GURU NANAK COLLEGE (AUTONOMOUS)

(Affiliated to University of Madras and Re-Accredited at 'A' Grade by NAAC)

Guru Nanak Salai, Velachery, Chennai – 600042.

B.Sc. Plant Biology and Plant Biotechnology

(SEMESTER PATTERN WITH CHOICE BASED CREDIT SYSTEM)

Syllabus

(For the candidates admitted in the Academic year 2018-19 and thereafter)

VISION

To establish a viable and conducive environment for the conduct of learning and research in plant sciences and equip the graduate with updated skills to seek their professional pursuits.

MISSION

Earnest endeavors towards imparting fundamental and essential subject knowledge and also to incorporate new emerging frontiers knowledge in the curriculum to keep up with the contemporary academic trends.

PROGRAMME OUTCOME

PO1 : Provide the needed statistical tools to experience inter disciplinary and cross disciplinary study and to discern the multi- disciplinary scope of biological science.

PO2 : Additional skills in multidisciplinary study offers the scope to the demands of recent advances in biological sciences .

PO3: Demonstrable skills in the core discipline enhance the prospects of employment and higher research.

PO 4: Encouraging group participation in laboratory work and plant nursery and eco-club activities imparts team spirit and team work amidst students.

PO 5: Participation in inter departmental competitions hones communication and subject knowledge and peer gauging.

PROGRAMME SPECIFIC OUTCOMES

PSO 1: Demonstrable understanding of molecules, cells, systems, organisms, ecosystems and use comparative approach to explain the evolution of organism and understand the genetic diversity of the flora and fauna.

PSO 2: The subject knowledge enables to successfully endeavour in the fields like plant explorer, conservationist, ecologist, environment consultant, horticulturist, plant Physiologist, nursery manager, genetics and molecular biologist, taxonomist, plant pathologist, and farming consultant.

B.Sc. (PLANT BIOLOGY AND PLANT BIOTECHNOLOGY)
COURSE STRUCTURE 2018-19 Batch

Semester	Part	Course Component	Subject Name	Subject Code	Credit	Hours	Marks		Total
							Internal	External	
I	I	Language	Tamil-I	16UTAMF01	3	6	50	50	100
	II		Hindi - I	16UHINF01					
			English – I	16UENGF41	3	4	50	50	100
	III	Core - I	Algae, Fungi & Lichens	16UPBTC01	4	6	50	50	100
		Core - II	Practical – I (Algae, Fungi & Lichens)	16UPBTC02P	2	2	50	50	100
		Allied - I	Zoology – I	16UAZTA11	3	6	50	50	100
		Allied - I	Allied Zoology Practical		-	2	50	50	100
	IV	1. NME	Basic Tamil	16UBAT401	2	2	50	50	100
			Nursery & Landscaping	16UNME01F					
		2. Skill Based Subject Language English	Soft Skill – I - Listening and Speaking Skills	16UGSLS01	3	2	50	50	100
Total Credits - 20, Total Hours/ week- 30									
II	I	Language	Tamil - II	16UTAMF02	3	6	50	50	100
			Hindi - II	16UHINF02					
	II		English – II	16UENGF42	3	4	50	50	100
	III	Core - III	General Microbiology	16UPBTC03	4	6	50	50	100
		Core - II	Practical – II (General Microbiology)	16UPBTC02P	2	2	50	50	100
		Allied - II	Zoology – II	16UAZTA13	3	6	50	50	100
			Allied Zoology Practical	16UAZTA12P	4	2	50	50	100
	IV	1. NME	Basic Tamil	16UBAT402	2	2	50	50	100
			Mushroom Cultivation	16UNME02F					
		2. Skill Based Subject Language English	Soft Skill – I - Reading and Writing Skills	16UGSLS02	3	2	50	50	100
Total Credits - 24, Total Hours/ week- 30									
III	I	Language	Tamil III	16UTAMF03	3	6	50	50	100
			Hindi - III	16UHINF03					
	II		English III	16UENGF43	3	4	50	50	100
	III	Core IV	Bryophytes &	16UPBTC04	4	6	50	50	100

			Pteridophytes						
		Core V	Practical – III (Bryophytes & Pteridophytes)	16UPBTC05P	–	2	50	50	100
		Allied III	Allied Chemistry I	16UCHEA14	3	6	50	50	100
			Allied Chemistry Practical	16UCHEA15 P	–	2	50	50	100
	IV	NME	Environmental Studies	16UEVS401	–	2	50	50	100
		Soft Skill	Personality Enrichment	16UGSLS03	3	2	50	50	100
Total Credits - 16, Total Hours/ week- 30									
IV	I	Language	Tamil IV	16UTAMF04	3	6	50	50	100
			Hindi - IV	16UHINF04					
	II		English IV	16UENGF44	3	4	50	50	100
	III	Core VI	Gymnosperms, Paleobotany & Evolution	16UPBTC06	4	6	50	50	100
		Core V	Practical – IV (Bryophytes & Pteridophyte, Gymnosperms, Paleobotany & Evolution)	16UPBTC05 P	4	2	50	50	100
		Allied IV	Allied Chemistry II	16UCHEA16	3	6	50	50	100
			Allied Chemistry Practical	16UCHEA15 P	4	2	50	50	100
	IV	Soft Skill	Computing skills	16UGSLS04	3	2	50	50	100
		EVS	Environmental studies	16UEVS401	2	2	50	50	100
Total Credits – 26, Total Hours/ week- 30									
V	III	Core VII	Cell Biology & Anatomy	16UPBTC07	4	4	50	50	100
		Core VIII	Morphology, Taxonomy of Angiosperm & Embryology	16UPBTC08	4	4	50	50	100
		Core IX	Plant Biotechnology	16UPBTC09	4	4	50	50	100
		Core X	Plant Microtechnique	16UPBTC10	4	4	50	50	100
		Core XI	Practical – V (Cell Biology, Anatomy, Morphology, Taxonomy of Angiosperm, Embryology, Plant Biotechnology and Plant Microtechnique)	16UPBTC11 P	4	8	50	50	100
		Elective - I	Plant Diseases & Management	16UPBTE01	5	5	50	50	100
	IV	Value Education	Value Education	16UVED401	2	1	50	50	100
Total Credits – 27, Total Hours/ week- 30									
VI	III	Core XII	Genetics & Plant Breeding	16UPBTC12	4	5	50	50	100
		Core XIII	Plant Ecology & Phytogeography	16UPBTC13	4	5	50	50	100
		Core XIV	Plant Physiology &	16UPBTC14	4	4	50	50	100

			Biochemistry						
		Core XV	Practical – VII (Genetics, Plant Breeding, Plant Ecology, Phytogeography, Plant Physiology and Biochemistry - Practical)	16UPBTC15P	4	6	50	50	100
		Elective I	Herbal Science	16UPBTE02	5	5	50	50	100
		Elective II	Horticulture	16UPBTE03	5	5	50	50	100
	V	Extension Activities			1	–	50	50	100
Total Credits - 27, Total Hours/ week- 30									
Grand Total Credits – 140, Grand Total Hours/ week- 180									

SEMESTER -I

CORE I

ALGAE, FUNGI & LICHENS

SUBJECT CODE :16UPBTC01	**THEORY**	**MARKS:100**
SEMESTER: I	**CREDITS: 4**	**TOTAL HOURS: 90**

COURSE OBJECTIVES:

- The main objective is to acquaint the students about morphology, biology and importance of algae fungi and lichens.
- To provide knowledge on the structure and reproduction of certain selected algal, fungal and Lichen forms besides giving an overview.
- To introduce students the economic importance of all groups.

Unit – I **(20 Hours)**

General Characteristics – Habitat, habit. Cell structure – Prokaryotic and Eukaryotic. Reproduction – Vegetative, asexual and sexual. Life cycle patterns. Algal Classification – F.E. Fritsch, 1945.

Unit – II **(20 Hours)**

Structure and reproduction with special reference to the following algal forms (no development) of (a) ***Nostoc*** (b) ***Chlorella*** (c) ***Cyclotella*** (d) ***Sargassum*** (e) ***Gracilaria***. Economic Importance of Algae.

Unit – III **(20 Hours)**

General Characteristics – Habit, Nutrition, Cell structure – Unicellular, Mycelial, Reproduction – Asexual, sexual, fruiting bodies. Lifecycle patterns.
Fungal classification – Alexopoulus.

Unit – IV **(20 Hours)**

Structure and reproduction with special reference to the following forms (no development) of (a) ***Albugo*** (b) ***Saccharomyces*** (c) ***Puccinia*** (d) ***Agaricus*** (e) ***Colletotrichum***. Economic Importance of fungi.

Unit – V **(10 Hours)**

Occurrence, structure and reproduction of Fruticose lichen - ***Usnea***

Prescribed Books:

1. Vashista Sinha B.R., Singh, V.P., 2002, Botany for Degree students, Algae 9th revised edition, S. Chand & Company Ltd., New Delhi.
2. Chopra G.L., A Textbook of Fungi, S.Nagin & Co. Meerut, India

Suggested Reading

1. Pandey B.P., 2000. Revised edition, Text Book of Botany Algae, S. Chand & Company, New Delhi.
2. Sharma O.P., 1992, Text Book of Algae, Tata McGraw Hill Publication Company Ltd., New Delhi
3. Pandey B.P., 1997 College Botany Vol. I Fungi & Pathology.
4. Mehrotra, R,S and Aneja, K.R.2003. An introduction to mycology. New age International (P) Ltd, Publishers, NewDelhi.

Question Paper Pattern:

Section	Question Component	Numbers	Marks	Total
Section A	**Definition / Principle** Answer any 10 out of 12 Questions	01-12	2	**20**
Section B	**Short Answer** Answer any 5 out of 7 questions	13-19	8	**40**
Section C	**Essay** Answer any 2 out of 5 questions	20-24	20	**40**

Distribution of Questions:

Sections	Units	No. of Questions	
		Theory	**Problems**
Section A	Unit – 1	2	
	Unit – 2	3	
	Unit – 3	3	
	Unit – 4	2	
	Unit – 5	2	
Section B	Unit – 1	1	
	Unit – 2	2	
	Unit – 3	2	
	Unit – 4	1	
	Unit – 5	1	
Section C	Unit – 1	1	
	Unit – 2	1	
	Unit – 3	1	
	Unit – 4	1	
	Unit – 5	1	

NON MAJOR ELECTIVE -I

NURSERY AND LANDSCAPING

SUBJECT CODE : 16UNME01F	**THEORY**	**MARKS:100**
SEMESTER: I	**CREDITS: 2**	**TOTAL HOURS: 30**

COURSE OBJECTIVES:

1. To expose the students to the principles of vegetative propagation.
2. To provide the students a theoretical knowledge to establish home gardens scientifically.

UNIT I **(5 Hours)**

Introduction, prospects and scope of Nursery and landscaping.

UNIT II **(5 Hours)**

Methods of Propagation – cutting, layering, grafting, budding, Floriculture – Rose, Chrysanthemum, Jasmine – cultivation.

UNIT III **(5 Hours)**

Gardening – formal garden, informal garden, vegetable garden, landscaped layout designing – formation and maintenance of lawn.

UNIT IV **(5 Hours)**

Nursery structures – Green house – shade house, Mist chamber – topiary, Bonsai culture.

UNIT V **(10 Hours)**

Manure, composting – Vermicomposting

Prescribed Books:

1. Edmond Muser and Andres. Fundamentals of Horticulture, McGrawHill Book co.,
2. Gardener, Basic Horticulture Mac Millon N.
3. Lex Lauries and victor H. Rise, Floriculture Fundamentals and practices, McGrawhill publishers.
4. Mukherjee D. Gardening in India, Oxford IBH publishing co, New Delhi.
5. Randhawa, Ornamental Horticulture in India Today and Tomorrow Publishers, New Delhi.
6. Sandhu M.K., plant propogation, willey Easter Ltd., New Delhi.
7. Sundararajan, J.S., Muthuswamy J, shanmugavelu, K.G., and Balakrishnan R., A Guide to Horticulture, Thiruvenkadam Printers, Coimbatore.

Suggested reading

1. Kumar N. Introduction to Horticulture, Raja Lakshimi Publication, Nagercoil, India.
2. Edmond Musser and Andres Fundamentals of Horticulture McGraw Hill Book Co.,
3. Amarnath V., 2006, Nursery and Lanscaping, M/s IBD Publishers, New Delhi.
4. Manibushari Rao K. Text Book of Horticulture, MacMillon India Ltd.

Question Paper Pattern:

Section	Question Component	Numbers	Marks	Total
Section A	**Essay** Answer any 5 out of 10 questions	01-10	20	100

Distribution of Questions:

Sections	Units	No. of Questions	
		Theory	**Problems**
Section A	Unit – 1	2	
	Unit – 2	2	
	Unit – 3	2	
	Unit – 4	2	
	Unit – 5	2	

ALLIED

ALLIED BOTANY- I

SUBJECT CODE : 16UPBTA11	**THEORY**	**MARKS:100**
SEMESTER: I	**CREDITS: 3**	**TOTAL HOURS: 90**

COURSE OBJECTIVES:

1. To provide knowledge on the structure and reproduction of certain Cryptogams and Gymnosperms forms besides giving an overview.
2. To make the student to understand the organization of prokaryotic and eukaryotic cell, structure and function of organelles and cell division.
3. To make the student to become familiar and to understand the plant cell, tissues, and internal structures of stem, root and leaves.

Unit I **(20 Hours)**

Structure and life history of *Nostoc*, *Chlorella*, *Sargassum*, *Albugo*, *Penicillium* and *Agaricus.*

Unit II **(15 Hours)**

Structure and life history of *Funaria*, *Lycopodium* and *Cycas*.

Unit III **(15 Hours)**

General characters of Bacteria, ultra structure of *E. coli*, Economic importance. General account of Plant virus (TMV).

Unit IV **(20 Hours)**

Prokaryotic and Eukaryotic cell (Plant Cell), Cell Organelles – structure and function of chloroplast, Mitochondria and Nucleus. Cell Division - Mitosis and Meiosis.

Unit V **(20 Hours)**

Tissues: Meristematic and Permanent tissues. Primary structure of Dicot stem, dicot root and dicot leaf. Structure of monocot root.

Question Paper Pattern:

Section	Question Component	Numbers	Marks	Total
Section A	**Definition / Principle** Answer any 10 out of 12 Questions	01-12	2	**20**
Section B	**Short Answer** Answer any 5 out of 7 questions	13-19	8	**40**
Section C	**Essay** Answer any 2 out of 5 questions	20-24	20	**40**

Distribution of Questions:

Sections	Units	No. of Questions	
		Theory	Problems
Section A	Unit – 1	2	
	Unit – 2	3	
	Unit – 3	3	
	Unit – 4	2	
	Unit – 5	2	
Section B	Unit – 1	1	
	Unit – 2	2	
	Unit – 3	2	
	Unit – 4	1	
	Unit – 5	1	
Section C	Unit – 1	1	
	Unit – 2	1	
	Unit – 3	1	
	Unit – 4	1	
	Unit – 5	1	

SEMESTER -II

CORE III

GENERAL MICROBIOLOGY

SUBJECT CODE :16UPBTC03	**THEORY**	**MARKS:100**
SEMESTER: II	**CREDITS: 4**	**TOTAL HOURS: 90**

COURSE OBJECTIVES:

- To provide information on the classification, growth, morphology and genetics of microbes and the recent advances in the field of microbiology. The role of microbes as beneficial and as pathogens is also studied.
- To understand the applied aspects of microbiology in dairy industries, pharmaceuticals, food and waste water.

Unit I **(15 Hours)**

History and scopes of microbiology. Mycoplasma - structure and multiplication. VAM fungi and their importance,

UNIT II **(20 Hours)**

Cleaning and sterilization of glassware, media Isolation techniques- Pour plate – Spread plate – Streak plate – Serial dilution – Types of culture media- staining techniques – simple and differential staining Control of microbes – physical, chemical and biological methods

Unit III **(20 Hours)**

Bacteria - Classification (Bergey's Manual) Ultrastructure and nutrition.
Bacterial genetics – Transformation, Transduction and Conjugation

Unit IV **(20 Hours)**

General characteristics – structure, replication and viruses of animals, plants, bacteriophage and human, mode of transmission

Unit V **(15 Hours)**

Microbiology of foods – food spoilage, food preservation
Industrial Microbiology – Lactic acid, Citric acid, Alcohol beverages,
Medical Microbiology - Antibiotic production – Penicillin and Streptomycin.

Prescribed Books:

1. Adams, M.R. and M.O. Moss. 1995.Food microbiology . New Age International (p) Ltd., Chennai.
2. Agarwal, 2006. Industrial Microbiolgy: Fundamentals and Application, IBD publishers,, New Delhi.
3. Ananthanarayanan, R and C.K.J. Panikar. 2000. Text book of Microbiology, 6th Edition, Orient Longman.
4. Atlas, R.M. 1989. Microbiology- Fundamental and Applications. McMillan Publishing Company. New York.

Suggested Readings

1. Cruger F. and Anneliese Crueger, 2000. Biotechnology: Industrial Microbiology. Panima Publications.
2. O.P Sharma, 2011. Fungi and Allied microbes. Tata McGraw Hill Pvt. Co.
3. P.D. Sharma, 2005. Fungi and Allied organisms. Narosa Publishing house Ltd.
4. George N., Agrios. 2008. Plant pathology. V edition, Academic Press.
5. P.D. Sharma, 2006. Plant pathology. Narosa Publishing house Ltd.
6. Mehrotra , 2008. Plant Pathology Tata McGraw Hill Pvt. Co.
7. Madigan, M.T. and J.N. Martinko. 2006. Brock Biology of Microorganisms. 11thedition, Pearson Education, inc. Upper Saddle River, USA
8. Mackane, L. and J. kandel, 1996. Microbiolgy-Essential and applications. McGraw Hill Inc., New York.

CORE II

ALGAE, FUNGI & LICHENS

SUBJECTCODE :16UPBTC02P	**PRACTICAL**	**MARKS:100**
SEMESTER: I	**CREDITS: 2**	**TOTAL HOURS: 30**

COURSE OBJECTIVES:

- To provide knowledge on the structure and reproduction of certain Cryptogams and
- To make the student to understand the organization of prokaryotic algae, Fungi and eukaryotic algal cell.
- Students will have the knowledge and skills to:
- Identify and classify specimens up to order
- Identify, draw and label diagrams of the specimen
- Highlight on the biological significance of the given specimen
- Understand the morphology and anatomy of Algae , Fungi and Lichens specimen through dissection
- Mount and learn their significance
- Relate structure and function

PRACTICAL - ALGAE, FUNGI & LICHENS (30 Hours)

Micro preparation of the types prescribed in the syllabus.
Identifying the micro slides relevant to the syllabus.
Identifying types of algal mixture.
Morphological study of Algae, Fungi and Lichens.

CORE II

GENERAL MICROBIOLOGY

SUBJECT CODE: 16UPBTC02P	**PRACTICAL**	**MARKS: 100**
SEMESTER: II	**CREDITS: 2**	**TOTAL HOURS: 30**

COURSE OBJECTIVES:

- To provide knowledge on preparing stained smears, culturing micro-organisms, performing tests to identify bacteria and fungi, and studying microbial growth control methods.
- To understand the Bacterial Morphology, Structures, Motility; & Culture
- To make the students gain knowledge in Media Preparation; Bacterial Culture Characteristics, Biochemical Characteristics.

PRACTICAL: GENERAL MICROBIOLOGY (30 Hours)

Cleaning and sterilization of glassware.

Preparation of different types of culture media.

Isolation of pure culture – streak, spread and pour plate methods.

Staining of bacteria – Simple staining, Gram staining.

Photographs of micro-organisms prescribed in the syllabus.

NON MAJOR ELECTIVE -II

MUSHROOM CULTIVATION

SUBJECT CODE : 16UNME02F	**THEORY**	**MARKS:100**
SEMESTER: II	**CREDITS: 2**	**TOTAL HOURS: 30**

COURSE OBJECTIVES:

1. To help the students to learn mushroom cultivation, bio-composting and biofertilizer production through hands- on- experience.
2. To enable the students to become self- employed/ entrepreneur.

Unit – I **(5 Hours)**

Introduction, types of mushroom, identification of edible and poisonous mushroom, changes during the development of the mushroom

Unit – II **(5 Hours)**

Life cycle of *Agaricus* spp*., Pleurotus* sp.,

Unit – III **(5 Hours)**

Mushroom cultivation, isolation, spawn production, growth media, spawn running and harvesting of mushroom.

Unit – IV **(5 Hours)**

Medicinal and nutritional value of mushrooms, composting, importance in waste recycling

Unit – V **(10 Hours)**

Diseases - insect pest, nematodes, mites, viruses, fungal competitors and other important diseases.

Post-harvest technology – freezing, drying and canning.

Prescribed Books:

1. Handbook of Mushroom Cultivation, 1999, TNAU publication.
2. Nita Bahl, 2002, Handbook on Mushroom 4th edition vijayprimlani for oxford & IBH publishing co., Pvt., Ltd., New Delhi. Dr.C. Sebastian Rajesekaran Reader in Botany Bishop Heber College, Trichy – 17.
3. Suman, 2005, Mushroom Cultivation Processing and Uses, M/s. IBD Publishers and Distributors, New Delhi.

Suggested readings:

1. Sing, 2005, Modern Mushroom Cultivation, International Book Distributors, Dehradun.
2. Mushroom growing. Dey, S.C., Agrobios (India), Jodhpur.
3. Handbook of Edible Mushroom Today and Tomorrows printers and publishers.
4. Mushroom cultivation. Kapoor, J.N., KrishiBhavan, New Delhi.
5. Mushroom Production and Processing Technology. Pathak, V.N., Yadav, N. and Gaur, M., Agrobios (India), Jodhpur.
9. Diseases and pests of Mushroom. Sharma, V.P., 2006, M/S. IBD Publishers and Distributors, New Delhi.

Question Paper Pattern:

Section	Question Component	Numbers	Marks	Total
Section A	**Essay** Answer any 5 out of 10 questions	01-10	20	100

Distribution of Questions:

Sections	Units	No. of Questions	
		Theory	Problems
Section A	Unit – 1	2	
	Unit – 2	2	
	Unit – 3	2	
	Unit – 4	2	
	Unit – 5	2	

ALLIED

ALLIED BOTANY- II

SUBJECT CODE : 16UPBTA13	**THEORY**	**MARKS:100**
SEMESTER: II	**CREDITS: 3**	**TOTAL HOURS: 90**

COURSE OBJECTIVES:

1. To expose the students to the diagnostic features of selected families.
2. To provide an insight into the physico-chemical organization and the functional aspects of plants.
3. To give an insight into ecology and microbial processes in the environment.
4. To understand the lifecycle of angiospermic plant development and the various processes those are involved.
5. To know the basics in biotechnology.

Unit I **(20 Hours)**

Study and range of characters of Fabaceae, Cucurbitaceae, Apocynaceae, Euphorbiaceae and Liliaceae.

Unit II **(20 Hours)**

Absorption of water.

Photosynthesis – Light reaction and dark reaction (Calvin cycle), Respiration – Glycolysis, Krebs cycle & Electron transport system. Nitrogen cycle.

Growth Hormones – Auxins, Gibberellins and Cytokinins.

Unit III **(20 Hours)**

Ecosystem – definition, basic components of ecosystem, examples of ecosystem – Fresh water ecosystem, Energy flow in ecosystem – Trophic level, Food Chain, Food web.

Unit IV **(20 Hours)**

Structure of Mature anther, structure of Ovule and its types.

Unit V **(10 Hours)**

Plant Biotechnology – Introduction, Genetic Engineering, Tissue culture.

Suggested reading

1. Ganguly A.K. 1971, General Botany, Vol.I. The New Book Stall, Calcutta.

2. Rao. K.N. Krishnamurthy K.V. and Rao. G., 1979, Ancillary Botany, Viswanathan Private Ltd.

3. Dutta A.c., College Botany, Vol. I & II.

4. Gupta P.K., Elements of Biotechnology Rastogi and Company.

Question Paper Pattern:

Section	Question Component	Numbers	Marks	Total
Section A	**Definition / Principle** Answer any 10 out of 12 Questions	01-12	2	**20**
Section B	**Short Answer** Answer any 5 out of 7 questions	13-19	8	**40**
Section C	**Essay** Answer any 2 out of 5 questions	20-24	20	**40**

Distribution of Questions:

Sections	Units	No. of Questions	
		Theory	**Problems**
Section A	Unit – 1	2	
	Unit – 2	3	
	Unit – 3	3	
	Unit – 4	2	
	Unit – 5	2	
Section B	Unit – 1	1	
	Unit – 2	2	
	Unit – 3	2	
	Unit – 4	1	
	Unit – 5	1	

ALLIED

ALLIED BOTANY- PRACTICAL

SUBJECT CODE : 16UPBTA12P	**PRACTICAL**	**MARKS:100**
SEMESTER: II	**CREDITS: 4**	**TOTAL HOURS: 30**

COURSE OBJECTIVES:

- To provide knowledge on the structure and reproduction of certain Cryptogams and to make the student to understand the organization of prokaryotic algae, Fungi and eukaryotic algal cell.
- Build up the knowledge of the students in the area of seedless plants and
- Open up the students to detailed study on morphology, anatomy and structure of the vegetative and reproductive organs of Bryophyte and Pteridophytes.
- To provide knowledge on the comparative studies of steles, sporangia and gametangia in eusporangiate and leptosporangiate groups.
- To impart knowledge on morphology, anatomy and reproduction of selected Gymnosperms. This course also includes the study of a few representative fossil forms.

Allied Botany Practical **(30 Hours)**

1. Describe and to make suitable micro-preparations: Algae, Fungi, Bryophytes, Pteridophytes and Gymnosperms prescribed in the theory.

2. To describe in technical terms plants belonging to the families prescribed.

3. To describe experimental setup in plant physiology.

4. Microphotographs of cell biology

5. Study of internal structure of dicot stem, root and leaf.

6. Structure of Mature anther and Ovule types (Permanent slides only).

SEMESTER -III

CORE IV

BRYOPHYTES & PTERIDOPHYTES

SUBJECT CODE :16UPBTC04	**THEORY**	**MARKS:100**
SEMESTER: III	**CREDITS: 4**	**TOTAL HOURS: 90**

COURSE OBJECTIVES:

- To build up a sound foundation in cryptogamic botany in general and to acquaint the students about classification, morphology, biology and economic importance of various bryophytic plants and ferns.
- To provide knowledge on the comparative studies of steles, sporangia and gametangia in eusporangiate and leptosporangiate groups.

Unit – I **(15 Hours)**

General Characteristics – Habitat – Habit – Gametophyte – Sex organs – Sporophyte – Alternation of Generations & life cycle.

Unit – II **(20 Hours)**

Detailed study of structure and reproduction of

a) ***Marchantia*** b) ***Anthoceros*** c) ***Polytrichum*** (No developmental studies)

Unit – III **(20 Hours)**

General charactertics – Classification (Reimer's 1954) – Apogamy & Apospory – Homospory & Heterospory – Origin and evolution of Pteridophytes.

Unit – IV **(20 Hours)**

Detailed study of structure and reproduction in the following forms (no developmental aspects)

a) ***Lycopodium*** b) ***Equisetum*** c) ***Adiantum*** d) ***Marsilea***.

Unit – V **(15 Hours)**

Stelar system in Pteridophytes – Heterospory and seed habit, Economic Importance of Pteriodophytes.

Prescribed Books:

1. Eames.A, 1963 – Morphology of lower vascular plant, McGraw Hill
2.Forster and Gifford, 1959 – Comparative morphology of vascular plants.
3.Pandey B.R., 1977 – A text book of Botany, Pteridophytes and Gymnosperms, K. Nath &Meerut.
4.Parihar. N.S., 1967 – An introduction of Embryophyta, Vol.III – Pteriodophyta, Central book depot, Allahabad.
5.Smith.G.M., 1955- Cryptogamic Botany, Volume-II– McGraw Hill
6.Sporne.K.L., 1976 – Morphology of Pteriodophytes, 4th edition, B.I.Publication.

Suggested Reading

1.Vashista.P.C., 1971 – Botany for Degree students : Pteridophyta. S.Chand&Co.
2.Watson, E.V. The structure and Life of Bryophytes
3.Prem Puri. 1973. Bryophytes-A broad perspective, Atma Ram & Sons, New Delhi
4. Parihar, N.S. 1991. Bryophytes. Central Book Depot, Allahabad.
5. Parihar, N.S. 1996. The Biology and Morphology of Pteridophytes. Central Book Depot, Allahabad.
6. Puri, P. 1980. Bryophytes. Atma Ram & Sons, New Delhi.
7. Sporne, K.R. 1991. The Morphology of Pteridophytes. B.I. Publ. Pvt. Ltd.

Question Paper Pattern:

Section	Question Component	Numbers	Marks	Total
Section A	**Definition / Principle** Answer any 10 out of 12 Questions	01-12	2	**20**
Section B	**Short Answer** Answer any 5 out of 7 questions	13-19	8	**40**
Section C	**Essay** Answer any 2 out of 5 questions	20-24	20	**40**

Distribution of Questions:

Sections	Units	No. of Questions	
		Theory	**Problems**
Section A	Unit – 1	2	
	Unit – 2	3	
	Unit – 3	3	
	Unit – 4	2	
	Unit – 5	2	
Section B	Unit – 1	1	
	Unit – 2	2	
	Unit – 3	2	
	Unit – 4	1	
	Unit – 5	1	

SEMESTER -IV

CORE VI

GYMNOSPERM, PALEOBOTANY & EVOLUTION

SUBJECT CODE : 16UPBTC06	**THEORY**	**MARKS:100**
SEMESTER: IV	**CREDITS: 4**	**TOTAL HOURS: 90**

COURSE OBJECTIVES:

- To acquaint the students about the latest trends in classification, vegetative morphology and reproductive biology of gymnosperms.
- To provide knowledge on the detailed study of fossils, its kinds and the geological time scale.
- Takes into account the concept of: origin of life and theories associated with it.

Unit – I **(15 Hours)**

General Characters – Distribution – Morphology – Structure and reproduction of Gymnosperms – Classification of Sporne (1954).

Unit – II **(20 Hours)**

Detailed study of structure and reproduction (no developmental aspects) of a) ***Cycas*** b) ***Pinus*** c) ***Gneutm***.

Unit – III **(20 Hours)**

Introduction – fossils – process of fossilization (preservation) – types of fossils - unaltered (Coal, Ice embedded fossils and embedded in Amber) and altered (Compression, petrification, impressions, moulds and casts) – Geological Time Scale.

Unit – IV **(20 Hours)**

Father of Indian Paleobotany (Birbal Sahni and its contribution). Study of the following fossil form genera a) *Lepidodenron* b) *Lepidocarpon* c) *Calamites* (Fossil Pteridophytes)

d) *Williamsonia* (fossil Gymnosperm).

Unit – V **(15 Hours)**

Origin of Life – Chemosynthetic theory of origin of life – Evolutionary theory of Lamarck and Charles Darwin Theory.

Prescribed Books:

1.Sporne. K.R., 1954- Morphology of Gymnosperms, Hutchinson University Library.
2.Gupta.M.N., 1972, - The Gymnosperms (2nd Edition) Shiva Lal Agarwala & Co., Agra.
3.Vashista, P. C .,1976, Gymnosperms, S.Chand & Co.
4.Sporne, K.R.1991. The Morphology of Gymnosperme. B.I. Publications, New Delhi.

Suggested Reading

1.Bhatnagar, S.P. and Moitra, A. 1996. Gymnosperms, New Age Int. Pvt. Ltd., New Delhi
2. Stewart, W.N. and Rathwell, G.W. 1993. Paleobotany and the Evolution of Plants. Cambridge University Press.

Question Paper Pattern:

Section	Question Component	Numbers	Marks	Total
Section A	**Definition / Principle** Answer any 10 out of 12 Questions	01-12	2	**20**
Section B	**Short Answer** Answer any 5 out of 7 questions	13-19	8	**40**
Section C	**Essay** Answer any 2 out of 5 questions	20-24	20	**40**

Distribution of Questions:

Sections	Units	No. of Questions	
		Theory	**Problems**
Section A	Unit – 1	2	
	Unit – 2	3	
	Unit – 3	3	
	Unit – 4	2	
	Unit – 5	2	
Section B	Unit – 1	1	
	Unit – 2	2	
	Unit – 3	2	
	Unit – 4	1	
	Unit – 5	1	

CORE V
BRYOPHYTES AND PTERIDOPHYTES

SUBJECT CODE : 16UPBTC05P	**PRACTICAL**	**MARKS:100**
SEMESTER: III	**CREDITS: 2**	**TOTAL HOURS: 30**

COURSE OBJECTIVES:

- Build up the knowledge of the students in the area of seedless plants
- Open up the students to detailed study on morphology, anatomy and structure of the vegetative and reproductive organs of Bryophyte and Pteridophytes.
- To present students with basic principles of reproductive pattern, including: life cycles, gametangia, sporangia, sporophylls, heterospory, ovules and seeds.

BRYOPHYTES AND PTERIDOPHYTES (30 Hours)

Study of morphology, anatomy and structure of the vegetative and reproductive organs of Bryophyte genera included in the theory syllabus.
Study of morphology, anatomy and structure of the vegetative and reproductive organs of Pteridophyte genera included in the theory syllabus.

CORE V
GYMNOSPERMS, PALEOBOTANY AND EVOLUTION

SUBJECT CODE : 16UPBTC05P	**PRACTICAL**	**MARKS:100**
SEMESTER: IV	**CREDITS: 2**	**TOTAL HOURS: 30**

COURSE OBJECTIVES:

- To provide knowledge on the comparative studies of steles, sporangia and gametangia in eusporangiate and leptosporangiate groups.
- To impart knowledge on morphology, anatomy and reproduction of selected Gymnosperms. This course also includes the study of a few representative fossil forms.

GYMNOSPERMS, PALEOBOTANY AND EVOLUTION (30 Hours)

Study of morphology, anatomy of the vegetative and reproductive organs of *Cycas, Pinus* and *Gnetum.*
Fossil slides of *Lepidodenron, Lepidocarpon , Calamites* & *Williamsonia*
Photographs of Evolution scientists.

SEMESTER -V

CORE VII

CELL BIOLOGY & ANATOMY

SUBJECT CODE : 16UPBTC07	**THEORY**	**MARKS:100**
SEMESTER: V	**CREDITS: 4**	**TOTAL HOURS: 60**

COURSE OBJECTIVES:

- To acquaint the student about the anatomical and cytological studies of various plant groups.
- To make the student understand the organization of prokaryotic and eukaryotic cell, structure and function of cell organelles including cell division.
- To expose the student to understand the plant cell, tissues, and internal structures of stem, root and leaves including their anomalies.

Unit – I **(15 Hours)**

Cell Theory, Cell Organelles – Plasma Membrane, Ribosomes, Golgi apparatus, Endoplasmic Reticulum, Lysosomes, Peroxisomes, Mitochondria and Chloroplast.

Unit – II **(15 Hours)**

Nucleus, Nuclear Membrane, Chromosomes – Euchromatin, Heterochromatin - Types of Nucleic Acids. Giant Chromosome (Polytene and Lamp Brush Chromosome), Cell Division (Mitosis and Meiosis).

Unit – III **(10 Hours)**

Plant Cell Structure – Nature of Plant cell wall, tissue and tissue system – Meristematic tissues, Permanent tissues and secretary cells.

Unit – IV **(10 Hours)**

Meristems – types of meristems – apical meristem – theories – Apical cell theory, tunica corpus theory and histogen theory. Differentiation of stem, leaf and root, vascular bundle and vascular cambium.

Unit – V **(10 Hours)**

Structure of Dicot stem – primary and secondary structure – structure of dicot root – primary and secondary, monocot stem, structure of monocot root, nodal anatomy, leaf anatomy – Dorsiventral and Isobilateral, stomatal types. Anomalous secondary growth (Dicot – Nyctanthes, Boerhaavia, Monocot – Dracaena).

Prescribed Books:

1.Verma, P.S. & V.K. Agarwal, 2002, Cytology. S. Chand & Co.Ltd., New Delhi-55.
2.Verma, P.S. & V.K. Agarwal, 2003, Genetics. S. Chand & Co.Ltd., New Delhi-55.
3.Freifelder, D.1987. Essentials of Molecular Biology, Jones & Bartlett, Boston.

Suggested Books

1. Gardner, EJ., Simmons, MJ. & Snustad, D. 1991. Principles of Genetics, John Wiley Sons Inc., 8th Edn., New York.
2. Sinnott, EW., Dunn, LL. & Dobzhansky, T. 1997. Principles of Genetics, Tata Mc Graw Hill Publishing Co., New Delhi.
3. Brown W.V. and Bertke.E.M., 1974, A text book of Cytology C.V.Mosley Co.,St. Louis.
4. Cohn.N.S., 1979, Elements of Cytology, Freeman Book Co.,
5. De Robritis E.D.P. and DeRobrities. E.M.F.jr 1987 – Cell and Molecular biology Lea and Febiger..
6. Feifelder.D., - Molecular Biology, Narosa. Publication
7. Watson. J.D., et.al Molecular biology of the Gene The Benjamin/ Cummings.
8. Freifelder, D. 1987. Essentials of Molecular Biology, Jones Bartlett, Boston, USA.
9. De Robertis & De Robertis. 1990. Cell and Molecular Biology, Saunders College,Philadelphia, USA.
10. Gardner, EJ., Simmons, MJ. & Snustad, D. 1991. Principles of Genetics, 8th Edn., John Wiley & Sons Inc., New York.
11. Glick, B.R. and Thompson, J.E. 1993. Methods in Plant Molecular, Biology and Biotechnology. CRC Press, Boca Raton, Florida.
12. Hackett, P.B., Fuchs, J.A. and Messing, J.W. 1988. An Introduction to Recombinant. DNA Techniques : Basic Experiments in Gene Manipulation. The Benjamin/Cummings Publishing Co. Inc., Menlo Park, California.
13. Hall, J.L. and Moore, A.L. 1983. Isolation of Membranes and Organelles from Plant Cells. Academic Press, London, UK.
14. Harris, N. and Oparka, K.J. 1994. Plant Cell Biology : A Practical Approach. IRL Press, at Oxford University Press, Oxford, U.K.
15. Shaw, C.H. (Ed.), 1988. Plant Molecular Biology: A Practical Approach. IRL Press Oxford.
16. Esau.K. (1985) – Anatomy of Seed Plants –John Willey
17. Cutter.E.G (1989) – Plant Anatomy – Part I – Addison – Wesley Publishing Co..
18. Vashista.P.C. (1988) – A Text Book of Plant Anatomy. S.Nagin & Co.
19. Fageri, K. and Van der Pijl, L. 1979. The Principle of Pol1ination Ecology. Pergamon Press, Oxford.
20. Fahn, A. 1982. Plant Anatomy. (3rd edition). Pergamon Press, Oxford.

Question Paper Pattern:

Section	Question Component	Numbers	Marks	Total
Section A	**Definition / Principle** Answer any 10 out of 12 Questions	01-12	2	**20**
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Section C	**Essay** Answer any 2 out of 5 questions	20-24	20	**40**

Distribution of Questions:

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		Theory	**Problems**
Section A	Unit – 1	2	
	Unit – 2	3	
	Unit – 3	3	
	Unit – 4	2	
	Unit – 5	2	
Section B	Unit – 1	1	
	Unit – 2	2	
	Unit – 3	2	
	Unit – 4	1	
	Unit – 5	1	
Section C	Unit – 1	1	
	Unit – 2	1	
	Unit – 3	1	
	Unit – 4	1	
	Unit – 5	1	

CORE VIII

MORPHOLOGY, TAXONOMY OF ANGIOSPERM & EMBRYOLOGY

SUBJECT CODE : 16UPBTC08	THEORY	MARKS:100
SEMESTER: V	CREDITS: 4	TOTAL HOURS: 60

COURSE OBJECTIVES:

* To acquaint the students about the basic principles involved in classification, naming and identification of angiospermic plants.
* To expose the students to the diagnostic features of selected families and to know the economically important plant products and their utilization.
* To understand the lifecycle of angiospermic plant development and the various processes that is involved.

Unit – I **(10 Hours)**

Morphology – root system – modifications. Shoot system – modifications – (Aerial, sub-aerial and underground). Leaf-simple and compound- phyllotaxy, modifications, (phyllode, pitcher) tendrils, stipules. Inflorescences – definition and types – racemose, cymose, mixed and special types. Fruits - classification.

Unit – II **(15 Hours)**

Taxonomy and its importance, Concept of a Taxon – Genus and Species, Author citation, Binomial Nomenclature, ICBN, Taxonomic Hierarchy and Herbarium Techniques.

Systems of Plant Classification – Artificial (Linnaeus), Natural (Bentham & Hooker), Modern and Phylogenetic (Cronquist). Merits and Demerits.

Unit – III **(15 Hours)**

Detailed study of following Angiospermic families

Dicot

Polypetalae : a) Capparidaceae b) Leguminosae c) Cucurbitaceae

Gamopetalae : d) Rubiaceae e) Apocynaceae f) Solanaceae

Monochlamydeae : g) Euphorbiaceae

Monocot : h) Poaceae

Unit – IV **(10 Hours)**

Development of anther - Microsporangium – Microsporogenesis, Microspores, male gametophyte.

Development of ovule – Megasporogenesis, female gametophyte

(Monosporic – *Polygonum*, Bisporic – *Allium*, Tetrasporic – *Peperomia*).

Unit – V **(10 Hours)**

Fertilization – Double fertilization, triple fusion, Endosperm and its types (Cellular, Nuclear and Helobial), development of dicot embryo (*Capsella)*, development of monocot embryo (*Najas*), polyembryony, apomixis – definition and types.

Prescribed reading:

1.Lawrence.G.H.M, 1985 – An Introduction to Plant Taxonomy, Central Book Depot, Allahabad.
2.Porter.C.L., 1982 – Taxonomy of Flowering Plants, Eurasia Publications House, New Delhi
3.Rendle.A.B., 1980 – The Classification of Flowering Plants (Vol. I & II), Vikas Students Education.
4.Pandey.B.P., 1987 – Taxonomy of Angiosperms.

Suggested reading

1. Clive AS.1989. Plant Taxonomy and Biosystematics, Chapman and Hall Inc. New
2. Lawrence, GH. 1955. Taxonomy of Vascular Plants, MacMillan Co., USA.
3. Samuel, BJ & Arlene, EL. 1987. Plant Systematics, Mc Graw Hill Inc. New York
4. Grant, W.E. 1984. Plant Biosystematics. Academic Press London.
5. Harrison, H.J. 1971. New Concepts in Flowering Plant Taxonomy. Rieman Educational Book Ltd., London.
6. Heslop-Harrison, J. 1967. Plant Taxonomy -English Language Book Soc. & Edward Arnold Pub. Ltd. U.K.
7. Heywood, V.H. and Moore, D.M. 1984. Current Concepts in Plant Taxonomy. Academic Press, London.
8. Jones, S.B. Jr. and Luchsinger, A.E. 1986. Plant Systematics (2nd edition). McGraw-HilI Book Co., New York.
9. Nordenstam, B., EI Gazaly, G. and Kassas, M. 2000 Plant Systematics for 21st Century. Portlant Press Ltd., London.
10. Radford, A.E. 1986. Fundamentals of Plant Systematics. Harper & Row Publications, USA.
11. Solbrig, O.T. 1970. Principles and Methods of Plant Biosystematics. The MacMillan Co-collier-MacMillan Ltd., London.
12. Stebbings, G.L. 1974. Flowering Plant - Evolution above Species Level. Edward Arnold Ltd. London.
13. Stace, C.A. 1989. Plant Taxonomy and Biosystematics (2nd edition) Edward Arnold Ltd., London.
14. Takhtajan, A.L. 1997. Diversity and Classification of Flowering Plants. Columbia University Press, New York.
15. Woodland, D.W. 1991. Contemporary Plant Systematics. Prentice Hall. New Jersey.
16. Maheswari.P. (1991) – An Introduction to Embryology of Angiosperms, Tata McGraw Hill Publishing Co. Ltd.,
17. Swamy B.G.L. and Krishnamoorthy. K.V. (1990) – From Flower to Fruits, Tata McGraw Hill Publishing Co. Ltd.

18. Bhojwani S.S. and Bhatnagar.S.P. (1987) – Embryology of Angiosperms, Vikas Publishing House Pvt. Ltd.,
19. Bhojwani, S S. & Bhatnagar, SP. 1994. Embryology of Angiosperms, Vikas
20. Bhojwani, S.S. and Bhatnagar, S.P. 2000. The Embryology of Angiosperms (4th revised and enlarged edition). Vikas Publishing House, New Deihi.
21. Burgess, J. 1985. An Introduction to Plant Cell Development. Cambridge University Press, Cambridge.
22. Leins, P., TucKer, S.C. and Endress, P.K. 1988. Aspects of Floral Development, J. Cramer, Germany.
23. Lyndon, R.F. 1990. Plant Development. The Cellular Basis, Unnin Byman, London.
24. Murphy, T.M. and Thompson, W.E, 1988. Molecular Plant Development. Prentice Hall, New Jersey.
25. Proctor, M. and Yeo, P. 1973. The Pollination of Flowers. William Collins Sons, London.
26. Raghavan, V. 1997. Molecular Embryology of Flowering Plants. Cambridge University Press, Cambridge.
27. Raghavan, V. 1999. Developmental Biology of Flowering Plants. Springer-Verlag, New York.
28. Raven, P.H., Evrt, R.F. and Eichhorn, S. 1992. Biology of Plants (5th edition). Worth, New York.
29. Steeves, T.A. and Sussex, I.M., 1989. Patterns in Plant Development (2nd edition). Cambridge University Press, Cambridge.
30. Waisel, Y., Eshel, A. and Kafkaki, U. (eds.). 1996. Plant Roots : The Hidden Hall (2nd edition). Marcel Dekker, New York.
31. Shivanna, K.R. and Sawhney, VK. (eds.) 1997. Pollen Biotechnology for Crop Production and Improvement. Cambridge University Press, Cambridge.
32. Shivanna, K.R. and Rangaswamy, N.S. 1992. Pollen Biology : A Laboratory Manual. Springer-Verlag. Berlin.
33. Shivanna, K.R. and Johri, B.M. 1995. The Angiosperm Pollen : Structure and Function. Wiley Eastern Ltd.. New York.

Question Paper Pattern:

Section	Question Component	Numbers	Marks	Total
Section A	**Definition / Principle** Answer any 10 out of 12 Questions	01-12	2	**20**
Section B	**Short Answer** Answer any 5 out of 7 questions	13-19	8	**40**
Section C	**Essay** Answer any 2 out of 5 questions	20-24	20	**40**

Distribution of Questions:

Sections	Units	No. of Questions	
		Theory	Problems
Section A	Unit – 1	2	
	Unit – 2	3	
	Unit – 3	3	
	Unit – 4	2	
	Unit – 5	2	
Section B	Unit – 1	1	
	Unit – 2	2	
	Unit – 3	2	
	Unit – 4	1	
	Unit – 5	1	
Section C	Unit – 1	1	
	Unit – 2	1	
	Unit – 3	1	
	Unit – 4	1	
	Unit – 5	1	

CORE IX

PLANT BIOTECHNOLOGY

SUBJECT CODE : 16UPBTC09	**THEORY**	**MARKS:100**
SEMESTER: V	**CREDITS: 4**	**TOTAL HOURS: 60**

COURSE OBJECTIVES:

- To understand the fundamental aspects of plant tissue culture and molecular biology of plants for the production of transgenics.
- To understand the concepts of modern technology pertaining to large scale production of agricultural products.

Unit – I **(10 Hours)**

Biotechnology – definition, history and scope. Isolation and cultivation of economically important microbes (a) Fresh Water Alga (*Scenedesmus*) (b) Fungus (*Aspergillus*).

Unit – II **(15 Hours)**

Tissue Culture – *In vitro* culture techniques: Sterilization Methods, Culture Media – Composition and types of medium, inoculation, incubation and acclimatization. Callus formation and protoplast fusion with reference to improvement of plants. Somoclonal variation and cryopreservation.

Unit – III **(15 Hours)**

Single cell protein (SCP) – Micro-organism used in SCP (*Scenedesmus* and *Spirulina*). Nutritional value of SCP. Algal Biomass production and maintenance.

Biofertilizers – Blue green algae, *Azolla*, Fungi – *Mycorrhiza* (VAM and Ectomycorrhiza), Bacterium – *Azospirillum* and *Rhizobium*.

Unit – IV **(10 Hours)**

Production of primary metabolites – ethanol production by Yeast, citric acid production by *Aspergillus niger*. Production of secondary metabolites - antibiotics – *Pencillin*. Enzymes from microbes and their application – amylase, proteases, renin, pectinase and glucose oxidase. Improvement of plants: alkaloid production, vaccine production luminescent plants and protein sweetener.

Unit – V **(10 Hours)**

Principles and tools of Genetic Engineering –Restriction enzymes, Cloning vectors, Gene delivery system: Plant Viruses, *Agrobacterium* mediated gene transfer (biological), Particle gun bombardment, microinjection, electrophoration. Production of transgenics : disease resistant plant (*Bt* gene).

Prescribed books:

1. James D Watson et al., 1992. Recombinant DNA (2nd Edition), WH Freeman and Co., New York.
2. Maniatis & Sambrook. 2003. Molecular Cloning- A lab manual Vol.I, II & III, Coldspring Harbor Laboratory Press, New York.
3. Old, RW & Primrose, SB. 2001. Principles of Gene Manipulation-an introduction togenetic engineering, Black Well Science Ltd., New York.
4. Bhojwani. S., Dhawan, V. and Cocking, E.C. Plant tissue culture. Springer – Verlag
5. Bajaj, Y.P.S. Plant, cell and organ culture. Springer – Verlag.
6. Bajaj, Y.P.S. (1987). Biotechnology in agriculture and forestry. Springer – Verlag
7. Halder, T. and Gadgil, V.N., 1981. Plant cell culture in crop improvement. Plenum, New York.

Suggested books:

1. Bernard R Glick & Jack J Pasternak. 2001. Molecular biotechnology-principles andapplications of recombinant DNA, (2nd Edition), ASM Press, Washington, D.C.
2. Jogdand, SN. 1997. Gene biotechnology, Himalaya Publishig House, New Delhi.Books for Reference
3. Ernst L. Winnaccker, 2002. From Genes to Clones-introduction to gene technology,VCR Pub., Weintein
4. Neuman, K.H., Barz, W., and E.Reinhard, 1985. Primary and secondary metabolism of plant cell cultures – Springer – Verlag, Berlin.
5. Mantell, S.H., and Hedsmith, 1983. Plant biotechnology, SEB Seminar series 18, Cambridge University Press, Cambridge.
6. Barz, W., Reinhard, E., and Zenk, M.H., 1977. Plant tissue culture and its biotechnology application – Springer – Verlag, Berlin.
7. Mizrahi, A., (1988). Biotechnology in agriculture, advances in biotechnological processes, Vol. 9, Alen R. Liss Loc; New York.
8. Scragg, A.H. The economics of mass culture. Secondary metabolism in plants, Cambridge, London, New York.
9. Thorpe, T.A., 1978. Frontiers of plant tissue culture. University of Calgary Publication.
10. Hu, C.Y. and P.J.Wang, 1984. Hand book of plant cell culture Vol.1. Mac million, New York.
11. Reinert, J. and Y.P.S.Bajaj, 1977. Applied and fundamental aspects of plant cell – tissue culture and organ culture – Springer – Verlag, Heidelbery, Berlin.
12. Gleba, Y.Y. and Sytnik, K.M. (1984). Genetic engineering in higher plants – Springer Verlag, Heidelbery.
13. Bhajwani. S., and Razdan, 1984. Plant tissue culture. Theory and practice.

Question Paper Pattern:

Section	Question Component	Numbers	Marks	Total
Section A	**Definition / Principle** Answer any 10 out of 12 Questions	01-12	2	**20**
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Distribution of Questions:

Sections	Units	No. of Questions	
		Theory	**Problems**
Section A	Unit – 1	2	
	Unit – 2	3	
	Unit – 3	3	
	Unit – 4	2	
	Unit – 5	2	
Section B	Unit – 1	1	
	Unit – 2	2	
	Unit – 3	2	
	Unit – 4	1	
	Unit – 5	1	
Section C	Unit – 1	1	
	Unit – 2	1	
	Unit – 3	1	
	Unit – 4	1	
	Unit – 5	1	

CORE X
PLANT MICROTECHNIQUE

SUBJECT CODE : 16UPBTC10	**THEORY**	**MARKS:100**
SEMESTER: VI	**CREDITS: 4**	**TOTAL HOURS: 60**

COURSE OBJECTIVES:

- To study the objects for examination under a microscope through various techniques.
- To study the methods and procedures in the structure, vital activity, development, chemical composition, and physical properties.

Unit I. (**10 Hours)**

Light microscopy – History and - Optical principles use and care of Microscopes - A brief . Survey of different types of microscopes including E.M.

Unit II. (**10 Hours)**

Microtechnical processes – principles and techniques:

(A) Fixation and Fixatives

(B) Temporary staining and stains

Unit III. (**10 Hours)**

Microscopic preparation, Semi-permanent and Permanent.

Unit IV. (**15 Hours)**

Special techniques: smear, squash & maceration

Unit V. (**15 Hours)**

Microtomy: types of microtomes and their use.

Methods of specific materials:

(A) Whole mount of algae & fungi

(B) Sectioning of bryophytes, pteridophytes and gymnosperms.

(C) Maceration & sectioning of angiosperm materials.

Prescribed Book:

1. Alan peacock H.1966 Elementary Microtechnique Edward Arnold (Pub) Ltd.
2. Duddington - C.L. 1960 Practical Microscopy, Pitinan.
3. Cray P.Hand Book of Basic Microtechnique. Mac - Graw Hill, New Delhi.
4. Johnson D.A. 1940 Plant Microtechnique. Mac - Graw Hill, New Delhi.

Suggested reading

1. MC Clung, C.L.1961, Hand book of Microscopical Technique.
2. Patki L.R.1992 An Introduction to Microtechnique S.Chand & Company, New Delhi.
3. Prasad & Prasad 2000 Emkay Replications, Delhi.
4. Puru's M.J.et al 1966 Laboratory Techniques in Botany Butter Worths.

Question Paper Pattern:

Section	Question Component	Numbers	Marks	Total
Section A	**Definition / Principle** Answer any 10 out of 12 Questions	01-12	2	**20**
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Distribution of Questions:

Sections	Units	No. of Questions	
		Theory	Problems
Section A	Unit – 1	2	
	Unit – 2	3	
	Unit – 3	3	
	Unit – 4	2	
	Unit – 5	2	
Section B	Unit – 1	1	
	Unit – 2	2	
	Unit – 3	2	
	Unit – 4	1	
	Unit – 5	1	
Section C	Unit – 1	1	
	Unit – 2	1	
	Unit – 3	1	
	Unit – 4	1	
	Unit – 5	1	

ELECTIVE -I

PAPER TITLE: PLANT DISEASES & MANAGEMENT

SUBJECT CODE : 16UPBTE01	**THEORY**	**MARKS:100**
SEMESTER: V	**CREDITS: 5**	**TOTAL HOURS: 75**

COURSE OBJECTIVES

- To study about the plant diseases with special reference to southern India.
- To understand the diseases, symptoms, causal organisms – etiology of the diseases and control measures.

Unit – I **(15 Hours)**

Plant Diseases: Introduction, Concept, Importance, History and classification. Basic concept of infection – inoculum, inoculum potential, penetration, infection, invasion, growth, reproduction and dispersal.

Unit – II **(15 Hours)**

Defence mechanism – ***Innate*** : surface structure, structure of natural openings, inhibitors, suberized, lignified tissue – gum deposition – phenols – phenolic glycosides**.** ***Induced*** : hypersensitivity - histological – cork – abscission – biochemical phenols and phytoalexins. Fundamental concepts on cross protection and induced resistance.

Unit – III **(15 Hours)**

Study of the following diseases with reference to their incitants, symptom manifestation and control measures.

Smut of Sorghum, Rust of Wheat, Downy mildew of Grapes, Bacterial blight of rice, Wilt of cotton, club root of cabbage.

Unit – IV **(15 Hours)**

Study of casual organisms and symptoms of

1. Blast diseases of rice
2. Red rod of sugarcane
3. Tikka disease of groundnut
4. Citrus cankar
5. Leaf curl of Papaya
6. TMV
7. Insect diseases - Plant galls
8. Parasitic diseases of plants - *Cuscuta*

Unit – V **(15 Hours)**

Modern methods of disease forecast – epiphytotic – causes, course, decline and prophylaxis; Detection of plant pathogens using molecular tools. Plant protection – Prevention, eradication - environmental, chemical and biological.

Prescribed books:

1. Bilgrami, K.S. and Dube, H.C. 1976. A text book of modern plant pathology. Vikas Publishing House Pvt. Ltd., New Delhi.

Suggested reading

1. Pandey B.P. 1989. A text book of plant pathology, pathogen and plant diseases. S. Chand and Company Ltd., New Delhi.
2. Mukerji, K.G. &Bhasin , J. 1972. Plant diseases of India – A source book.Tata McGraw Hill, New Delhi.
3. Mehrotra. R.S. 1980. Plant pathology. Tata McGraw Hill, New Delhi.
4. Rangaswamy, G. 1975. Diseases of crop plants in India. 2nd Edn. Prentice Hall, India

Question Paper Pattern:

Section	Question Component	Numbers	Marks	Total
Section A	**Definition / Principle** Answer any 10 out of 12 Questions	01-12	2	**20**
Section B	**Short Answer** Answer any 5 out of 7 questions	13-19	8	**40**
Section C	**Essay** Answer any 2 out of 5 questions	20-24	20	**40**

Distribution of Questions:

Sections	Units	No. of Questions	
		Theory	Problems
Section A	Unit – 1	2	
	Unit – 2	3	
	Unit – 3	3	
	Unit – 4	2	
	Unit – 5	2	
Section B	Unit – 1	1	
	Unit – 2	2	
	Unit – 3	2	
	Unit – 4	1	
	Unit – 5	1	
Section C	Unit – 1	1	
	Unit – 2	1	
	Unit – 3	1	
	Unit – 4	1	
	Unit – 5	1	

PAPER TITLE: PLANT BIOTECHNOLOGY & PLANT MICROTECHNIQUE

SUBJECT CODE : 16UPBTC15P	**PRACTICAL**	**MARKS:100**
SEMESTER: V	**CREDITS: 2**	**TOTAL HOURS: 30**

COURSE OBJECTIVES

- To make the students to understand the lifecycle of angiospermic plant development and the various processes that are involved.
- To expose the students to the diagnostic features of selected families and to know the economically important plant products and their utilization.
- The main objective is to provide an overview of the plant derived natural products for their occurrence, sources, basic chemistry and therapeutic applications.

PLANT BIOTECHNOLOGY (15 Hours)

Sterilization techniques in plant tissue culture

Preparation of MS Medium, Embryo culture, Meristem culture and Anther culture

Study of algal biofertilizers, VAM fungi, Bacteria – *Azospirillum*

Plant Microtechnique (15 Hours)

1. Microscopic preparation of semi-permanent and permanent slides.
2. Special techniques: smear, squash & maceration.

Question Paper Pattern:

Section	Question Component	Numbers	Marks	Total
Section A	**Definition / Principle** Answer any 10 out of 12 Questions	01-12	2	**20**
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Section C	**Essay** Answer any 2 out of 5 questions	20-24	20	**40**

Distribution of Questions:

Sections	Units	No. of Questions	
		Theory	**Problems**
Section A	Unit – 1	2	
	Unit – 2	3	
	Unit – 3	3	
	Unit – 4	2	
	Unit – 5	2	
Section B	Unit – 1	1	
	Unit – 2	2	
	Unit – 3	2	
	Unit – 4	1	
	Unit – 5	1	
Section C	Unit – 1	1	
	Unit – 2	1	
	Unit – 3	1	
	Unit – 4	1	
	Unit – 5	1	

SEMESTER -VI

CORE XII

GENETICS & PLANT BREEDING

SUBJECT CODE : 16UPBTC12	**THEORY**	**MARKS:100**
SEMESTER: VI	**CREDITS: 4**	**TOTAL HOURS: 75**

COURSE OBJECTIVES

- To understand the principles of genetics and transfer of hereditary characters.
- To make the student to understand the mechanisms of gene expression and its regulation.
- To understand the process of crop improvement and hybridization.

Unit – I **(15 Hours)**

History, branches and application, Mendelian genetics –Mendel's experiment, Mendel's laws. Monohybrid cross and its modification, dihybrid cross and test cross.

Unit – II **(15 Hours)**

Allelic and non-allelic interactions. Chromosome theory of linkage, crossing over, recombinations and mapping of genes on chromosomes. Polygenic inheritance, Multiple alleles.

Unit – III **(15 Hours)**

Chromosomal aberrations – duplication, deletion, inversion and translocation, sex linkage, Sex determination in plants. Polyploidy origin, types and significance.

Unit – IV **(15 Hours)**

Extra nuclear inheritance and its significance. Male sterility in corn. Mutation – types, mutagenic agents (physical and chemical) and significance. Population genetics – Hardy Weinberg principles.

Unit – V **(15 Hours)**

Principles involved in plant breeding, methods of crop improvement – selection (pure line, mass and clonal). Hybridization: types, selection of parents, emasculation, bagging, heterosis, introduction and acclimatization.

Prescribed Books:

1. Verma, P.S. & V.K. Agarwal, 2002, Cytology. S. Chand & Co.Ltd., New Delhi-55.
2. Verma, P.S. & V.K. Agarwal, 2003, Genetics. S. Chand & Co.Ltd., New Delhi-55.

   Freifelder, D.1987. Essentials of Molecular Biology, Jones & Bartlett, Boston.
3. Gardner, EJ., Simmons, MJ. & Snustad, D. 1991. Principles of Genetics, John Wiley Sons Inc., 8th Edn., New York.
4. Sinnott, EW., Dunn, LL. & Dobzhansky, T. 1997. Principles of Genetics, Tata Mc Graw Hill Publishing Co., New Delhi.

Suggested reading

1. Brown W.V. and Bertke.E.M., 1974, A text book of Cytology C.V.Mosley Co.,St. Louis.
2. Cohn.N.S., 1979, Elements of Cytology, Freeman Book Co.,
3. De Robritis E.D.P. and DeRobrities. E.M.F.jr 1987 – Cell and Molecular biology Lea and Febiger..
4. Feifelder.D., - Molecular Biology, Narosa. Publication
5. Watson. J.D., et.al Molecular biology of the Gene The Benjamin/ Cummings.
6. Freifelder, D. 1987. Essentials of Molecular Biology, Jones Bartlett, Boston, USA.
7. De Robertis & De Robertis. 1990. Cell and Molecular Biology, Saunders College,Philadelphia, USA.
8. Gardner, EJ. Simmons, MJ. & Snustad, D. 1991. Principles of Genetics, 8th Edn., John Wiley & Sons Inc., New York.
9. Glick, B.R. and Thompson, J.E. 1993. Methods in Plant Molecular, Biology and Biotechnology. CRC Press, Boca Raton, Florida.
10. Hackett, P.B., Fuchs, J.A. and Messing, J.W. 1988. An Introduction to Recombinant. DNA Techniques: Basic Experiments in Gene Manipulation. The Benjamin/Cummings Publishing Co. Inc., Menlo Park, California.
11. Hall, J.L. and Moore, A.L. 1983. Isolation of Membranes and Organelles from Plant Cells. Academic Press, London, UK.
12. Harris, N. and Oparka, K.J. 1994. Plant Cell Biology: A Practical Approach. IRL Press, at Oxford University Press, Oxford, U.K.
13. Shaw, C.H. (Ed.), 1988. Plant Molecular Biology: A Practical Approach. IRL Press Oxford.

CORE XIII

PLANT ECOLOGY AND PHYTOGEOGRAPHY

SUBJECT CODE : 16UPBTC13	**THEORY**	**MARKS:100**
SEMESTER: VI	**CREDITS: 4**	**TOTAL HOURS: 75**

COURSE OBJECTIVES

1. To give an insight into ecology, environmental pollution and microbial processes in the environment.
2. To introduce the students to the essential basics of phytogeography and forestry of India.

Unit – I **(15 Hours)**

Biotic and abiotic factors and their influence on vegetation – a brief account of microbes, plants, animals, soil, wind, light, temperature, rain fall and fire. Plant succession – Primary and secondary – Xerosere, Hydrosere. Adaptation in xerophytes, hydrophytes and epiphytes.

Unit – II **(15 Hours)**

Ecosystem – Concept processes and components. Food chain, food web, energy flow in ecosystem. Types of Ecosystems : Coastal and grassland. Ecological pyramids and nutrient cycling.

Unit – III **(15 Hours)**

Ecological species and genetic species diversity, concept : classical and modern. Allopatric and sympatric speciation.

Unit IV **(15 Hours)**

Biodiversity: Principles and need for conservation - in situ and Ex situ, Endemism. Endangered plants

Unit V **(15 Hours)**

Phytogeographic regions of India – Ever green forests, Deciduous forests, Scrub jungle and Mangrove forests.

Prescribed Books:

1. Atlas. R.M. and Bartha.R. (1987) – Microbial Ecology : Fundamentals and applications. The Benjamin/ Cummings Publishing Co. Inc.
2. Colinvaux.P. (1986) – Ecology, John Wiley and Sons.
3. Kumar.H.D. (1990) – Modern concepts of Ecology, Vikas Publishing House Pvt. Ltd.,
4. Krishna Iyer.V.R (1992) Environmental protection and legal defence. Sterling Publishers Pvt. Ltd.,

Suggested reading

1. Mabberley.D.J. (1983) – Tropical Rain forest \ecology, Blackie and Son Ltd.,
2. Odum.E.P. (1983) – Basic Ecology, Holt-Saunders International Editions.
3. Shukla.R.S. and Chandel.PS. (1990) – Plant Ecology, S.Chand & Co. Pvt. Ltd.,
4. Singh.D.V (1985), The Eco Vote : - People's representatives and global environment.
5. Smith.W.H. (1981) – Air pollution and forest : Interactions between air contaminants and forest ecosystems.
6. Vickery.M.L. (1984) – Ecology of Tropical plants, John Wiley and Sons.
7. Krishnamurthy KV. 2003. An advanced text book on Biodiversity - Principle and Practice. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
8. Melchias, G., 2001. Biodiversity and Conservation, Science Publishers Inc. USA.
9. Sharma, PD. 1999. Ecology and Environment, Rastogi Publishers, Meerut.
10. Asthana, DK & Meera Asthana. 2006. A text book of Environmental studies. S.Chand & Company Ltd. New Delhi.
11. Brian Groombridge. 1992. Global Biodiversity, Chapman and Hall, UK.
12. IUCN, 1985. The World Conservation Strategy, IUCN, Switzerland.
13. Odum, EP. 1970. Fundamentals of Ecology, 3rd edn, W.B.Saunders Ltd., UK
14. Simmons et al., 1980, Conservation of Threatened Plants, NATO Scientific affairs, New York.

CORE XIV

PLANT PHYSIOLOGY & BIOCHEMISTRY

SUBJECT CODE : 16UPBTC14	**THEORY**	**MARKS:100**
SEMESTER: V	**CREDITS: 4**	**TOTAL HOURS: 60**

COURSE OBJECTIVES

1. To provide an insight into the physico-chemical organization and the functional aspects of plants.
2. To orient the students to understand effectively the concepts on morphogenesis and ultimately plant biochemistry.

Unit – I **(10 Hours)**

Atomic structure, chemical bonds – ionic bond and covalent bond, pH, buffers and electrolytes. Water relations – movement of water from soil to plant, Apoplast and Symplast. Stomatal physiology – types of transpiration in plants and Guttation.

Unit – II **(10 Hours)**

Deficiency and symptoms – Absorption and translocation of solutes – active & passive uptake. Enzymes: Classification, properties and mode of action.

Unit – III **(15 Hours)**

Photosynthesis – Chloroplast pigments, Energy sources, Photosystem I & II, electron flow through cyclic and non-cyclic photophosphorylation – pathways of CO_2 fixation in C_3 and C_4 plants.

Unit – IV **(10 Hours)**

Respiration – Glycolysis, Krebs cycle, electron transport system, oxidative phosphorylation, respiratory quotient. Anaerobic respiration and fermentation.

Nitrogen assimilation – importance of nitrogen in plant life, biological nitrogen fixation, legume – *Rhizobium* symbiosis.

Unit – V **(15 Hours)**

Growth – Plant growth regulators (Auxins, Gibberellic acid, cytokinin and Ethylene) – mechanism of action and practical applications.

Physiology of flowering: Photo periodism – Vernalisation. Seed – Dormancy, viability and germination.

Prescribed Books:

1. Buchanan, B.B., Gruissem, W. and Jones, R.L. 2000. Biochemistry and Molecular biology of Plants, American Society of Plant Physiologists, Maryland, USA.

2. Dennis, D.T., Turpin, D.H., Lefebvre, D.D. and Layzell, D.B. (Eds) 1997. Plant Metabolism (second edition). Longman Essex, England.
3. Galston, A.W. 1989. Life Processes in Plants. Scientific American Library, Springer-Verlag, New York, USA.
4. Hooykaas, P.J.J., Hall M.A. and Libbenga, K.R. (eds) 1999. Biochemistry and Molecular Biology of Plant Hormones, Elsevier, Amsterdam, The Netherlands.

Suggested reading

1. Hopkins, W.G. 1995. Introduction to Plant Physiology. John Wiley & Sons, Inc., New York, USA.
2. Lodish, H., Berk, A., Zipursky, S.L., Matsudaira P., Baltimore, D. and Darnell, J. 2000. Molecular Cell Biology (fourth edition). W.H. Freeman and Company, New York, USA.
3. Moore, T.C. 1989. Biochemistry and Physiology of Plant Hormones (second edition). Springer-Verlag, NewYork, USA.
4. Nobel, P.S. 1999. Physiochemical and Environmental Plant Physiology (second edition), Academic Press, San Diego, USA.
5. Salisbury, F.B. and Ross, C.W. 1992. Plaut Physiology (4th edition). Wadsworth Publishing Co., California, USA.
6. Singhal, G.S., Renger, G., Sopory, S.K., Irrgang, K.D. and Govindjee 1999., Concepts in Photobiology : Photosynthesis and Photomorphogenesis. Narosa Publishing House, New Delhi.
7. Taiz, L. and Zeiger, E. 1998. Plant Physiology (2nd edition). Sinauer Associates, Inc., Publishers, Massachusetts, USA.
8. Thomas, B. and Vince-Prue, D. (1997) Photoperiodism in Plants (second edition). Academic Press, San Diego. USA.
9. Westhoff, P. (1998) Molecular Plant Development from Gene to Plant. Oxford University Press, Oxford, UK.
10. Jain, JL. 1979. Fundamentals of Biochemistry, Chand & Co. Ltd., New Delhi
11. Jain, VK. 2006. Fundamentals of Plant Physiology, S.Chand&Company Ltd.,
12. Verma, SK. 2006. A Textbook of Plant Physiology, S.K.Chand & Co., New Delhi
13. Conn, E & Stumpf, PK. 1979. Outline of Biochemistry Niley Easdtern Ltd., New
    Delhi
14. Metz, ET. 1960. Elements of Biochemistry. V.F & S (P) Ltd., Bombay
15. Noggle and Fritz, 1976. Introductory Plant Physiology, Prentice Hall, New Delhi
16. Pandey, SN & Sinha, BK. 1989. Plant Physiology, Vikas Publishing House Ltd., New Delhi
17. Robert M. Devlin. 1970. Plant Physiology, East West Press, New Delhi

Question Paper Pattern:

Section	Question Component	Numbers	Marks	Total
Section A	**Definition / Principle** Answer any 10 out of 12 Questions	01-12	2	**20**
Section B	**Short Answer** Answer any 5 out of 7 questions	13-19	8	**40**
Section C	**Essay** Answer any 2 out of 5 questions	20-24	20	**40**

Distribution of Questions:

Sections	Units	No. of Questions	
		Theory	**Problems**
Section A	Unit – 1	2	
	Unit – 2	3	
	Unit – 3	3	
	Unit – 4	2	
	Unit – 5	2	
Section B	Unit – 1	1	
	Unit – 2	2	
	Unit – 3	2	
	Unit – 4	1	
	Unit – 5	1	
Section C	Unit – 1	1	
	Unit – 2	1	
	Unit – 3	1	
	Unit – 4	1	
	Unit – 5	1	

ELECTIVE I

HERBAL SCIENCE

SUBJECT CODE : 16UPBTE02	**THEORY**	**MARKS:100**
SEMESTER: V	**CREDITS: 5**	**TOTAL HOURS: 75**

COURSE OBJECTIVES:

To know the elementary treatment of various morphological, anatomical and biochemical

parameters used in the identification and utilization of medicinal plants in general.

To provide an overview of ethnobotany, methods of herbal preparation, tribal

Unit – I **(15 Hours)**

Introduction, Food Plants – Plant and Plant products of Industrial value. Cereals – Rice & Wheat, Millet – Sorghum & Pearl millet, Pulses – Soya bean, Nuts – Peanut.

Unit – II **(15 Hours)**

Fibers and fiber yielding plants – Cultivation, extraction and uses of Fibres. Soft fibres – *Corchorous*, Hard fibre – Manila Hemp – *Musa textilis*, Surface fibre – *Gossypium*.Timber – Harvesting & processing of wood in *Tectona*. Rubber – Extraction & processing with reference to *Hevea braziliensis*.

Unit – III **(15 Hours)**

Sugar – *Saccharum officinarum* – cultivation, harvesting and extraction. Spices – *Eugenia caryophyllata* – cultivation & harvesting. Beverages – *Coffea arabica* & *Thea sinensis* – cultivation & harvesting. Pulp and paper – raw materials & manufacture of pulp.

Unit – IV **(15 Hours)**

Definition, history and scope of Pharmacognosy. Indigenous systems of medicine – Ayurvedic, Siddha, Unani and Homeopathy.

Unit – V **(15 Hours)**

Sources, descriptions, constituents and uses of the following:

Antirheumatic – *Colchicine*
Antitumour – *Vinca*
Antidiabetic – *Gymnema*
Antiseptic – Neem

Prescribed Books:

1. Text book of Pharmacognosy, Wallis, T.E. 1999. CBS Publishers and Distributors, New Delhi.
2. Practical Pharmacognosy, Kokate. 2000. Vallabh, New Delhi.
3. Herbal cure for common diseases. Acharya Vipul Rao, 2000. Diamond books, Pvt. Ltd.

Suggested reading

1. Indian medicinal plants used in Ayurvedic preparations, Dey. A.C. 1998. Bishen Singh Mahendra pal singh.
2. Herbal drug microscopy. Vasudevan, T.N. and Laddha, K.S. 2003. Yucca Pub. House.

Question Paper Pattern:

Section	Question Component	Numbers	Marks	Total
Section A	**Definition / Principle** Answer any 10 out of 12 Questions	01-12	2	**20**
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Section C	**Essay** Answer any 2 out of 5 questions	20-24	20	**40**

Distribution of Questions:

Sections	Units	No. of Questions	
		Theory	Problems
Section A	Unit – 1	2	
	Unit – 2	3	
	Unit – 3	3	
	Unit – 4	2	
	Unit – 5	2	
Section B	Unit – 1	1	
	Unit – 2	2	
	Unit – 3	2	
	Unit – 4	1	
	Unit – 5	1	
Section C	Unit – 1	1	
	Unit – 2	1	
	Unit – 3	1	
	Unit – 4	1	
	Unit – 5	1	

ELECTIVE II

HORTICULTURE

SUBJECT CODE : 16UPBTE03	**THEORY**	**MARKS:100**
SEMESTER: V	**CREDITS: 5**	**TOTAL HOURS: 75**

COURSE OBJECTIVES:

- To acquaint the students about the basics of plant propagation, irrigation methods ,manures and organic farming.
- To provide the students a theoretical knowledge of horticulture so as to establish home gardens scientifically.
- Introduce the methodology of food processing.

Unit – I **(15 Hours)**

Brief history of horticulture, horticultural classification, horticultural crops. Economic importance : Essentials of nursery Management – Soil management: Garden soil, physical and chemical properties of soil, organic matter, compost, cultural practices, water management : Water quality, irrigation, mulching, nursery structures : Protected cultivation (greenhouses), environment controls.

Unit – II **(15 Hours)**

Hydroponic culture – types of container. Use of manures and fertilizers in Horticultural crop production. Organic farming. Environment factors influencing vegetable and fruit production.

Unit – III **(15 Hours)**

Horticultural crops protection – physical control, pruning. Biological control, chemical control – pesticides, fungicides and insecticides.

Unit – IV **(15 Hours)**

Plant propagation – cutting, layering, grafting. Indoor gardening. Orcharding vegetable farming, floriculture, ornamental gardening and landscape horticulture.

Unit – V **(15 Hours)**

Technology of horticultural crops – market preparation: harvesting and handling packaging and transport, storage, chemical treatment. Food processing – freezing, bottling and canning, drying and chemical preservation.

Prescribed Books:

1. H.T. Hartmann and D.E. Kester 1989. Plant propagation – principles and practices. Half of India New Delhi.
2. T.K.Bose and Mitra and Sadhu, 1991. propagation of tropical and subtropical horticultural crops. Naya Prakash.
3. Singh S.P 1989 Mist propagation Metropolitan book Co., New Delhi.
4. Arditti, A., 1977. Orchid biology, Gornell Univ., Press. Ithaca.
5. Bose, T.K., and Mukharjee, D., 1977. Gardening in India. Oxford & IBH Pub., Co., Calcutta.
6. Gopalswamy Iyyangar, 1970. Complete gardening in India, Kalyan Printers, Bangalore
7. Rangaswami, G. and Mahadevan, A. 1999. Diseases of Crop Plants in India (4th edition). Prentice Hall of India Pvt. Ltd., New Delhi.

Suggested readings:

1. Bose, T.K., and Bhattacharjee, S.C., 1980. Orchids of India.
2. Mukherjee, S.K., 1983. Orchids ICAR, New Delhi.
3. Wltz., S., 1972. The world of gladiolus, NAGC, USA.
4. Bailey, S., 1971. Perpectual flowering carnation, Fabner and Fabner, London.
5. Laurie, A., Kiplingr, D.D., and Nelson, K.S., 1968. Commercial flower forcing. Mc Graw-Hill Book, London.
6. Bunt, A.C., 1976. The chrysanthemum. Nat., Chrysanthemum Soc., London.
7. Cumming, R.W., 1964. The chrysanthemum Book. D.Van., Nostrand Inc.
8. Guenther, F., 1952. The essential oil. Van, Nostrand, Inc., New York.
9. Bhatcharjee, B.S., 1959. Rose growing in tropics. Thackarspink and Co., Calcutta.
10. Biswas, T.D., 1984. Rose growing – Principles and Practices – Assoc., Pub., Co.,
11. Champneys, H.P., 1956. Pearsons encyclopedia of roses. Arthur Pearsons Ltd., New Delhi.
12. Hartman, H.T. and Kester, D.E., 1989. Plant propagation printice hall Ltd., New Delhi
13. Larsen, R.A., 1981. Introduction to floriculture. Academic Press, New York.
14. Abraham, A. and Vatsala, P., 1981. Introduction to Orchids. Trop. Bot. Garden, Trivendrum.
15. Bose, T.K. and Yadav, L.P., 1989. Commercial flowers. Naya Prakash, Calcutta.
16. Mc Daniel, G.L., 1982. Ornamental horticulture. Reston Publ., London.
17. Chadha, K.L., 1986. Ornamental horticulture in India ICAR, Krishi Bhavan, New
18. Meninger, E.A., 1970. Flowering vines. Hearside Press, New York.
19. Trivedi, P.P., 1983. Home gardening, ICAR, New Delhi.
20. Helleyer, A., 1976. The Collingridge Encyclopedia of gardening Chartwell Book,
21. Bailey, L.H., 1963. The Standard Encyclopedia of Horticulture. Mc Million & Co., London.

Question Paper Pattern:

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	Unit – 4	2	
	Unit – 5	2	
Section B	Unit – 1	1	
	Unit – 2	2	
	Unit – 3	2	
	Unit – 4	1	
	Unit – 5	1	
Section C	Unit – 1	1	
	Unit – 2	1	
	Unit – 3	1	
	Unit – 4	1	
	Unit – 5	1	

CORE XI

CELL BIOLOGY, ANATOMY, MORPHOLOGY, TAXONOMY OF ANGIOSPERM, EMBRYOLOGY

SUBJECT CODE : 16UPBTC05P	**PRACTICAL**	**MARKS:100**
SEMESTER: V	**CREDITS: 2**	**TOTAL HOURS: 30**

COURSE OBJECTIVES:

To link the anatomical details in naming plants or nomenclature of plants.

- An overview of arrangement of genes on chromosomes through chromosome mapping technique
- To identify the Morphology of leaves, stem, root, and modification, types of inflorescence.
- To identify plants of local flora and family identification and derivation based on reasoning.

CELL BIOLOGY

Squash and Smear techniques.

Ultra structure of Plant cell and cell organelles with the help of ultra-microphotograph.

ANATOMY

Study of internal structure of primary (young) and secondary (Old) stems

Internal structure of monocot stem and root T.S. of dicot and monocot leaf. Stomatal types Anomalous secondary growth in the stem of *Nyctanthes*, *Boerhaavia* and *Dracaena*

MORPHOLOGY, TAXONOMY OF ANGIOSPERM

Morphology of root, stem, leaves and modifications, types of inflorescence and fruits.

Plants of local flora included under theory syllabus and family identification and derivation based on reasoning.

Dissection, identification, observation and sketching the floral parts of the plants belonging to the families included in the syllabus.

Ten (10) Herbarium sheets and field note book to be submitted.

Economic uses of plants and plant parts included under theory syllabus.

Field trips to places for observation, study and collection of plants prescribed in the syllabus for 2 to 5 days under the guidance of faculties.

EMBRYOLOGY

T. S. of young and mature anther – (Permanent slides only)

Types of ovules, different stages of embryo sac development

Types of Endosperm: Cellular, Nuclear and Helobial.

Stages and the development of dicot embryo (*Capsella)* & monocot embryo (*Najas*).

Dissection and display of any two stages of embryo in *Tridax*.

CORE XI

GENETICS, PLANT BREEDING, PLANT ECOLOGY, PHYTOGEOGRAPHY, PLANT PHYSIOLOGY AND BIOCHEMISTRY

SUBJECT CODE : 16UPBTC15P	**PRACTICAL**	**MARKS:100**
SEMESTER: VI	**CREDITS: 4**	**TOTAL HOURS: 90**

COURSE OBJECTIVES:

- To make the students to understand the lifecycle of angiospermic plant development and the various processes that are involved.
- To expose the students to the diagnostic features of selected families and to know the economically important plant products and their utilization.
- The main objective is to provide an overview of the plant physiology and its derived natural products for their occurrence, sources, basic chemistry and therapeutic applications.
- An overview of arrangement of genes on chromosomes through chromosome mapping technique

Genetics and Plant Breeding **(30 Hours)**

Genetics problems : Monohybrid cross, dihybrid cross, test cross and its modification. Allelic and non-allelic interactions.
Gene Mapping : Three point test cross
Hybridization Technique.

Plant Ecology, Phytogeography **(30 Hours)**

Study of morphological and structural adaptations of

Xerophyte : *Nerium*, *Casuarina*

Hydrophyte : *Nyphaea*, *Hydrilla*

Epiphytes : *Vanda*

Map of Phytogeographical regions of India.

Plant Physiology **(30 Hours)**

Experiments to be performed and recorded by students individually:

1. Determination of water potential by plasmolytic method.

2. Determination of water potential by gravimetric method.

3. Effect of temperature and chemicals on membrane permeability.

4. Study of rate of transpiration under different environmental factors.

5. Separation of plant pigments by paper chromatography.

6. Study of rate of photosynthesis under different light intensities.

7. Study of rate of photosynthesis under different wavelength s of light.

8. Measurement of pH of expressed cell's sap and different soils using pH Meter.

DEMONSTRATION – EXPERIMENTS

1. Estimation of proteins and carbohydrates

2. The relationship between Transpiration and Absorption

3. Determination of RQ using Ganong's Respirometer