d. Urea e. Vanaspati f. Formalin g. Curd- Vanaspati h. Rabdi- Blotting paper i. Khoa- Starch j. Paneer- Starch

3.	Adulterants detection test and effect on health in **Oils and Fats.** a. Ghee- Vanaspati or Margarine, Mashed potatoes, Sweet potatoes and other starch b. Butter- Vanaspati or Margarine c. Coconut oil- Any other oil
4.	Adulterants detection test and effect on health in **Sweetening agents.** a. Sugar- Chalk powder, Urea b. Honey- Sugar solution c. Jaggery- Washing soda, Chalk powder, Metanil yellow colour, Sugar solution d. Bura sugar- Washing soda e. Sweetmeats, Ice- cream and Beverages- Metanil yellow, Saccharin
5.	Adulterants detection test and effect on health in **Grain products.** a. Maida- Boric acid b. Sella rice (Parboiled Rice)- Metanil yellow c. Wheat flour- Chalk powder d. Besan/ Gram powder- Metanil yellow
6.	Adulterants detection test and effect on health in **Miscellaneous products.** a. Saffron- Dried tendrils of maize cobs b. Common salt- White powdered c. Iodized salt- Common salt d. Tea leaves- Exhausted tea e. Vinegar- Mineral acid f. Coffee- Chicory g. Catechu powder- Chalk h. Sweet potato- Rhodamine B color

PRACTICAL Module – II	
1.	Study of Microscope.
2.	Study of powder and microscopic study of **Cinchona.**
3.	Study of powder and microscopic study of **Cinnamon.**
4.	Study of powder and microscopic study of **Senna leaf.**
5.	Study of powder and microscopic study of **Clove.**
6.	Study of powder and microscopic study of **Fennel fruit.**
7.	Study of powder and microscopic study of **Coriander fruit.**
	• Every candidate shall complete laboratory courses by the regulations issued from time to time by the Academic Council on the recommendation of the Board of Studies. • Every candidate shall record observations directly in the laboratory journal. Every journal shall be signed periodically. • At the end of the semester candidates shall produce a certified journal during the practical examination.

Mapping of CLOs and PSOs

Course Learning Outcomes	Programme Outcomes					
	1	2	3	4	5	6
1. Understand the basics of food adulteration, develop skills in laboratory techniques for food testing.		X				
2. Learn and apply different methods for detecting food adulteration.		X	X			
3. Utilize scientific knowledge and critical thinking skills to address issues related to food safety, quality control, and adulteration.		X	X	X		
4. Apply knowledge and information to evaluate social, health, safety and legal issues and responsibilities related to professional pharmacy practice.			X			
5. Applying knowledge of pharmacognosy can be used for public health initiatives.			X			

B.Sc. (BOTANY) SEMESTER IV

Core Course- VI

IKS THEORY

COURSE NAME: ANCIENT BOTANY -II

COURSE CODE: BOTIKS-S4P1-2CR25 [CREDITS - 02]

Course Learning Outcome		
After the successful completion of the Botany Minor Course, the learner will be able to: 1.Understand the contribution of Vedas and Samhita in Indian civilization. 2. Aware about the knowledge of Rugveda, Atharvaveda, Charak Samhita and Sushrut Samhita 3. Identify the local medicinal plants. 4. Apply the knowledge of uses of medicinal plants.		
Module 1	**Influence of Ancient Botany on Medicinal Practice**	**[15L]**
Learning objectives: The module is intended to • Understand the ancient text and contribution of Vedas and Samhita. • Learn about the ancient pharmacognosy. • Do practice for various techniques in pharmacognosy.		
Learning outcomes: After the successful completion of the module, the learner will be able to • Obtain knowledge and understand the Ethno-Botany in Ramayana and Mahabharata • Important approaches and practices of various techniques in pharmacognosy. • Explain the concept of ancient Indian Pharmacognosy.		
1.1	Ethno -Botany in the Ramayana and Mahabharata Sacred Forests and Their Sacred Ritualitic Plants • Ramayana: Dandakaranya, Panchvati, Ashoka Vatika, Chitrakoot, Plants: Sanjeevani Booti, Tulsi, Ashoka, Bilva, Sandal wood,	[7L]

	• Mahabharat : Kamyaka Forest, Matsya kingdom's flora, Nidhivan Plants Peeplal, Banyan, Parijat, Kalpavriksha, Arjuna tree	
1.2	Key Concepts in Ancient Indian Pharmacognosy: • Rasa (Taste) • Virya (Potency) • Vipaka (Metabolism) Practices and Methods • Distillation • Fermentation • Decoctions and Infusions	[8L]
Module 2	**Influence on Global Medicine:**	**[15L]**
Learning objectives: This module is intended to • Ancient Bharatiya pharmacognosy influenced traditional systems, which spread to other parts of Asia and the Middle East. • The knowledge eventually contributed to modern pharmacology.		
Learning outcome: After the successful completion of the module, the learner will be able to • Describe the medicine system of Ayurveda, Siddha and Unani. • Explain the importance of medicinal plant. • Point out specific uses of medicinal plants per specific diseases.		
2.1	➢ Ayurveda ➢ Siddha Medicine ➢ Unani	[8L]
2.2	Important Medicinal Plants: • Ashwagandha (Withania somnifera): Known as "Indian ginseng," used for stress and vitality. • Turmeric (Curcuma longa): Valued for its anti-inflammatory and antiseptic properties. • Neem (Azadirachta indica): Used for skin diseases and as an antimicrobial agent. • Brahmi (Bacopa monnieri): Used to enhance cognitive functions.	[7L]
References: • Valmiki Ramayana – References to Sanjeevani Booti • Shah Vaidya Bapalal G., (1927), Nighantu Adarsha.		

- V. Singh, P.C. Pandey and D.K. Jain, A text book of botany.
- Dr. Shrikrushna, Vruxaaryuveda, Banaras Aaryuved Series-6.
- Chunekar K.C, Pandey G.S. (2020), Bhaprakash Nigantu, Varansi India. Chakrakhambha Bharti publisher and distributor.
- Mahabharat (Vanaparva) – Mention of Medicinal Plants like Ashwagandha, Arjuna Tree and Kalpavriksha.

Mapping of CLOs and PSOs

Course Learning Outcomes	Programme Outcomes					
	1	2	3	4	5	6
1. Understand the ancient text and contribution of Vedas and Samhita.	X	X				
2. Apply their knowledge for the identification and uses of medicinal plants in various ways.	X	X				
3. Explain and the understand the concept of ancient Indian Pharmacognosy.		X	X			
4. Understand and apply the knowledge in various techniques in pharmacognosy		X	X			

Question Paper Template

S.Y. B. Sc. (BOTANY) SEMESTER IV

Core Course- VI

IKS (THEORY)

COURSE TITLE: ANCENT BOTANY-II

COURSE CODE: BOTIKS-S4P1-2CR25 **[CREDITS - 02]**

Module	Remembering / Knowledge	Understanding	Applying	Analysing	Evaluating	Creating	Total marks
I	20%	40%	40%	-	-	-	100%
II	20%	40%	40%	-	-	-	100%