

**PERIYAR E.V.R.COLLEGE (AUTONOMOUS), TIRUCHIRAPPALLI - 23**

**GENERAL COURSE PATTERN FOR PG – Botany SINCE-2018 – 2019**

S.No.	PART	COURSE	COURSE TITLE	Exam Hrs.	Hrs.	Credits	Internal Exam	External Exam	Total
<b>I SEMESTER</b>									
1		Core I	<b>Plant Diversity – I</b>	3	6	5	25	75	100
2		Core II	<b>Plant Anatomy , Embryology and Morphogenesis</b>	3	6	5	25	75	100
3		Core III	<b>Ecology and Phytogeography</b>	3	6	4	25	75	100
4		Core IV	<b>Microbiology, Plant Pathology and Immunology</b>	3	6	4	25	75	100
5		Core V P	<b>Core Practical – I</b>	3	6	4	25	75	100
			<b>TOTAL</b>		<b>30</b>	<b>22</b>	<b>125</b>	<b>375</b>	<b>500</b>
<b>II SEMESTER</b>									
6		Core VI	<b>Plant Diversity – II</b>	3	6	5	25	75	100
7		Core VII	<b>Cell and Molecular Biology</b>	3	6	5	25	75	100
8		Core VIII	<b>Horticulture and Plant Breeding</b>	3	6	5	40	60	100
9		Core IX	<b>Biotechnology and Bioinformatics</b>	3	6	4	25	75	100
10		Core X P	<b>Core Practical - II</b>	3	6	4	40	60	100
			<b>TOTAL</b>		<b>30</b>	<b>23</b>	<b>125</b>	<b>375</b>	<b>500</b>
<b>III SEMESTER</b>									
11		Core XI	<b>Plant Systematics</b>	3	6	5	25	75	100
12		Core XII	<b>Genetics and Evolution</b>	3	6	5	25	75	100
13		Core XIII P	<b>Core Practical - III</b>	4	6	5	25	75	100
14		CBE I	<b>Biological Techniques and Biophysics</b>	3	6	4	25	75	100
15		CBE II	<b>Research Methodology and Biostatistics</b>	3	6	4	25	75	100
			<b>TOTAL</b>		<b>30</b>	<b>23</b>	<b>120</b>	<b>375</b>	<b>500</b>
<b>IV SEMESTER</b>									
16		Core XIV	<b>Plant Physiology and Biochemistry</b>	3	6	5	25	75	100
17		Core XV P	<b>Core Practical -IV</b>	4	6	5	25	75	100
18		CBE III	<b>Nutrition and Dietetics</b>	3	6	4	25	75	100
19		CBE IV	<b>Pharmacognosy</b>	3	6	4	25	75	100
20		Project	<b>Project Work</b>		6	4	25	75	100
					<b>30</b>	<b>22</b>	<b>125</b>	<b>375</b>	<b>500</b>
					<b>120</b>	<b>90</b>	<b>500</b>	<b>1500</b>	<b>2000</b>

**SEMESTER - I**  
**CORE PAPER – I**  
**PLANT DIVERSITY - I**

**Hours: 6**  
**Credits: 5**  
**Code:**

**Objectives:** Cryptogams include 84% of World's Botanical diversity. Scientific information on these group of plants excepting Pteridophytes will be taught along with a introduction to plant diseases.

**Unit – I**

Classification of Algae (Fritsch). Range of vegetative structure – reproduction, life cycle and Evolutionary trends in Cyanophyceae and Chlorophyceae with detailed study of *Anabaena*, *Scytonema*, *Ulva* and *Caulerpa*.

**Unit – II**

Range of vegetative structure – reproduction, life cycle and evolutionary trends in Phaeophyceae and Rhodophyceae with detailed study of *Sargassum*, *Polysiphonia* and *Gracilaria*. Economic importance of algae. Algae as pollution indicators. Elementary study of Fossil Algae ().

**Unit – III**

Classification of Fungi (Alexopoulos). Structure, nutrition, homothallism, heterothallism and parasexuality, reproduction, life cycle, phylogeny and affinities of the major groups of Fungi: Myxomycotina, Zygomycotina, Ascomycotina, Basidiomycotina, Deuteromycotina. Detailed study of the forms: *Plasmodiophora*, *Pilobolus*, *Xylaria*, *Lycoperdon* and *Alternaria*. Economic importance of Fungi. Elementary study of Fossil Fungi ().

**Unit IV**

General features of Lichens, distribution, Classification (Miller), Distribution, thallus organization, vegetative & sexual reproduction, lichens as indicators of pollution & economic importance.

**Unit – V**

Classification of Bryophytes (Rothmaler). Origin of Bryophytes. Range of variation in the structure of gametophyte and sporophyte in the major groups of Bryophytes with special reference to the types: *Riccia*, *Reboulia*, *Porella*, *Anthoceros* and *Polytrichum*. Economic importance of Bryophytes. Elementary study of Fossil Bryophytes ().

### **Text Books**

1. Singh and Pandey – (1966) College botany Vol-I Books of India Publishers
2. Vashishta, B. R. *et al.* (2008). Botany for Degree Students - Algae. S. Chand and Co. Ltd., New Delhi.
3. Kumar, H. D. (1989). Introductory Phycology. East-West Press, Madras.
4. Sharma, O. P. (1986). Textbook of Algae. Tata McGraw Hill, New Delhi.
5. Mehrotra, R. S and Aneja, K. R. (1990). An Introduction of Mycology. Wiley Eastern Ltd., New Delhi.
6. Sharma, P. D. (1987). The Fungi. Rastogi and Co., Meerut.
7. Vashishta, B. R. and Sinha, A. K. (2007). Botany for Degree Students - Fungi. S. Chand and Co. Ltd., New Delhi.
8. Hale, M. E. Jr. (1983). Biology of Lichens. Edward Arnold, Maryland.
9. Vashishta, B. R. *et al.* (2008). Botany for Degree Students: Bryophyta. S. Chand and Co. Ltd., New Delhi.
10. Prempuri, 1973, Bryophytes - A Broad perspective. Atma Ram & Sons, New Delhi.

### **Reference Books**

1. Bold, H. C. and Wynne, M. J. (1978). Introduction of Algae - Structure and Reproduction. Prentice Hall, New Jersey.
2. Chapman, C.J. and Chapman, D.J. (1981). The Algae. 2nd ed. Macmillan, London.
3. Alexopoulos, C. J. and Mims, C. W. (1979). Introductory Mycology. Wiley Eastern Ltd., New York.
4. Bessey, E. A. (1979). Morphology and Taxonomy of Fungi. Vikas Publishing House Pvt. Ltd., New Delhi.
5. Parihar, N. S (1972). An Introduction to Embryophyta-I: Bryophyta. Central Book Depot, Allahabad.
6. Watson, E. V. (1971). The Structure and Life of Bryophytes. B.I. Publications, New Delhi.

**SEMESTER - I**  
**CORE PAPER – II**  
**PLANT ANATOMY, EMBRYOLOGY AND MORPHOGENESIS**

**Hours: 6**  
**Credits: 5**  
**Code:**

**Objectives:** This paper will enable the students to have a knowledge about the various anatomical feature of plants, formation of wood and to understand the growth and development of embryo

**Unit – I**

Organization of Shoot and Root Apical meristems – Theories and Classification of meristems. Structure, Distribution and Significance of Simple tissues (Parenchyma, Collenchyma & Sclerenchyma) - Complex tissues ( Xylem and Phloem) - Transfer cells. Cambium - types, origin and function – wound healing - Periderm formation

**Unit – II**

Root- Shoot transition zone - Nodal anatomy - Unilacunar, Trilacunar and Multilacunar. Stomata - structure, types & function . Primary structure of Root, Stem and Leaf in Dicots and Monocots. Normal and abnormal Secondary growth in Dicot stem and root – Anomalous Secondary Growth - *Achyranthes*, *Bignonia*, *Bougainvillea* & *Dracaena*.

**Unit – III**

Anther – Structure and Ontogeny- Microsporangium - Microsporogenesis – Development of male gametophyte. Pollen morphology and Pollination. Ovule – Structure ,Ontogeny and types - Megasporangium - Megasporogenesis –Development of female gametophyte and embryo sac – monosporic (*Polygonum*) bisporic (*Allium*) and tetrasporic (*Peperomia*)

**Unit – IV**

Concept of fertilization and Sexual Incompatibility - Double fertilization and Triple fusion Development of Monocot and Dicot embryo, Endosperm (types & development), nutrition of embryo. Polyembryony – causes, experimental induction and classification - Apomixis - Apospory – Parthenogenesis – Parthenocarpy.

**Unit – V**

Morphogenesis and its relation to morphology - Morphogenetic factors - growth regulators - genetic and environment – polarity and symmetry - Cytosol and cytoskeleton, microtubules and

microfilaments - Cellular level morphogenesis –Morphogenesis at tissue level – Differentiation, dedifferentiation and redifferentiation of vascular tissue *in vivo*, *in vitro* and in wound healing.

### **Text Books**

1. Pandey, B.P. 2007. Plant Anatomy, S. Chand & Co. De, New Delhi.
2. Tayal, M.S. 2004 . Plant Anatomy , Rastogi Publications, Meerut.
3. Brown et al., 1981. Text book of Wood Technology, Mc Graw Hill Inc. New York.
4. Bhojwani, S S. & Bhatnagar, S.P. 2008. Embryology of Angiosperms, Vikas Publishing House (P) Ltd., New Delhi.
5. Singh, V., Pande, P.C. & Jain, D.K. 2005. Embryology of Angiosperms, Rastogi Publications, Meerut

### **Reference Books**

1. Cuttler, E.G. 1969. Plant Anatomy - Part I Cells & Tissue. Edward Arnold Ltd., London.
2. Esau K. 1985. Plant Anatomy (2nd ed.) Wiley Eastern Ltd. New Delhi
3. Maheswari, P. 1985. An Introduction to the Embryology of Angiosperms .Tata McGraw Hill Publishing Co.,Ltd., New Delhi.
4. Bard, J. (1990). Morphogenesis. Cambridge University Press, London.
5. Bonner, J. T. (1965). Morphogenesis. Oxford & IBH Publications, Bombay

**SEMESTER - I**  
**CORE PAPER – III**  
**ECOLOGY AND PHYTOGEOGRAPHY**

**Hours: 6**  
**Credits: 4**  
**Code:**

**Objectives:** The world is in a period of unprecedented environmental change. Learning how to live sustainably on this planet is going to require that humanity learns how to utilize and manage our natural resources more effectively and this paper will deal this.

**Unit – I**

History and Scope of Ecology. Concept of Ecosystem, its structure and function, Ecological factors; Edaphic, Climatic, Topographic, Biotic and Abiotic factors. Water: Importance of water in plant distribution, Adaptation of plants, Energetics: Productivity, Food chains, Food webs and Tropic levels and energy flow, Ecological pyramids.

**Unit – II**

Synecology: Methods and purpose of studying plant communities, quadrat, transects frequency, abundance, density cover, ecotone, community, species diversity and dominance, community dynamics. Autecology: Ecological life cycle – ecotypic differentiation study of populations.

**Unit – III**

Pollution: Sources, nature and impact of different kinds of pollution (air, water, soil, thermal, radioactive and noise pollution). Cumulative effect of pollution on Global environment – Acid rains – green house effect. Depletion of Ozone layer and its causes and consequences. Biodegradation of environmental pollutants (pesticide waste, toxic heavy metals and petroleum products). Treatment of waste water (aerobic and anaerobic), water recycling, Methods of pollution control – treatment of ground water.

**Unit – IV**

Phytogeography – Basic principles of Phytogeography – Continental drift, continuous and discontinuous distribution and theories. Endemism – age and area hypothesis – Altitudinal and Latitudinal distribution of vegetation. Vegetation of India. Characteristic features of different types of forest and forest conservation.

## **Unit – V**

Remote sensing – application and its limitations, afforestation programmes – social forestry, Chipco movement, productive, commercial / exploitative forestry – wild life management. Environmental monitoring and impact assessment. Soil reclamation – principles and methods.

### **Text Books**

1. Ambasht, R.S. 1974. A text book of plant ecology (3rd ed.), Students' Friends. & Co., Varanasi, India.
2. Agarwal, K.C. 1987. Environmental biology, Agro-botanical publications, India.
3. Anathakrishnan, T.N. 1982. Bioresource Ecology, Oxford & IBH Publ. Co., Inc., Belmont.

### **Reference Books**

1. Billings, W.B. 1965. Plants and the ecosystem, Wardsworth Publ. Co., Inc., Belmont.
2. Conard, H.S. 1951. The background of Plant Ecology, Iowa state press, Iowa.
3. Kumar, H.D. 1986. Modern Concepts of Ecology, Vikas Publishing House, New Delhi.
4. Misra, R. 1968. The Ecology work book, Oxford & IBH Publishing & Co., Calcutta.
5. Odum, E.P. 1971. Fundamentals of ecology, W.B. Saunders & Co., Philadelphia, USA.
6. Shukla, R. S. and Chandel, P. S. 2015. Textbook of Plant Ecology. S. Chand Publications Pvt. Ltd., New Delhi.
7. Kumar, S. 2015. Basics of Remote Sensing and GIS, Firewall Media, NewDelhi.

**SEMESTER –I**  
**CORE PAPER -IV**  
**MICROBIOLOGY, PLANT PATHOLOGY AND IMMUNOLOGY**

**Hours: 6**  
**Credits: 4**  
**Code:**

**Objectives:** This course will introduce the student to the world of microbes, which are there in every possible niche. The beneficial and detrimental aspects will be taught. The principles of Plant Pathology and immunology also will be given an insight.

**Unit – I**

Scope, history and branches of microbiology. Bacteria – morphology and fine structure, Classification of bacteria according to Bergey's manual (9th ed.), bacterial photosynthesis, bacterial respiration. Sterilization methods. Dry heat -moist heat -kinds of media (Nutrient agar, nutrient broth) and its preparation techniques– Isolation of microorganisms from soil –serial dilution technique. Pure culture techniques( pour plate, streak plate and spread plate methods). Culture maintenance and preservation. Microbial staining method – Gram staining.

**Unit – II**

Morphology of viruses – (size, shape and structure, DNA and coat structure). Classification of virus – replication of viruses (transduction, transfection, lytic and lysogenic cycles), transmission of virus – vector relationship. Isolation and purification of viruses. General account of mycoplasma, spiroplasma and bacteriophages.

**Unit – III**

Plant microbe interactions- types- legume root nodules, mycorrhizae and lichens. Effect of environment in plant diseases – temperature, wind, light. Toxins. Resistance pathogenesis – structural and chemical protection, histological defence, phenols, PR proteins and phytoalexins.

**Unit –IV**

Etiology, Symptoms, Causative agents and dissemination of the following diseases in crop plants : Little leaf of Brinjal, Tobacco mosaic, Blight of Paddy, Leaf spot in cotton, Blast in Paddy, Citrus canker, Smut in maize – principles and methods of disease control : chemical, biological and cultural. Modern methods of crop protection by evolving transgenic plants (Virus and Fungal resistance).



## **Unit –V**

Immune system - organs - immune cells - T and B cells. Innate immunity- Receptors (TLR, Scavenge receptor etc.) Adaptive immunity- Types. Antigens - Types and properties, B-cell epitopes, T-cell epitopes. Adjuvants, Types of immune response (Humoral, Cell mediated). Immunoglobulin- Basic structure, classes and subclasses, Antigenic determinants on immunoglobulins. Immune modulation. Vaccines - plantibodies, plants based vaccines, edible vaccines.

### **Text Books**

1. Microbiology. 2015. RC Dubey and DK Maheswari, S. Chand & Co., New Delhi.
2. Microbiology. 2015. PD Sharma, Rastogi Publications, Meerut
3. Nandini Shetty 1996, Immunology - An introductory Text Book, New Age Intl (P) Ltd.
4. Chakravarty, AK. 2000. Immunology, Tata McGraw Hill Publication Co. Ltd., New Delhi.

### **Reference Books**

1. Microbiology. 1986. M.J. Pelczar, Jr., E.C.S. Chang and N.R. Krieg, McGraw Hill Company, Newyork.
2. Microbiology - concepts and applications. 1993. M.J. Pelczar, Jr., E.C.S. Chan and N.R. Krieg, McGraw Hill Company.
3. Microbiology. 1993. L.M. Prescott, J.P. Harley D.A. Klein – Wm.c. Brown publishers. Dutique, Jawa, Melbourne.
4. Basic and Practical Microbiology. 1986. Ronald M. Atlas, Mac.Milleen Company, Newyork.
5. Kuby J, 2000, Immunology, 4th edition, W H Freeman Janeway and Travers
6. Immunobiology, 3rd edition Gerland Pub. Inc. NY.
7. Roitt *et al.*, 1998, Immunology 5<sup>th</sup> edition, Mosby International limited, London.UK.

**SEMESTER - I**  
**CORE PAPER - V P**  
**CORE PRACTICAL – I**

**Hours: 6**  
**Credits: 4**  
**Code:**

Practical covering

**Core Paper I**

- Algae
- Fungi
- Bryophytes

**Core Paper II**

- Anatomy
- Embryology of Angiosperms

**Core Paper III**

- Ecology
- Phytogeography

**Core Paper IV**

- Microbiology
- Plant Pathology
- Immunology

## SEMESTER - II

### CORE PAPER -VI

#### PLANT DIVERSITY - II

**Hours: 6**

**Credits: 5**

**Code:**

**Objectives:** The course deals with the structure and development of primitive vascular land plants. Studies of stele, sporophyte and sorus are considered in an evolutionary sequence. The second part of the syllabus deals with the morphology, anatomy and reproduction of selected Gymnosperms. It also includes the study of few representative fossil forms.

#### **Unit - I**

General features and Origin of Pteridophytes. Classification of Pteridophytes (Reimers). Range of morphology, structure, reproduction and evolution of gametophytes and sporophytes of the following orders: *Rhyniales*, *Psilotales*, *Lycopodiales*, *Selaginellales*, *Isoetales*, *Calamitales* and *Equisetales*.

#### **Unit - II**

Range of morphology, structure, reproduction and evolution of gametophytes and sporophytes of the following orders: *Ophioglossales*, *Marattiales*, *Osmundales*, *Filicales* and *Salviniales*. Stelar evolution-Telome theory- Heterospory and origin of seed habit. Structure, development and evolution of sorus in Filicales. Apogamy and Apospory. Economic importance of Pteridophytes.

#### **Unit - III**

General features and Origin of Gymnosperms - Classification of Gymnosperms (Sporne). Comparative morphology and phylogeny of *Cycadales*, *Coniferales* and *Ginkgoales*.

#### **Unit - IV**

Comparative morphology and phylogeny of *Ephedrales*, *Welwitschiales* and *Gnetales*. Economic importance of Gymnosperms.

#### **Unit - V**

Concepts of Paleobotany - Geological Time Scale - Fossils - types - Compression, Incrustation, Impression, Casts, Molds, Petrification and Coal Balls. Age determination and methods of study of fossils - Role of fossil in oil exploration and coal excavation - Paleopalynology.

#### **Text Books**

1. Eames, A. J. (1936). Morphology of Vascular Plants - Lower Groups. Tata McGraw Hill, New Delhi.

2. Parihar, N. S. (1985). The Biology and Morphology of Pteridophytes. Central Book Depot, Allahabad.
3. Sporne, K. R. (1974). The Morphology of Gymnosperm. B.I. Publications, New Delhi.
4. Vasishta, P. C. *et al.* (2006). Botany for Degree Students: Gymnosperms. S. Chand and Co. Ltd., New Delhi.
5. Shukla, A. C. and Mishra, S. P. (1982). Essentials of Paleobotany. 2<sup>nd</sup> Edition, Vikas Publishing House Pvt. Ltd., New Delhi.
6. Arnold C.A. (1972). An introduction to Paleobotany. McGraw-Hill Publishers, New York.

### **Reference Books**

1. Rashid, A. (1986). An Introduction to Pteridophyta. Vani Educational Books, New Delhi
2. Sharma, O. P. (1990). Text Book of Pteridophyta. Macmillan India Ltd., India.
3. Smith, G. M. (1971). Cryptogamic Botany. Vol. II. Bryophytes and Pteridophytes. TataMcGraw Hill, New Delhi.
4. Sporne, K. R. (1972). The Morphology of Pteridophytes. B. I. Publications, Madras.
5. Sundararajan, S. (2007). Introduction to Pteridophyta. New Age International Publishers, New Delhi.
6. Vashishta, P. C. *et al.* (2008). Botany for Degree Students: Pteridophyta. S. Chand and Co. Ltd., New Delhi
7. Trivedi P.C. (2002). Advances in Pteridology. Pointer Publishers.
8. Rashid, A. (1978). An introduction of Peridophytes. Vikas publishers
9. Foster, A. S. and Gifford, E. M. (1965). Morphology and Evolution of Vascular Plants. W. H. Freeman & Co.
10. Govil, C.M. (2011). Gymnosperm. Krishna Prakashan Media.
11. Bhatnagar S.P. and Alok Moitra (1996). Gymnosperms. New Age International.
12. Sambamurthy, A.V.S.S. (2005). A Textbook of Bryophytes, Pteridophytes, Gymnosperms and Paleobotany. I.K. International Publishing House. New Delhi.
13. Taylor D.V. and Hickey L.J. (1997). Flowering plants: Origin, evolution and phylogeny.
14. Sporne, K.R. (1996). Morphology of Pteridophytes. Hutchinson; 3rd edition
15. Nikias, K. J. (1981). Paleobotany, Paleoecology and Evolution. Praeger Publishers, USA.
16. Seward, A. C. (1919). Fossil Plants. Vol. I, II, III and IV. Cambridge University Press, London.
17. Seward, A. C. (1931). Plant Life through the Ages. Cambridge University Press, London.

**SEMESTER - II**  
**CORE PAPER - VII**  
**CELL AND MOLECULAR BIOLOGY**

**Hours: 6**  
**Credits: 5**  
**Code:**

**Objectives:** The objective of this course is to make the learner to understand the organization of cell structure and function of organelles. It enables the students to understand the concepts of modern technology to solve many problems of large scale production of agricultural products.

**Unit - I**

Organization of chloroplast genome, nucleus-encoded and chloroplast-encoded genes. Organization of mitochondrial genome; nuclear and mitochondria encoded genes, targeting proteins into mitochondria, mitochondrial genome and cytoplasmic male sterility.

**Unit - II**

Chromatin Structure - nucleosomes, packaging of DNA into chromosomes. Melting of DNA, Cot curve, C value and C value paradox. Cell Cycle: Cytokines, Cell Cycle regulation. Cytoskeleton: Microtubules, and Actin Filaments.

**Unit - III**

Replication of DNA. Eukaryotic replication; Enzymes – Primase, DNA polymerases, replication fork. Leading and lagging strands. Prokaryotic - Rolling circle replication. Replicon, regulation of replication.

**Unit - IV**

Transcription: Prokaryotes - RNA polymerase, initiation - promoter sequences, elongation and termination. Processing of tRNA and rRNA. Initiation in eukaryotes – Transcription Factors- elongation and termination; splicing of mRNA, Ribozymes, Differential splicing.

**Unit - V**

Protein Synthesis: In prokaryotes - Initiation, elongation and termination. Eukaryotic translation. Post translational modifications. Targeting and Secretion of proteins. Regulation of gene expression in Eukaryotes – gene loss, amplification, rearrangement.

**Text Books**

1. David Freifelder (2000). Molecular Biology. 2nd ed. Narosa Publishing House, New Delhi.

2. De Robertis, E. D. P. and De Robertis, E. M. F. (1980). Cell and Molecular Biology.  
Saunders International Education, Philadelphia.

**Reference Books**

1. Molecular Biology of the Cell by Alberts et al., (1994) Garland Publishing, New York.
2. Molecular cell Biology by Lodish et al.,(1995) Scientific American Press.
3. Principles of Cell and Molecular Biology by Kleinsmith and Kish (1995) Harper Collins  
College Publishers, New York.
4. Molecular Biology by David Freifelder, Narosa Publishers.

**SEMESTER -II**  
**CORE PAPER - VIII**  
**HORTICULTURE AND PLANT BREEDING**

**Hours: 6**  
**Credits: 5**  
**Code:**

**Objectives:** To study the progress made in the field of Horticulture and Plant breeding. and to understand the principle and to study the basic techniques in Horticulture and Plant breeding.

**Unit – I**

Horticulture – Introduction – Importance – Scope of horticulture – Divisions of horticulture – Pomology - Olericulture – Floriculture – Arboriculture – Classification of horticultural crops – Classification of vegetables and fruits. Garden implements & tools. Types of garden – Formal, Informal and Kitchen garden. Establishment and maintenance of Lawn.

**Unit – II**

Methods of Plant Propagation – Cutting - Layering – Grafting – Budding. Stock – Scion relationship in grafting. Training & Pruning. Nursery preparation and maintenance. Role of growth hormones in horticulture – root induction – flowering – fruit setting – fruit development – seedless fruits – control of fruit drop.

**Unit – III**

Floriculture – commercial flowers – cultivation of Rose, Jasmine, *Chrysanthemum* and *Crossandra* – cut flowers – Indoor plants – Bonsai – cultivation of fruit trees – Mango, Banana and Sapota. Manures – organic manure – chemical fertilizers (N,P,K).

**Unit – IV**

Basic principles of plant breeding – Introduction & scope – Selection – Mass, pureline and clonal. Hybridization – selfing and crossing techniques – Heterosis – Hybrid vigour – causes and achievements.

**Unit – V**

Breeding for disease resistance – back cross method – polyploidy – types, role and achievements – Mutation breeding – physical and chemical mutagens - gamma garden, its application on plant breeding – role of mutation in plant breeding and achievements.

**Text Books**

1. Kumar, N. (1987). Introduction to Horticulture., Rajalakshmi Publishers, Nagercoil.

2. Manibushan Rao, K. (1991). Textbook of Horticulture. Macmillan Publishing Co., NewYork.
3. Rao, K. M. (2000). Text Book of Horticulture. Macmillan India Ltd., New Delhi.
4. V.L. Sheela. (2011). Horticulture. MJP publishers, India.
5. Chopra, V. L. (1989). Plant Breeding. Oxford & IBH Publishing Co. Pvt. Ltd., NewDelhi.
6. Vijendra Das, L. D. (1998). Plant Breeding. New Age International Publishers, New Delhi.

#### **Reference Books**

1. Arora, J. S. (1992). Introductory Ornamental Horticulture. Kalyani Publishers, NewDelhi.
2. Edmond, J. B. *et al.* (1977). Fundamentals of Horticulture. Tata McGraw Hill Publishers Co. Ltd., New Delhi.
3. Sundararajan *et al.*, A guide to Horticulture. Thiruvankadam Printers, Coimbatore.



**SEMESTER - II**  
**CORE PAPER IX**  
**BIOTECHNOLOGY AND BIOINFORMATICS**

**Hours: 6**  
**Credits: 4**  
**Code:**

**Objectives:** Plant Biotechnology includes genetic modification, genetic engineering and mutagenesis. This paper will deal with the basic principles of these. Bioinformatics is a recent advent involving the usage of computers to analyze biological data and its basics will be taught.

**Unit - I**

Basic techniques and tools of genetic manipulation: Cutting and joining DNA molecules – Enzymes involved. Adaptors, linkers and homopolymer tailing. Plasmids and phage vectors: pBR322, Bacteriophage, single stranded DNA vectors, filamentous phage vectors, cosmids, BAC, YAC, expression vectors and shuttle vectors. Cloning strategies: Cloning genomic DNA – PCR as an alternative to genomic cloning; Gene transfer to plants: *Agrobacterium* mediated transformation, direct DNA transformation – protoplast transformation, particle bombardment, electroporation and microinjection.

**Unit - II**

DNA libraries - genomic DNA libraries, properties cDNA libraries, preparation of cDNA for library construction, full-length cDNA cloning. Screening Strategies: Sequence - dependent screening, screening by hybridization, probe designing, chromosome walking, screening expression libraries – immunological, southern, western blotting, RAPD, RFLP, DNA foot printing. Site-directed mutagenesis.

**Unit - III**

Plant Tissue Culture - Introductory history, Laboratory organization, Media and Aseptic manipulation. Preparative steps for tissue culture, surface sterilization of plant tissue material, basic procedure for aseptic tissue transfer and incubation of culture. Growth Hormones - Composition of culture media, Growth hormones, Vitamins, Unidentified supplements and

selection of media. Callus Culture, Cell Suspension Culture, Organ Micro-culture, plant micro-propagation and Somatic Embryogenesis.

#### **Unit - IV**

Human Genome Project (HGP) – an overview of the project, goals of the project, major scientific strategies & approaches used in HGP, expected scientific & medical benefits of this project, about the organizations behind this project. Applications of Biotechnology in Plant, Animal and Human welfare. Genetically modified organisms – Principles and issues. Golden rice. Production of recombinant human hormones- Somatostatin, Somatotrophin, Insulin, Interferons, Biotechnology and IPR, Biosafety, Biopiracy and Bioterrorism. Bioethics – Necessity of Bioethics, different paradigms of Bioethics – National & International.

#### **Unit - V**

Bioinformatics: Use of Computers in Biological research; Retrieval of sequence and structural information from internet; Genomics – definition, genome, functional genomics; Metabolomics – definition, types of metabolites, metabolome and NMR profile. Basic DNA sequencing – chain terminator sequencing, automated sequencing – analysis of sequence data.

#### **Text Books**

1. R.C. Dubey. 2015. A text book of Biotechnology, S.Chand & Co., New Delhi
2. P. Parihar. 2015. A text book of Biotechnology, Argobios Publications, Jodhpur
3. Arthur M Lesk. 2003. Introduction to Bioinformatics, Oxford, UK

#### **Reference Books**

1. P.K. Gupta: Elements of Biotechnology, Restogi Publications, Meerut
2. Kalyan Kumar De: Plant Tissue culture, New central Book Agency, Calcutta
3. M.D. Kumar: A text book on Biotechnology, East west press, New Delhi
4. S.S. Purohit: Agricultural Biotechnology, Agrobios Publications, Joshpur
5. S. Ignacimuthu: Plant Biotechnology, Oxford & IBM Publishing Co., New Delhi
6. Trevan, Boffey, Goulding & Stanbury: Biotechnology – The Biological Principles, Tata Mc Graw Hill Publishing Co., New Delhi
7. A.K Chatterji: Introduction to Environmental Biotechnology, Prentice Hall India Pvt., Ltd., New Delhi
8. David W Mount. 2002. Bioinformatics; Sequence and Genome Analysis. CSHL Press, Newyork

**SEMESTER - II**  
**CORE PAPER – X P**  
**CORE PRACTICAL II**

**Hours: 6**  
**Credits: 4**  
**Code:**

Practical covering

**Core Paper VI**

- Pteridophytes
- Gymnosperms
- Paleobotany

**Core Paper VII**

- Cytology
- Molecular Biology

**Core Paper VIII**

- Horticulture
- Plant Breeding

**Core Paper IX**

- Nutrition and Dietetics

**SEMESTER - III**  
**CORE PAPER – XI**  
**PLANT SYSTEMATICS**

**Hours: 6**  
**Credits: 5**  
**Code:**

**Objectives:** Angiosperms are a group of flowering plants that represent a major community in the plant kingdom. They include about 2,50,000 species distributed all over the world. They are the most highly evolved group of plants and appeared on Earth about 130 million years ago and this paper will introduce ways and means of identifying them.

**Unit – I**

Plant Habits; Root, Stem and its modification; Leaf structure and its modifications; Phyllotaxy; Inflorescence and types; Types of flowers; Aestivation; Types of anthers and arrangement; Gynoecium – types; Placentation; Classification of fruits; Description of simple, aggregate and multiple fruits and examples.

**Unit – II**

Historical account of the classification of the angiosperms, familiarization of the classification of Linnaeus, Engler & Prantl and detailed account of the classification of Bentham & Hooker. Outline of Takhtajan classification. Biosystematics, Chemotaxonomy, Numerical taxonomy and taxonomic evidences from Anatomy and Embryology.

**Unit – III**

ICBN and ICNafp, Typification, Principles of priority and their limitation, effective and valid publication, citation, rejection and retention of names. A general account on keys. Floristic study. Monographs, Periodicals and Flora

**Unit – IV**

A detailed study of the following families and their economic importance:

**Dicots**

**Polypetalae:**

- 1) *Thalamiflorae* - Menispermaceae, Polygalaceae, Portulacaceae and Sterculiaceae.
- 2) *Disciflorae* - Zygophyllaceae, Burseraceae, Anacardiaceae and Moringaceae
- 3) *Calyciflorae* - Crassulaceae, Melastomataceae, Combretaceae and Onagraceae

## Unit – V

A detailed study of the following families and their economic importance

### **Gamopetalae:**

- 1) *Inferae* - Asteraceae
- 2) *Hetermoerae* - Ebenaceae
- 3) *Bicarpellatae* – Gentianaceae, Boraginaceae, Scrophulariaceae and Lamiaceae

### **Monochlamydeae:**

- 1) Achlamydosporae - Loranthaceae
- 2) Unisexuales - Euphorbiaceae

### **Monocots:**

- 1) Epigynae – Zingiberaceae
- 2) Nudiflorae – Pandanaceae
- 3) Glumeae - Cyperaceae

### **Text Books**

1. Pandey, B. P. (1989). Taxonomy of Angiosperms (Systematic Botany). S. Chand & Co. Ltd., Ram Nagar, New Delhi.
2. Vashista, P.C. (1997). Taxonomy of Angiosperms. S. Chand & Co., New Delhi.
3. Sharma, O.P. (2000) Plant Taxonomy. Tata McGraw Hill Publishing Co., New Delhi.

### **Reference Book**

1. Sivarajan, V.V. (1993). Introduction to Principles of Plant Taxonomy, Oxford & IBH Publishing Co., New Delhi. 27 5.
2. Naik, V.N (1996). Taxonomy of Angiosperms, Tata McGraw Hill Publishing Co., (P) Ltd, New Delhi.
3. Singh, V & Singh, D.K (1983). Taxonomy of Angiosperms, Rastogi Publications, Meerut.
4. Lawrence, G. H. M (1953). Taxonomy of Vascular Plants, Oxford & IBH Publishes, New Delhi.

**SEMESTER III**  
**CORE PAPER - XII**  
**GENETICS AND EVOLUTION**

**Hours: 6**  
**Credits: 5**  
**Code:**

**Objectives:** In this paper exposure would be given to genes and their role in hereditary mechanism. Evolution which explains and expedites biological reasoning will also be dealt.

**Unit I**

Heredity and Variation – Introduction to Mendelian principles of inheritance with special reference to his methodology – Mono and Dihybrid cross, Back cross, Test cross and its significance – deviation from Mendelian principles (interaction of factors) – Incomplete dominance and multiple alleles.

**Unit II**

Gene interactions – Intra and Inter allelic interactions , Atavism and Pleotropism – Quantitative Genetics – History , Characteristics of multiple genes with examples from plants - Biochemical basis of Genetics with reference to *Neurospora*. Linkage, Crossing over and its significance. Mapping of genes.

**Unit III**

Sex linked inheritance with reference to color blindness. Sex determination in plants, cytoplasmic inheritance. Mutations – sources & causes, mutagens (physical & chemical), rate of mutations and its role in evolution. Gene units – cistron, recon, muton and operon.

**Unit IV**

Inorganic chemical and molecular evolution and Origin of life , Origin of Species. Evidences in favour of evolution (Morphology and Anatomy, Embryology, Palaentology). Population Genetics – Gene pool and Gene Frequency, Hardy Weinberg Equilibrium, Natural selection, non-random mating and genetic drift.

**Unit V**

Theories of Lamarck and Charles Darwin with Merits and Demerits – Contributions of Weismann, Hugo de Vries and Sewall Wright and Modern Synthetic Theories.

### **Textbooks**

1. Meyyan, R.P., (2000) : Genetics & Evolution Saras Publication, Nagercoil, India
2. Gupta, P.K. (2000) : Genetics Rastogi Publishers, Meerut, India
3. Agarwal., V.K. (2000) : Simplified course in Genetics(B.Sc., Zoology) S. Chand & Co., New Delhi
4. Sharma N.S. 2005, Molecular Cell Biology, International Book distributors, Dehradun
5. Verma P.S. and Agarwal V.K. 1986, Cell Biology and Molecular Biology (Cytology) S. Chand and Company, New Delhi.

### **Reference Books**

1. Winchester, A.M. (1958) : Genetics(3rd Edition) Oxford & IBH Publishing House, New Delhi
2. Singleton, R. (1963) : Elementary Genetics D. Van Nostrand Co., Ltd., Inc., N.Y. & Affiliated East West Press (P) Ltd., New Delhi
3. Chandrasekaran, S.N. & Parathasarathy , S.V. (1965) : Cytogenetics and Plant Breeding P. Varadhachari & Co., Madras
4. Sinha, U.& Sinha, S. (1989) : Cytogenetics, Plant Breeding & Evolution Vikas publishing House, New Delhi.
5. Ahluwalia, K.B. (1990) : Genetics Wiley Eastern Ltd.,New Delhi
6. Sandhya Mitra (1994) : Genetics-A Blue Print of Life Tata McGraw Hill Publishing Co., Ltd., New Delhi.

**SEMESTER III**  
**CORE BASED ELECTIVE - I**  
**BIOLOGICAL TECHNIQUES AND BIOPHYSICS**

**Hours: 6**  
**Credits: 4**  
**Code:**

**Objectives:** To know the principles and applications of various instruments, to understand the technique behind permanent slide preparation of plant tissues. Knowledge of Biophysics help the students in understanding biology and physics content and to integrate methods and techniques in biological processes.

**Unit - I**

Microscopy - magnification- resolving power - Principle, Instrumentation and Application of Light, Phase contrast, Polarizing, Fluorescent, Scanning and Transmission Electron Microscopy - Specimen preparation for electron microscopes.

**Unit - II**

Microtomy - Rocking and Rotary - material preparation for microtome sectioning. Microtechniques – Fixation - Fixatives - Dehydration - Clearing reagents - Embedding with wax and resins - permanent slide preparation - Stains and staining mechanism - Natural and synthetic stains - Mounting.

**Unit - III**

Chromatography - TLC, GLC, HPLC, GCMS, Ion Exchange, Molecular sieving and Affinity chromatography. Centrifugation: Ultra, Differential and Density gradient centrifugation. Electrophoresis : AGE and SDS - PAGE.

**Unit - IV**

Working principles and application of : pH meter, Conductivity bridge, Flame photometer, Spectrophotometer , Atomic Absorption Spectrophotometer, NMR , Autoradiography, Geiger - Muller counter, Scintillation counter.

**Unit - V**

Biophysics - Physical forces and chemical bonds - Light diffraction - Biological effect of ionizing radiations - Laws of Thermodynamics, Entropy and free energy - Photobiology - Dual nature of light, solar radiation and solar energy - Efficiency of atoms- Absorption spectra in molecules, energy states – De-excitation.



### **Text Books**

1. Bajpai, P.K. (2006). Biological Instrumentation and Methodology, S.Chand & Company Ltd., New Delhi.
2. Narayana, P. (2007). Essential of Biophysics, New Age International Publishers,
3. Casey, E. J. (1962). Biophysics : Concepts and Mechanics, Van Nodtrand Reinhold C. and East-West Press, New Delhi.
4. Lehninger, A. L. (1971). Bioenergetics : The Molecular Basis of Biological Energy Transformation, Addison Wiley.
5. Salil Bose, S. (1982). Elementary Biophysics, Vijaya Printers, Madurai.

### **Reference Books**

1. Jayaraman, J. (1981). Laboratory Manual in Biochemistry. Wiley Eastern Ltd., New Delhi.
2. Jensen, W. A. (1962). Botanical Histochemistry: Principles and Practice. W. H.Freeman and Co., San Francisco, USA.
3. Johansen, D. A. (1940). Plant Microtechnique. McGraw Hill, New York.
4. Krishnamurthy, K. V. (1988). Methods in Plant Histochemistry. S. Viswanathan & Co., Madras.

**SEMESTER –III**  
**CORE BASED ELECTIVE-II**  
**RESEARCH METHODOLOGY AND BIOSTATISTICS**

**Hours: 6**  
**Credits: 4**  
**Code:**

**Objectives:** This course will help the students to understand the basic concepts of research and its methodologies and to select and define appropriate research problem and parameters.

**Unit-I**

Motivation and objectives – Research methods vs Methodology. Types of research – Descriptive vs. Analytical, Applied vs. Fundamental, Quantitative vs. Qualitative, Conceptual vs. Empirical. Choosing the problem for research - Review of Literature - Primary, Secondary and Tertiary sources.

**Unit-II**

Reporting the results of research in conference - Oral and Poster presentation. Planning and preparation of thesis - Research journals - National and International – Monographs - Reprints - Proof correction - Full paper - Short Communication – Review Paper – UGC recommended journals. Citation index – Impact factor – H index – i20 index, SNIP – SJR.

**Unit – III**

Environmental impacts – Ethical issues – Ethical committees – Commercialization — Intellectual Property Rights and patent law - Copy right –Royalty Reproduction of published material – Plagiarism – Citation and Acknowledgement – Reproducibility and Accountability.

**Unit - IV**

Biostatistics – Scope – collections – Tabulation and Classification of Data – Graphical & diagrammatic representation of Data.

**Unit – V**

Measures of Central tendency – Mean, Median and Mode - Standard Deviation – Standard Error – Test to Significance-‘t’ Test – Chi square test –ANOVA - Correlation – Regression.

**Text Books:**

1. Garg, B.L., Karadia, R., Agarwal, F. and Agarwal, U.K., 2002. An introduction to Research Methodology, RBSA Publishers.
2. Kothari, C.R., 1990. Research Methodology: Methods and Techniques. New Age International.

3. Sinha, S.C. and Dhiman, A.K., 2002. Research Methodology, Ess Ess Publications. 2 volumes.
4. Khan, I. A. and Khannum, A. (1994). Fundamentals of Biostatistics. Vikas Publishing, Hyderabad.
5. Gupta, S. P. (1990). Statistical Methods. S. Chand & Co. Ltd., New Delhi.
6. Rastogi, V. B. (2006). Fundamentals of Biostatistics. Ane Book India, New Delhi.

### **Reference Books**

1. Sree Ramalu, V.S., Thesis Writing, Oxford & IBH pub., New Delhi 1988.
2. Zar., J.H. Biostatistics Analysis, Prentice Hall International, England Cliffs, New Jersey, 1984.
3. Misra R.P., 1981, Research Methodology a hand Book, Concept Publishing Company, New Delhi
4. Anthony, M., Graziano, A.M. and Raulin, M.L., 2009. Research Methods: A Process of Inquiry, Allyn and Bacon.
5. Coley, S.M. and Scheinberg, C. A., 1990, "Proposal Writing", Sage Publications.
6. Fink, A., 2009. Conducting Research Literature Reviews: From the Internet to Paper. Sage Publications.
7. Leedy, P.D. and Ormrod, J.E., 2004 Practical Research: Planning and Design, Prentice Hall.

**SEMESTER - III**  
**CORE PAPER – XIII P**  
**CORE PRACTICAL – III**

**Hours: 6**  
**Credits: 5**  
**Code:**

Practical covering

**Core Paper XI**

- Plant Systematics

**Core Paper XII**

- Genetics
- Evolution

**Core Based Elective I**

- Biological Techniques
- Biostatistics

**Core Based Elective II**

- Research Methodology
- Biostatistics

**SEMESTER - IV**  
**CORE PAPER– XIV**  
**PLANT PHYSIOLOGY AND BIOCHEMISTRY**

**Hours: 6**  
**Credits: 5**  
**Code:**

**Objectives:** To understand the physico-chemical organization and functional aspects of plants, to understand the structure and properties of biomolecules like carbohydrates, proteins, lipids, enzymes and secondary metabolites.

**Unit – I**

Plant – water relations: Properties of water, water potential. Movement of water from soil to plants – Soil Plant Atmosphere Continuum (SPAC) – Membrane transport and translocation of solutes.

**Unit – II**

Photosynthesis : chloroplast ultra structure. Photo system I & II – Cyclic and Non- cyclic photo-phosphorylation – quantum yield concept - Red drop and Emerson's enhancement - Carbon metabolism : C<sub>3</sub> - C<sub>4</sub> and CAM pathways and their distinguishing features – PP Pathway and its significance.

**Unit – III**

Respiration: Glycolysis, Krebs's Cycle and electron transport chain - Cyanide resistant respiration pathway - Gluconeogenesis. Photoperiodism – classification of plants and mechanism of flowering - phytochrome and its action on flowering - Vernalization mechanism and their practical application. Plant senescence and fruit ripening and their biochemical mechanism.

**Unit – IV**

Carbohydrates: Classification and general properties of monosaccharide, polysaccharides.  
Proteins: Structural organization of protein (primary, secondary, tertiary and quaternary) - amino acid biosynthesis – properties of amino acids.

**Unit – V**

Enzymes : classification, nomenclature, chemical nature, structure and properties. Mechanism of enzyme action – Michaelis – Menton's constant – enzyme inhibitors – competitive, non-competitive and allosteric control of enzyme behavior – Factors affecting enzyme action. Lipids – Classification and general properties - Structure of fatty acids - alpha and beta oxidation – Secondary metabolites – Phenols – Terpenoids – Porphyrins - Alkaloids and Flavonoids.

### **Text Books**

1. V.K. Jain (2005). Text book of Plant Physiology. S. Chand and Company Ltd. New Delhi.
2. Devlin O.P. (1974). Plant Physiology, Affiliated East West Press Pvt. Ltd.
3. Jain. J.L. (2000). Fundamental s of Biochemistry, Vijaya Printers, Chennai.

### **Reference Books**

1. Noggle, G.R. and Fritz G. (1976) Introductory Plant Physiology , Prentice – Hall, India
2. Salisbury, F.B. and Ross, S. (1974) Plant Physiology, Prentice – Hall, India.
3. Lehninger, A.L. (1998), Biochemistry, C B S Publications.

**SEMESTER - IV**  
**CORE BASED ELECTIVE - III**  
**NUTRITION AND DIETETICS**

**Hours: 6**  
**Credits: 4**  
**Code:**

**Objectives:** This paper will motivate the students to obtain knowledge of different food groups, their composition and their role in diet, to study the different methods of cooking foods and to obtain knowledge about the nutrients present in the foods

**Unit – I**

Food- Nutrients- Nutritional Status- Malnutrition- Under – nutrition, over nutrition - Balanced diet - Food Groups- Nutritional classification of foods – Energy yielding, Body building and protective foods.

**Unit – II**

Cereals and Cereal products: Nutritive value of rice and wheat - Milling of rice and wheat, Parboiling of rice, Products of wheat and rice, Enrichment and fortification of cereals and flours. Nutritional importance of millets– maize, jowar, ragi, bajra - Malting of cereals. Pulses and Nuts: Nutritive value, factors affecting cooking quality of pulses, germination – process, advantages.

**Unit – III**

Vegetables: Botanical classification, Nutritive value, Pigments- fat soluble, water soluble, selection of vegetables, cooking of vegetables- changes during cooking, nutrient loss, effect of cooking on the pigments. Fruits: Classification, Nutritive value, changes during ripening of fruits, enzymatic browning and prevention, storage

**Unit – IV**

Milk and Milk Products: Composition and Nutritive value, Different types of milk, pasteurization of milk, milk products- dry milk, cheese. Egg: Composition and Nutritive value. Measures of egg quality, role of egg in cookery. Meat- composition, a list of different types of meat, cuts of meat, post mortem changes in meat, and tenderness of meat. Poultry- composition and classification. Fish- Composition, nutritive value and selection of fish.

**Unit – V**

Fats and oils- composition processing and refining of fats, refined oils, plasticity, hydrogenation, winterization. Sugar- nutritive value, sugar related products, stages of sugar cookery,

crystallization, factors affecting crystallization. Spices and condiments- types and uses in Indian cookery, medicinal value.

### **Text Books**

1. Potter, N. and Hotchkiss, J.H. Food Science, 5th Ed., CBS Publications and Distributors, Daryaganji, New Delhi, 1998.
2. ShakuntalaManay, Shadaksharaswamy. M (2000) Foods, Facts and Principles, New Age International Pvt Ltd Publishers, 2nd Edition
3. Usha Chandrasekhar, Food Science and Application in Indian Cookery, Phoenix Publishing House P. Ltd., New Delhi, 2002.
4. Srilakshmi, B. Food Science, New Age International Publishers, New Delhi, 2010
5. Swaminathan, M, Hand Book of Food Science and Experimental Foods, BAPPCO, Bangalore, 1992

### **Reference Books**

1. Brow, A., Understanding Food, Thomson Learning Publications, Wadsworth, 2000.
2. Mehas, K.Y. and Rodgers, S.L. Food Science and You, McMillan McGraw Company, New York, 2000.
3. Parker, R. Introduction to food Science, Delmer, Thomson Learning Co., Delma, 2000



**SEMESTER-IV**  
**CORE BASED ELECTIVE -IV**  
**PHARMACOGNOSY**

**Hours: 6**  
**Credits: 4**  
**Code:**

**Objectives:** The physical, biochemical and biological properties of natural drugs will be dealt.

**Unit- I**

Introduction: History, scope and importance of medicinal plants. Traditional medicinal systems – Siddha , Ayurvedha , Unani , Homeopathy and Naturopathy.

**Unit -II**

Drugs obtained from plants : Entire plant-*Bacopa monneri* and *Tribulus terrestris* , Roots – *Rauwolfia serpentina* and *Atropa belladonna*, Barks – *Cinchona officinalis* and *Pithecellobium dulce*, Flower Buds – *Syzygium aromaticum* and *Crocus sativus* , Flowers – *Hibiscus rosasinensis* and *Nelumbo nucifera*, Leaves – *Ocimum sanctum* and *Aloe vera* ,Seeds – *Myristica fragrans* and *Piper nigrum*, Exudations - *Ferula asafoetida*.

**Unit-III**

Cultivation, collection and preparation of natural drugs – Classification of Natural Drugs – Pharmaceutial uses of the following medical plants: *Azadirachta indica*, *Adathoda vasica*, *Catharanthus roseus*.

**Unit-IV**

Phytoconstituents of Therapeutic value – Carbohydrates – Glycosides – Lipids – Volatile oils – Resins and Resin Combinations – Alkaloids – Tannins – Phenols – Enzymes – Proteins.

**Unit-V**

Analytical Pharmacognosy – Modern methods of Drug preparation – Drug adulteration. Methods of drug evaluation – Biological testing of Herbal drugs – Phytochemical investigation.

### **Text Books**

1. Text book of Pharmacognosy, by G.E.Trease nad W.C.Evans, 15th edn,  
W.B. Saunders Edenburg, NewYork., 10.

### **Reference Books**

1. Text book of Pharmacognosy by Tyler, Brady and Robers
2. Modern methods of Plant analysis by Peach and M.V.Tracey, Volume I and II 12.
3. Chemistry of marine natural products by Paul J.Schewer, 1973.

**SEMESTER - IV**  
**CORE PAPER - XV P**  
**CORE PRACTICAL – IV**

**Hours: 6**  
**Credits: 5**  
**Code:**

Practical covering

**Core Paper XIV**

- Plant Physiology
- Biochemistry

**Core Based Elective III**

- Biotechnology
- Bioinformatics

**Core Based Elective IV**

- Pharmacognosy

**SEMESTER IV  
PROJECT  
PROJECT WORK**

**Hours: 6  
Credits: 4  
Code:**

**Project dissertation submission**