BHARATHIDASAN UNIVERSITY, TIRUCHIRAPPALLI - 620 024

M. Sc. BOTANY

COURSE STRUCTURE UNDER C.B.C.S.

(applicable to the candidates admitted from the year 2008-09 onwards)

Sem	Course	Course Title	Ins.hr/ week	Cre-dit	Exam hr	Marks		Total
						Int.	Ext.	
I	CC-I	Plant Biodiversity-I (Algae, Fungi, Lichens & Bryophytes)	6	5	3	25	75	100
	CC-II	Plant Biodiversity-II (Pteridophytes, Gymnosperms and Paleobotany)	6	5	3	25	75	100
	CC-III	Microbiology, Plant Pathology and Immunology	6	4	3	25	75	100
	CC-IV	Practical-I (Core Courses I, II & III)	6	4	3	40	60	100
	CC-V	Biofertilizers and Mushroom Technology	6	4	3	25	75	100
	Total		**30**	**22**				500
II	CC-VI	Anatomy, Embryology and Morphogenesis	6	5	3	25	75	100
	CC-VII	Angiosperm Taxonomy, Ecology, Phytogeography and Conservation Biology	6	5	3	25	75	100
	CC-VIII	Practical-II (Core Courses VI & VIII)	6	4	3	40	60	100
	CC-IX	Wood Science	6	4	3	25	75	100
	EC-I	Industrial Microbiology	6	4	3	25	75	100
	Total		**30**	**22**				500
III	CC-X	Cell Biology, Genetics and Plant Breeding	6	5	3	25	75	100
	CC-XI	Plant Physiology, Biochemistry and Biophysics	6	5	3	25	75	100
	CC-XII	Practical-III (Core Courses X & XI)	6	4	3	40	60	100
	EC-II	Biotechnology	6	4	3	25	75	100
	EC-III	Plant Tissue Culture	6	4	3	25	75	100
	Total		**30**	**22**				500
IV	CC-XIII	Research Methodology	6	5	3	25	75	100
	CC-XIV	Bioinstrumentation and Biological Techniques	6	5	3	25	75	100
	EC-IV	Horticulture and Landscaping	6	4	3	25	75	100
	EC-V	Food Preservation and Processing	6	4	3	25	75	100
		Project Work	6	6	–	-	-	100
	Total		**30**	**24**				500
Grand Total			**120**	**90**				2000

Note CC : Core Course
EC : Elective Course

ELECTIVE COURSES

The Botany Department offers the following Elective Courses for P.G. Botany students:

- EC-I : Industrial Microbiology (Sem. II)
- EC-II : Biotechnology (Sem.III)
- EC-III: Plant Tissue Culture (Sem.III)
- EC-IV: Horticulture and Landscaping (Sem. IV)
- EC-V : Food Preservation and Processing (Sem. IV)

Note:

Core Courses include Theory, Practicals & Project

No. of Courses	14 - 17
Credit per Course	4 - 5
Total Credits	70

Elective Courses

(Major based / Non Major / Internship)

No. of Courses	4 – 5
Credit per Course	4 – 6
Total Credits	20

	Internal	External
Theory	25	75
Practicals	40	60

Project

Dissertation	80 Marks	[2 reviews – 20+20 = 40 marks Report Valuation = 40 marks]
Viva	20 Marks	20 marks

Passing Minimum in a Subject

CIA 40%
UE 40%
} Aggregate 50%

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Core Course - I

PLANT BIODIVERSITY-I: ALGAE, FUNGI, LICHENS AND BRYOPHYTES

Unit-I: ALGAE

General trends and criteria for Algal classification (Bold and Wynne, 1978). Salient features of major classes: Prochlorophyta, Chlorophyta, Charophyta, Xanthophyta, Phaeophyta and Rhodophyta. Ultrastructure of Prokaryotic and Eukaryotic algal cells and their components - cell wall, protoplasm, flagella, eye spots, chloroplast, pyrenoid, nucleus, pigments and reserve foods. Economic importance of algae - Food and feed - Single cell protein - Industrial products (Agar-Agar, Carrageenan, Iodine, Vitamins) - In Medicine and Diatomaceous earth.

Unit-II: ALGAE

Range of thallus structure, origin and evolution of sex in algae, phylogeny and interrelationships of algae. Lifecycle patterns in algae and alternation of generations, Fossil algae.

Ecology of Algae: Freshwater algae, marine algae, soil algae, symbiotic algae and parasitic algae. Algae as pollution indicators, algal blooms, algicides culture and cultivation of fresh water and marine algae - Knop's solution and Chu-10 medium (1972).

Unit-III: FUNGI

General features, occurrence and distribution. Mode of nutrition in fungi, culture of fungi. Classification of fungi (Alexopoulos and Mims, 1979), recent trends in the classification of fungi. General characters of major classes: Mastigomycotina, Zysomycotina, Ascomycotina, Basidiomycotina and Deuteromycotina. Thallus organization, cell structure and fruit bodies. Phylogeny and interrelationships of major groups of fungi. Economic importance of fungi, in medicine and in industries.

Unit-IV: FUNGI

Homothallism and Heterothallism in fungi. Homokaryon and Heterokaryon, Hormonal control in sex organ development in fungi. Physiological specialization and physiological races in fungi. Reproduction, life cycle types, parasexual cycles, reduction in sexuality in fungi. Spore dispersal mechanisms and fungal genetics, Fossil fungi.

LICHENS: General features, classification (Miller, 1984), Distribution, thallus organisation, vegetative and sexual reproduction, lichens as indicators of pollution and economic importance.

Unit-V: BRYOPHYTES

General features, distribution, classification (Watson, 1955), General characters of major groups. Marchantiales, Jungermaniales, Anthoceratales, Sphagnales, Funariales and Polytrichales. Range of vegetative structure, Evolution of gametophytes and sporophytes. Reproduction - Vegetative and sexual, spore dispersal mechanisms in bryophytes, spore germination patterns in bryophytes. Ecological and economic importance of bryophytes. Origin and interrelationships, Fossil bryophytes.

References

Algae

- Bold, H. C. and Wyne, M. J. (1978). Introduction of Algae - Structure and Reproduction. Prentice Hall, New Jersey.
- Chapman, C.J. and Chapman, D.J. (1981). The Algae. 2nd ed. Macmillan, London.
- Darley, W. M. (1982). Algal Biology: A Physiological Approach. Blackwell Scientific Publications. Oxford, London.

- Fritsch, F. E. (1976). Structure and Reproduction of the Algae. Vol. I & II. Cambridge University Press, London.
- Ian Morris (1967). An Introduction to the Algae. Hutchinson University Library, London.
- Kumar, H. D. (1989). Introductory Phycology. East-West Press, Madras.
- Kumar, H. D. and Singh, H. N. (1982). A Textbook of Algae. East-West Press, Madras.
- Round, F. E. (1981). The Ecology of Algae. Cambridge University Press, London.
- Sharma, O. P. (1986). Textbook of Algae. Tata McGraw Hill, New Delhi.
- Smith, G. M. (1976). Cryptogamic Botany. Vol. I. Algae and Fungi. Tata McGraw Hill, New Delhi.
- Vashishta, B. R. *et al*. (2008). Botany for Degree Students - Algae. S. Chand and Co. Ltd., New Delhi.
- Venkataraman *et al*. (1974). Algal Form and Function. Today and Tomorrow Publishers, New Delhi.

Fungi

- Alexopoulus, C. J. and Mims, C. W. (1979). Introductory Mycology. Wiley Eastern Ltd., New York.
- Bessey, E. A. (1979). Morphology and Taxonomy of Fungi. Vikas Publishing House Pvt. Ltd., New Delhi.
- Bold, H. C. *et al.* (1980). Morphology of Plants and Fungi. Harper and Row Publishing Inc., New York.
- Burnet, J. H. (1971). The Fundamentals of Mycology. ELBS Publications, London.
- Mehrotra, R. S and Aneja, K. R. (1990). An Introduction of Mycology. Wiley Eastern Ltd., New Delhi.
- Sharma, P. D. (1987). The Fungi. Rastogi and Co., Meerut.
- Vashishta, B. R. and Sinha, A. K. (2007). Botany for Degree Students - Fungi. S. Chand and Co. Ltd., New Delhi.

Lichens

- Hale, M. E. Jr. (1983). Biology of Lichens. Edward Arnold, Maryland.

Bryophytes

- Cavers, F. (1911) The Interrelationship of Bryophytes. Cambridge, UK.
- Ingold, C. T. (1939). Spore Discharge in Land Plants. Oxford, UK.
- Kashyap, S.R. (1972). The Liverworts of Western Himalayas and Punjab. Plains I & II. Research Company Publications, New Delhi.
- Parihar, N. .S (1972). An Introduction to Embryophyta-I: Bryophyta. Central Book Depot, Allahabad.
- Prem Puri (1973). Bryophytes: A Broad Perspective. Atma Ram and Sons, New Delhi.
- Smith, G. M. (1971). Cryptogamic Botany. Vol. II. Bryophytes and Pteridophytes. Tata McGraw Hill, New Delhi.
- Vashishta, B. R. *et al*. (2008). Botany for Degree Students: Bryophyta. S. Chand and Co. Ltd., New Delhi.
- Watson, E. V. (1971). The Structure and Life of Bryophytes. B.I. Publications, New Delhi.

Core Course - II

PLANT BIODIVERSITY-II:

PTERIDOPHYTES, GYMNOSPERMS AND PALEOBOTANY

Unit-I: PTERIDOPHYTES

General features and origin of Pteridophytes. Classification of Pteridophytes (Reimer, 1954). 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: PTERIDOPHYTES

Range of morphology, structure, reproduction and evolution of gametophytes and sporophytes of the following orders: Ophioglossales, Marattiales, Osmnndales, Filicales and Salviniales. Stelar evolution in pteridophytes, Heterospory and origin of seed habit. Structure, development and evolution of sorus in Filicales. Phyletic slide, spore germination patterns. Economic importance of Pteridophytes.

Unit-III: GYMNOSPERMS

A general account of the characteristic features of Gymnosperms. Origin of Gymnosperms. Classification of Gymnosperms (Sporne, 1965). General structure and interrelationships of Pteridospermales, Bennetittales, Pentoxylales and Cordaitales.

Unit-IV: GYMNOSPERMS

A general account on the distribution, morphology, anatomy, reproduction and phylogeny of Cycadales, Coniferales, Ginkgoales, Ephedrales, Welwitchiales and Gnetales. Economic importance of Gymnosperms.

Unit-V: PALEOBOTANY

Concepts of Paleobotany, A general account on Geological Time Scale. Techniques for paleobotanical study.

Fossil types: Compressions, incrustation, casts, molds, petrifactions, coalballs and compactions. Age determination and methods of study of fossils. Systematic and Nomenclature of fossil plants. Paloclimates and fossil plants. Role of fossil in oil exploration and coal excavation, Paleopalynology.

References

Pteridophytes

- Bower, F. O. (1939). The Ferns (Vol. I, II, III). Today and Tomorrow's Printers, New Delhi.
- Eames, A. J. (1936). Morphology of Vascular Plants - Lower Groups. Tata McGraw Hill, New Delhi.
- Ingold, C. T. (1939). Spore Discharge in Land Plants. Oxford, UK.
- Parihar, N. S. (1985). The Biology and Morphology of Pteridophytes. Central Book Depot, Allahabad.

- Rashid, A. (1986). An Introduction to Pteridophyta. Vani Educational Books, New Delhi.
- Sharma, O. P. (1990). Text Book of Pteridophyta. Macmillan India Ltd., India.
- Smith, G. M. (1971). Cryptogamic Botany. Vol. II. Bryophytes and Pteridophytes. Tata McGraw Hill, New Delhi.
- Sporne, K. R. (1972). The Morphology of Pteridophytes. B. I. Publications, Madras.
- Sundararajan, S. (2007). Introduction to Pteridophyta. New Age International Publishers, New Delhi.
- Vashishta, P. C. *et al*. (2008). Botany for Degree Students: Pteridophyta. S. Chand and Co. Ltd., New Delhi.

Gymnosperms

- Chamberlain, C. J. (1957). Gymnosperms Structure and Evolution. University Chicago Press, New York.
- Coultar, J. M. and Chamberlin, C. J. (1967). Morphology of Gymnosperms. Central Book Depot, Allahabad.
- Foster, A. S. and Gifford, E. M. (1965). Morphology and Evolution of Vascular Plants. W. H. Freeman & Co.
- Maheswari, P. and Vasil, V. 1960. Gnetum: A Monograph. CSIR Publication, New Delhi.
- Sporne, K. R. (1974). The Morphology of Gymnosperm. B.I. Publications, New Delhi.
- Vasishta, P. C. *et al*. (2006). Botany for Degree Students: Gymnosperms. S. Chand and Co. Ltd., New Delhi.

Paleobotany

- Nikias, K. J. (1981). Paleobotany, Paleoecology and Evolution. Praeger Publishers, USA.
- Seward, A. C. (1919). Fossil Plants. Vol. I, II, III and IV. Cambridge University Press, London.
- Seward, A. C. (1931). Plant Life through the Ages. Cambridge University Press, London.
- Shukla, A. C. and Mishra, S. P. (1982). Essentials of Paleobotany. 2nd ed. Vikas Publishing House Pvt. Ltd., New Delhi.

Core Course - III

MICROBIOLOGY, PLANT PATHOLOGY AND IMMUNOLOGY

Unit-I: MICROBIOLOGY

Five kingdom system by Whittaker (1969) - Prokaryotic and Eukaryotic microbes - General features of Viruses - Classification, characteristics and ultrastructure, isolation, purification, chemical nature - replication, transmission, economic importance, virions and prions, phytoplasma (including mycoplasma).

Unit-II: MICROBIOLOGY

Bergey's system of Bacterial classification (1984-1991) - Eubacteria, Archibacteria, Cyanobacteria and Actinomycetes. General account, ultrastructure, nutrition, growth, reproduction, bacterial culture technique and economic importance.

Unit-III: PLANT PATHOLOGY

Plant pathology - Organisms and causal factor responsible for plant diseases - methods of studying plant diseases - Koch's postulates - common terminologies used in plant pathology - symptomology, Etiology, Epidemic disease, Control measures - Host parasite interactions - Mycotoxins - Aflatoxins, Defense mechanisms in plant - integrated disease management.

Unit-IV: PLANT PATHOLOGY

Common plant diseases of India (Tobacco Mosaic, Cucumber mosaic, Little leaf disease of Brinjal, Citrus canker, Rice blight, Tikka disease of groundnut, Anthracnose of mango, Wilt of Cotton, Downy mildew of grapes, White rust of Mustard, Damping off disease of seedlings, Rust of wheat, Root knot of tomato.

Unit-V: IMMUNOLOGY

Immunology - General account of immune systems and immunology - innate and acquired immunity - Antigen and antibody (types, structure, requirements and antigen-antibody interactions) - Detection of antibody (immunoelectrophoresis, ELISA and RIA) - Application of immunology in plant systems with special reference to immunocytochemistry.

References

Microbiology

- Carpenter, P. L. (1967). Microbiology. Saunders Co., Philadelphia, USA.
- Davis, B. D., Dulbecco, R., Eiser, H. N. and Grinsberg, H. S. (1980). Microbiology. Harper & Row, New York.
- Dubey, R. C. and Maheshwari, D. K. (2007). A Textbook of Microbiology. S. Chand and Co. Ltd., New Delhi.
- Edmond, P. (1978). Microbiology: An Environment Perspective. Macmillan & Co., New Delhi.
- Ketchum, P. A. (1988). Microbiology: Concepts and Applications. John Wiley & Sons, New York.

- Pelczar, M. J., Chan, E. C. S. and Krieg, N. R. (1993). Microbiology. Tata McGraw Hill Publishing Co. Ltd., New Delhi.
- Postage, J. (1975). Microbes and Man. Penguin Book, Baltimore.
- Power and Daginwala (1994). General Microbiology. Himalayan Publishing House, Bombay.
- Salle, A. J. (1974). Fundamental Principles of Bacteriology. Tata McGraw Hill Publishing Co. Ltd., New Delhi.
- Schegal, H. E. (1986). General Microbiology. Cambridge University, London.
- Sharma, P. D. (1992). Microbiology. Rastogi & Co., Meerut.
- Staley, J. T. *et al.*. (1991). Bergey's Manual of Systematic Bacteriology. Vol. I to IV. Williams & Wilkins, London.
- Stanier, R. Y., Adelberg, E. A. and Ingram, J. L. (1978). General Microbiology. Mac Millan & Co., New Delhi.

Plant Pathology

- Bilgrami, K. S. and Dube, H. C. (1990). A Textbook of Modern Plant Pathology. Vikas Publishing House Pvt. Ltd., New Delhi.
- Butler, E. J. and Jones, S. G. (1949). Plant Pathology. Macmillan & Co., London.
- Cooper, J. I. (1995). Viruses and the Environment. 2nd ed. Chapman & Hall, London.
- Mehrota, R. S. (1994). Plant Pathology. Tata McGraw Hill Publishing Co. Ltd., New Delhi.
- Pandey, B. P. (1982). A Textbook of Plant Pathology, Pathogen and Plant Diseases. S. Chand and Co. Ltd., New Delhi.
- Rangaswamy, G. (1972). Diseases of Crop Plants in India. Prentice Hall of India Pvt. Ltd.
- Rangaswamy, G. and Soumini Rajagopalan. (1973). Bacterial Plant Pathology. Tamil Nadu Agricultural University, Coimbatore.
- Singh, R. S. (1990). Plant Diseases. 6th ed., Oxford & IBH, New Delhi.
- Smith, K. M. (1957). A Textbook of Plant Virus Diseases. Little Borwn & Co., Boston.
- Southey, J. F. (1965). Plant Nematology. Tech. Bull. No.7, Ministry of Agricultural, Fisheries and Food, Her Majesty's Stationery Office, London.
- Walker, J. C. (1952). Diseases of Vegetable Crops. McGraw Hill Book Co. Inc., New York.

Immunology

- Annadurai, B. (2008). A Textbook of Immunology and Immunotechnology. S. Chand and Co. Ltd., New Delhi.
- Kuby, J. (2000). Immunology. 4th ed. W. H. Freeman and Co., New York.
- Nandini Shetty. (2008). Immunology Introductory Textbook. New Age International Publishers, New Delhi.
- Wein and Stewart, J. (1997). Immunology, Churchill Livingston, New York.

Core Course- IV - PRACTICAL - I
(Covering Core Courses I, II & III)

Algae

Gloeocapsa, Spirulina, Anabaena, Volvox, *Spirogyra, Ulothrix, Acetabularia, Nitella, Vaucheria, Cyclotella* and *Navicula* (Diatoms), *Padina, Sargassum, Gelidium* and *Gracilaria*

Fungi

Pthium, Pilobolus, Taphrina, Xylaria, Pluerotus, Lycoperdon, Cercospora, Fusarium and *Colletotrichum*

Lichens

Parmelia and Usnea

Bryophytes

Morphological and anatomical study of representative members of the following genera:

Marchantia, Lunularia, Targionia, Reboulia, Porella and *Polytrichum*

Pteridophytes

Study of the morphology and anatomy of the vegetative and reproductive parts of the following genera:

Isoetes, Lygodium, Angiopteris, Osmunda, Gleichenia, Pteris, Nephrolepis and *Azolla*

Gymnosperms

Study of the morphology and anatomy of vegetative and reproductive parts of the following genera:

Araucaria, Podocarpus, Ginkgo and *Ephedra*

Paleobotany

Lepidodendron, Stigmaria, Calamostachys, Lyginopteris, Lagenostoma and *Cordaites*

Microbiology

Isolation of microbes from soil - Serial dilution and Plating - Isolation of Microbes from food, fruits and vegetables - Gram's staining of Bacteria found in milk, curd, root - nodule - Effect of different antibodies on bacterial growth (antibiotic sensitivity) - Microbial analysis of milk by methylene - blue reduction test

Plant Pathology

Study of the following diseases:

Rust of wheat, Wilt of cotton, White rust of mustard, Anthracnose of mango - Citrus canker, rice blight - Tobacco mosaic, Cucumber mosaic - Little leaf of brinjal

Immunology

Blood group determination (Demonstration).

Note

Duly certified record notebooks should be submitted for all the practical examinations and those who do not submit, need not be permitted to the concerned practical examination.

Evaluation for CC-IV

- **Internal** (40 marks)
  - Practical skill : 10
  - Submission of observation notebooks : 10
  - Practical assessment by test : 10
  - Submission of 10 permanent slides of hand/microtome sections : 10 **=40**
- **External** (60 marks)
  - Practical Examination : 50
  - Submission of Record Notebook : 10 **= 60**

Core Course - V
BIOFERTILIZERS AND MUSHROOM TECHNOLOGY

Unit-I: BIOFERTILIZER

Biofertilizers - Introduction, scope. A general account of Biofertilizers organisms - Cyanobacteria (BGA), Bacteria and Mycorrhizae - Cyanobacteria (BGA) as biofertilizers - *Anabaena, Cylindrospermum, Gloeocapsa, Lyngbya, Nostoc, Plectonema* and *Tolypothrix. Algalization, Azolla - Anabaena* as biofertilizers. Isolation of cyanobacteria. Formation of Fogg's medium - Mass cultivation of *Azolla* - Cyanobacterial biofertilizers - Symbiotic association of Cyanobacteria - Field application of Cyanobacterial inoculants.

Unit-II: BIOFERTILIZER

Bacterial biofertilizers - Introduction, scope. A general account of bacterial biofertilizers organisms. *Azospirillum, Azotobacter, Frankia, Phosphobacteria* and *Rhizobium*. Isolation - *Azotobacter* - Ashby's mannitol agar, *Azospirillum* - Semisolid medium (Bulow and Dobereiner, 1975). Rhizolium - Yeast Extract Mannitol Agar medium - Culture characteristics. Mass production of *Azospirillum, Azotobacter* and *Phosphobacteria*. Mechanism of nitrogen fixation (free-living and symbiotic) - Biochemistry and molecular basis of nitrogen fixation - Phosphate solubilization and mobilization.

Unit-III: BIOFERTILIZER

Mycorrhizal fungi as biofertilizers - Introduction, scope. A general account of Ecto, Endo and Arbuscular mycorrhizae (AM). Methods of collection, wet sieving and decanting method and inoculum production. Culture of mycorrhizae in Modified Melin - Norkrans (MMN) agar medium - Cultural characteristics of Ecto mycorrhizal fungi. Techniques of Ectomycorrhizal inoculum, Endo mycorrohizae of orchids. Isolation and method of inoculation of Arbuscular mycorrhizae (AM), Legume - AM interactions - National and Regional Biofertilizers Production and Development Centres.

Unit-IV: MUSHROOM TECHNOLOGY

Mushroom Technology - Introduction, History and Scope - Edible and Poisonous Mushrooms. Vegetative characters - Formation and development of Basidiocarp, structure of basidiocarp - *Agaricus.* Importance and nutritive value of edible mushrooms. Food preparation- soup, cutlet, vegetable curry, samosa, omlette and pickle. Mushroom research centres in India.

Unit-V: MUSHROOM TECHNOLOGY

Cultivation of button mushroom (*Agaricus bisporus*), milky mushroom (*Calocybe indica*), oyster mushroom (*Pleurotus sajorcaju*) and paddy straw mushroom *(Volvariella volvcea*). Isolation and culture of spores, culture media preparation. Production of mother spawn, multiplication of spawn - Inoculation Technique - Cultivation technology - Substrates, composting technology, bed, polythene bag preparation, spawning - casing - Cropping - Mushroom production - Harvest - Storage methods and marketing.

References

Biofertilizers

- Dubey, R. C. (2008). A Textbook of Biotechnology. S. Chand & Co., New Delhi.
- Newton, W. E. *et al*. (1977). Recent Developments in Nitrogen Fixation. Academic Press, New York.
- Schwintzer, C. R. and Tjepkema, J. D. (1990). The Biology of *Frankia* and *Actinorhizal* Plants. Academic Press Inc., San Diego, USA.
- Stewart, W. D. P. and Gallon, J. R. (1980). Nitrogen Fixation. Academic Press, New York.
- Subba Rao, N. S. (1982). Advances in Agricultural Microbiology. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
- Subba Rao, N. S. (2002). Soil Microbiology. 4th ed. Soil Microorganisms and Plant Growth. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
- Subba Rao, N. S. and Dommergues, Y. R. (1998). Microbial Interactions in Agriculture and Forestry. Vol. I, Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
- Verma, A. (1999). Mycorrhiza. Springer Verlag, Berlin.
- Wallanda, T. *et al*. (1997). Mycorrhizae. Backley's Publishers, The Netherlands.

Mushroom Technology

- Alice, D., Muthusamy and Yesuraja, M. (1999). Mushroom Culture. Agricultural College, Research Institute Publications, Madurai.
- Marimuthu, T. *et al*. (1991). Oster Mushroom. Department of Plant Pathology. Tamil Nadu Agricultural University, Coimbatore.
- Nita Bhal. (2000). Handbook on Mushrooms. 2nd ed. Vol. I and II. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
- Pathak, V. N. and Yadav, N. (1998). Mushroom Production and Processing Technology. Agrobios, Jodhpur.
- Tewari Pankaj Kapoor, S. C. (1988). Mushroom Cultivation. Mittal Publication, New Delhi.
- Tripathi, D. P. (2005). Mushroom Cultivation. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.

***Note*:** No Practical for this paper.

Core Course - VI

ANATOMY, EMBRYOLOGY AND MORPHOGENESIS

Unit-I: ANATOMY

General account and theories of organisation of apical meristems of shoot apex and root apex, quiescent centre. Structural diversity and phylogenetic trends of specialization of xylem and phloem. Cambium - origin - cellular structure, cell division, stories and non-storied types. Cambium in budding and grafting - wound healing role. Trichomes, periderm and lenticels.

Unit-II: ANATOMY

Anatomical characteristics and vascular differentiation in primary and secondary structure of root and stem in Dicot and Monocot. Origin of lateral roots - Root stem transition - Anatomy of Dicot and Monocot leaves. Leaf abscission, stomatal types, nodal anatomy, petiole anatomy, vascularisation of flower and seedling.

Unit-III: EMBRYOLOGY

Microsporangium - Microsporogenesis, Microspores - arrangement - morphology - ultrastructure - Microgametogenesis - Pollen - Stigma - Incompatibiligy - Methods to overcome incompatibility - Megasporangium - Megagametogenesis - Female gametophyte - Monosporic - Bisporic and Tetrasporic - Nutrition of embryo sac and fertilization

Unit-IV: EMBRYOLOGY

Endosperm - Types - Endosperm haustoria - Cytology and physiology of endosperms, functions of endosperms - Embryo development in Dicot and Monocot, Nutrition of embryo - Polyembryony - Causes, Apomixis - Causes, Apospory - Their role in plant improvement programmes and seed development.

Unit-V: MORPHOGENESIS

Definition - Morphogenesis and its relation to morphology - Turing's diffusion reaction theory - Morphogenetic factors - growth regulators - genetic and environment - polarity.

Molecular basis of morphogenesis - Cytosol and cytoskeleton, microtubules and microfilaments - Cellular level morphogenesis - Nuclear transplantation experiments with *Acetabularia* - Sach's and Errer's laws - Asymmetric divisions and their significance. Morphogenesis at tissue level - Differentiation, dedifferentiation and redifferentiation of vascular tissue *in vivo, in vitro* and in wounds. Plant galls and their importance in morphogenesis.

References

Anatomy

- Clowers, F. A. L. (1961). Apical Meristems. Blackwell Scientific Publication, Oxford.
- Cutter, E. G. (1978). Plant Anatomy. Edward Arnold Publishers Ltd., London.
- Easu, K. (1953). Plant Anatomy. John Wiley & Sons Inc., New York.
- Fahn, A. (1989). Plant Anatomy. Maxwell Pvt. Ltd., Singapore.

- Metcalfe and Chalk (1950). Anatomy of the Dicotyledons and Monocotyledons. Vol. I and II. Clarendon Press, Oxford, UK.
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- Singh, V., Pande, P. C. and Jain, D. K. (1987). Anatomy of Seed Plants. Rastogi Publications, Meerut.

Embryology

- Agarwal, S. B. (1990). Embryology of Angiosperms - a fundamental approach. Sahitya Bhawan, Agra.
- Bhojwani, S. S. and Bhatnagar, S. P. (1981). Embryology of Angiosperms. Vikas Publishing House Pvt. Ltd., New Delhi.
- Dwivedi, J. N. (1998). Embryology of Angiosperms. Rastogi and Co., Meerut.
- Maheswari, P. (1963). An Introduction to Embryology of Angiosperms. International Society of Plant Morphologies, University of Delhi.
- Raghavan, V. (1976). Experimental Embryogenesis in Vascular Plants. Academic Press, London.

Morphogenesis

- Bard, J. (1990). Morphogenesis. Cambridge University Press, London.
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Core Course - VII

ANGIOSPERM TAXONOMY, ECOLOGY, PHYTOGEOGRAPHY AND CONSERVATION BIOLOGY

Unit-I: TAXONOMY

Introduction - History of classification - A detailed study of classification - Sexual system - Cerolus Linnaeus, Natural System - Bentham and Hooker, Modern System - Engler and Prantl, Hutchinson and Takhtajan - Biosystematics, Chemotaxonomy and Numerical Taxonomy, Role of Anatomy and Embryology in solving Taxonomic problems.

Unit-II: TAXONOMY

International code of Botanical Nomenclature - Typification, Principles of priority and their limitations. Effective and valid publications - Author citation, retention, choice and rejection of names. Familiarity with botanical literature - Monographs, periodicals and floras. A general account on keys - Herbarium preparation and management - A brief account of B.S.I. and its role.

Unit-III: TAXONOMY

Study of the families and their economic importance of plants mentioned in the practical syllabus.

Unit-IV: ECOLOGY

Concept and dynamics of ecosystem: Types of ecosystem, components, Food chain, Food web and energy flow - Trophic level, ecological pyramids. Productivity and biogeochemical cycles (N, P, C, S). Ecological amplitude of a species and adaptation - Ecads, ecotypes, ecospecies, Raunkaier's Life Forms.

Types of forests and forest conservation - Utilization of energy resources - Non-renewable and renewable.

Environmental pollution - Air, water, soil, thermal and radiation. Cumulative effect of pollution on global environment, Ozone depletion, Greenhouse effect and their consequences. Ecological indicators.

Unit-V: PHYTOGEOGRAPHY & CONSERVATION BIOLOGY

Phytogeography: Range - Dispersal and migration barriers hypothesis, Continental drift hypothesis, Land - Bridges hypothesis, Age and Area hypothesis, Endemism. Introduction to Remote Sensing and its uses.

Conservation Biology - Introduction - Current practices in conservation - Ecosystem approaches - Species based approaches - Social approaches - Chipko movement. *In situ* conservation (Afforestation, Social Forestry, Agro Forestry, Botanical Gardens, Biosphere Reserves, National Parks, Sanctuaries, Sacred Groves and Sthalavrikshas) and *ex situ* conservation (Cryopreservation, Gene Banks, Seed Banks, Pollen Banks, Sperm Banks, DNA Banks, Tissue Culture and Biotechnological strategies) - Environmental Education.

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Core Course- VIII

PRACTICAL - II

(Covering Core Courses VI & VII)

Anatomy

- Dissection of shoot apex in *Hydrilla* and whole mount.
- Examination of LS of shoot and root apices
- Study of origin of lateral roots.
- Examination of different types of pits - secondary wall thickening - annular, helical and scalariform and pitted thickening.
- Wood structure - TS, TLS and RLS - showing variations in vessel elements, fibres axial parenchyma and ray parenchyma.
- Identification of different types of stomata - Monocot and Dicot types

Embryology

- Slides showing developmental stages of anther, embryosac, endosperm and embryo.
- Study of different types of pollen grains.
- Dissection of endosperm haustoria - *Cassia, Cucumis, Peltophorum*
- Dissection of Embryo - *Abelmoschus, Cyamopsis, Tridax*

Morphogenesis

- Superficial 'V' shaped wounding of young stem and studying the wound healing response in Dicot and Monocot stems.
- Bisecting shoot and aerial root apices and studying their further behaviour.
- Study of one fungal gall (Club - Root of Cabbage) and insect gall (*Pongamia* leaf - gall)

Taxonomy

Study of the plants belonging to the following families:

- Menispermaceae
- Polygalaceae
- Caryophyllaceae
- Portulacaceae
- Rhamnaceae
- Sapindaceae
- Lythraceae
- Passifloraceae
- Aizoaceae
- Sapotaceae
- Oliaceae
- Gentianaceae
- Boraginaceae
- Scrophulariaceae
- Pedaliaceae
- Aristolochiaceae
- Loranthaceae
- Casuarinaceae
- Commelinaceae
- Cyperaceae

- Identification of binomial of the plants with the help of Gamble Flora.
- ICBN problems to be worked out.
- Submission of 30 herbarium specimens with field note book and tour report.

- The students should undertake as part of their course a tour and field study of vegetation under the guidance of the staff for three to five days within the state and neighbouring states. Students who have not undertaken the above activities shall forfeit the appropriate marks allotted for this purpose (10 marks) for practical examination.

Ecology

- Analysis of vegetation - by using quadrate / line transect to find out frequency and interpret the vegetations in terms of Raunkaier's frequency formula.
- Estimation of dissolved oxygen content in the given water sample.
- Estimation of primary production in the given water sample by the light-dark bottle method.
- Estimation of carbonate, bicarbonate and chloride content in water samples.

Phytography

- A study of plant distribution maps - Continuous, discontinuous, cricum polar, circum tropical, endemic distribution and continental drift.

Remote Sensing

- Study of satellite maps.

Evaluation for CC-VIII

- **Internal** (40 marks)
  - Practical skill : 10
  - Submission of observation notebooks : 10
  - Practical assessment by test : 10
  - Herbarium and Tour report : 10 = **40**

- **External** (60 marks)
  - Practical Examination : 50
  - Submission of Record Notebook : 10 = **60**

Core Course - IX

WOOD SCIENCE

Unit-I

Microscopic structure of wood: Vessels, Tyloses, Tracheids, Fibres, Wood parenchyma - Wood rays, Grain and Texture. Organisation of the cell wall - Microfibril - Orientation, cell wall pit - structure. Identification and classification of wood.

Unit-II

Chemical composition of wood, structure and properties of Cellulose - Hemicellulose - Wood polysaccharides and Lignin. Distribution of chemical constituents in wood. Physical properties of wood - Colour - Lustre - Fluorescence - Odour and Weight.

Unit-III

Mechanical properties of wood - Bending properties - Composition - Hardness - Shear. Properties of Dicot and Monocot wood. Growth rings in wood - Annual rings, early wood and late wood, soft wood and hard wood, pycnoxylic and manoxylic wood. Dendro - Chronology.

Unit-IV

Defects of wood - Knots - Reaction wood - Compression and tension wood - Cross-grain - variation in log form - shake - pitch pocket - Drying crack and Logging injury. Defects in seasoning and machining of wood, Defects due to weathering - Defects of wood due to fungi and insects.

Unit-V

Natural durability of wood - Wood preservation - Non-pressure processes - Pressure process - Chemical processing of wood - Commercial wood species and identification, Synthetic woods, Marine plywood, Fuel wood, pulp and paper making woods, match-stick wood. Economic importance of pulp and wood.

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Note: No Practical for this paper.

Core Course - X

CELL BIOLOGY, GENETICS AND PLANT BREEDING

Unit-I: CELL BIOLOGY

Structural organisation of the plant cell - Cell wall - primary and secondary - Plasma membrane - structure, models and functions, channels, pumps and receptors - plasmadesmata. Ultrastructures of Chloroplast and Mitochondria, Chloroplast and Mitochondrials genomes

Unit-II: CELL BIOLOGY

Structure and functions of Glyosomes, Peroxisomes, Spherosomes and Lysosomes. Ultrastructure of Nucleus, structure and organisation of Chromosomes. DNA types - Replication methods and DNA repair mechanisms. RNA types and functions - Genetic code - Lac operon and Trp operon - Programmed cell death (PCD).

Unit-III: GENETICS

Linkage and crossing over - Tetrad analysis - Sex determination in plants - Sex limited and sex linked intentence - Cytoplasmic inheritance - Male sterility, mechanisms, cytoplasmic, genetic and cytoplasmic and genetic male sterilities and applications.

Unit-IV: GENETICS

Mutation - Biochemical basis, induction, mutagenic agents - Physical and chemical mutagens, reverse and suppressed mutations. Polyploidy - types, induction, role in plant breeding. Population genetics - Hardy and Weingberg Law.

Unit-V: PLANT BREEDING

Genetic variability and its role in plant breeding - Breeding methods in self pollinated, cross pollinated, vegetatively propagated and apometic plants. Inbreeding depression - Role of heterosis and hybrid vigour in plant breeding. Plant breeding techniques. Somaclonal variation in crop improvement. RFLP in plant breeding.

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Core Course - XI

PLANT PHYSIOLOGY, BIOCHEMISTRY AND BIOPHYSICS

Unit-I: PLANT PHYSIOLOGY

Water relations of plants - Physicochemical properties of water, chemical potential and water potential in the plant, bulk movement of water, soil-plant atmosphere continuum, stomatal physiology and regulation.

Modern concepts of mineral salt absorption and translocation.

Photosynthesis: Photophysical and photochemical phase; Light reactions; sequence of photosynthetic pathway - Electron Transport Chain, Photophosphorylation. Pathways of CO_2 fixation.

Respiration: Photorespiration and dark respiration. Cycles of respiration, Oxidative Phosphorylation, Gluconeogenesis.

Unit-II: PLANT PHYSIOLOGY

Mechanism of nitrogen fixation, Nitrogen uptake and assimilation.

Plant growth regulators, their mode of action and effects.

Phytochrome and hormones in movements and flowering.

Physiology of Dormancy break. Senescence and aging.

Effect of water and salt stress on crop production.

Unit-III: BIOCHEMISTRY

Structure of atoms, molecules and chemical bonds. Chemistry of biological molecules.

Carbohydrates: Classification, structure of mono, di, oligo and polysaccharides.

Protein: Classification, structure and composition of amino acids.

Enzymes classification mode of action, km value, coenzymes, isoenymes. Reverse turn and Ramachandran Plot.

Unit-IV: BIOCHEMISTRY

Lipids: Classification, structure and properties of acyl lipids and phosphates. Biosynthesis of fatty acids.

Nucleic acids: Structure, composition, secondary metabolites: A general account. Biosynthesis and function of lignins, suberins, terpenes, phenols, alkaloids, flavonoids.

Unit-V: BIOPHYSICS

Bioenergetics, Energy and work. Laws of Thermodynamics. Energy transductions in biological systems. Redox potential, Redox couples, ATP bioenergetics, Order of reactions.

Photobiology: Dual nature of light, characteristics of solar radiation, solar energy - Efficiency of atoms - Absorption spectra in molecules, energy states, De-excitation.

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Biophysics

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Core Course- XII

PRACTICAL - III (Covering Core Courses X & XI)

Cell Biology, Genetics and Plant Breeding

- Squash and Smear techniques - Onion root tip and Rheo flower buds.
- Study of Karyotypes and Ideograms using suitable plant materials.
- Identification of DNA using Schiffs Reagent.
- Histochemical staining of DNA and RNA.
- Regulations of gene expression (with the help of models / charts)
- Detections of a plasmid containing foreign DNA (Diagramatic representation)
- Mapping a cloned gene on a cosmic vector (Diagramatic representation)
- Genetics practical will include working problems in genetics
- Emasculation, Crossing, Bagging.

Plant Physiology

- Determination of water potential in different tissues.
- Determination of chlorophyll-a, chlorophyll-b and total chlorophyll by the Arnon's method.
- Determination of carotenoids.
- Estimation of protein by Lowry's method.
- Estimation of total phenols.
- Hill reaction - demonstration.

Biochemistry

- Extraction and estimation of lipid
- Determination of reducing sugars in (grapes) fruit
- Estimation of amino acids by ninhydrin
- Separation and identification of amino acids by chromatography
- Separation of dyes by Paper/TLC methods
- Extraction of amylase and determination of its activity
- Determination of km-value, V-max, Michael's constant for amylase
- Determination of peroxidase activity.

Biophysics

- pH meter, Spectrophotometer, Centrifuge, Electrophoretic apparatus

Evaluation for CC-XII

- **Internal** (40 marks)
  - Practical skill : 10
  - Submission of observation notebooks: 10
  - Practical assessment by test : 10
  - Submission of Slides / Chart / Expt. Models : 10 = **40**
- **External** (60 marks)
  - Practical Examination : 50
  - Submission of Record Notebook : 10 = **60**

Core Course - XIII

RESEARCH METHODOLOGY

Unit-I

Choosing the problem for research - Review of Literature - Primary, Secondary and Tertiary sources - Bibliographs - Indexing and abstracting - Reporting the results of research in conference - Oral and Poster presentation.

Unit-II

Planning and preparation of thesis - Research journals - National and International monographs - Reprints - Proof correction - Full paper - Shoot Communication - Review Paper.

Unit-III

Biostatistics - Scope - Collection - Tabulation and classification of data - Probability analysis - Graphical diagrammatic representation - Mean, Median, Mode

Unit-IV

Standard Deviation - Standard Error - Test of significance - 't'-Test - Chi-square test - ANOVA Table - Simple Correlation - Regression.

Unit-V

Organisation to computer - CPU - Input and output devices - Memory - Internal and external storage memory - Knowledge about windows and its scientific applications (MS Office, Power Point, Excel) - Retrieval of information from internet.

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***Note*:** No Practical for this paper.

Core Course - XIV

BIOINSTRUMENTATION AND BIOLOGICAL TECHNIQUES

Unit-I

Microscopy - Principles and application of Light - Dark field - Phase contrast - Fluorescence - Polarization - Scanning and Transmission Electron Microscopy

Unit-II

pH meter - Centrifugation - Clinical, High speed, Micro and Ultra centrifuges - Colorimetry - UV visible - Spectrophotometer - Photometry - Flame photometer - Atomic Absorption Spectrophotometer, NMR, MASS.

Unit-III

Chromatography - Principles and applications of partition - adsorption - Ion Exchange - Affinity - Gel filtration - GLC, HPLC, GCMS.

Unit-IV

Radioactive isotopes - Half-life of isotopes - Tracer Techniques - Autoradiography - Counting of radioactivity - Scientillation Counter - GM counter - Electrophoresis - SDS PAGE - Agarose.

Unit-V

Fixation of plant materials: Fixation - Fixative - Dehydration - Clearing reagents - Embedding with wax - resins - sectioning. Stains and staining mechanisms - Natural and synthetic stains - Mountants. Microtome - rotary, wood and cryo types.

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***Note*:** No Practical for this paper.

Elective Course - I

INDUSTRIAL MICROBIOLOGY

Unit-I

General Introduction, history and development of industrial microbiology, scope of industrial microbiology. Microorganisms in industry - Sterilization - Preparation of media - Isolation methods for microorganisms - Culture and preservation and stability. Principles of storage of microbes at low temperature in liquid nitrogen, preparation of inoculum.

Unit-II

Principal types of fermentation: Factors involved in fermenter design, differences between biochemical and chemical processes; biochemical reactions, operational consideration. Fermenter configuration and various types of fermentors; principle of operation characteristics of fermentors.

Unit-III

Methylotrophs: Methanogens and methylotrophs, Mechanism of methane production - Economic importance of methylotrophs. Hydrogen fuel. Microbial leaching. Sulphur utilizing bacteria, sulphate reduction pathway - Use of nucleotides as nitrogen source for growth of certain microorganisms (pathway of nucleic acid breakdown).

Unit-IV

Microbial production of food; Microbial Single Cell Protein (SCP). Fermented dairy products, fermented meats, leavening of breads, alcoholic beverages - beer, distilled liquors and wines, vinegar; fermented vegetables, pickles, olives and soy sauce.

Unit-V

Production of pharmaceuticals: Antibiotics, Steroids, Human Proteins, Vaccines and Vitamins, Enzymes.

Antibiotics and their mode of action with reference to Penicillin, Streptomycin, Erythromycin, Cephalosporin and Griseofulvin.

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***Note*:** No Practical for this paper.

Elective Course - II

BIOTECHNOLOGY

Unit-I: BASIC TECHNIQUES OF GENETIC MANIPULATION

Basic techniques: Agarose gel electrophoresis, nucleic acid blotting, transformation of *E. coli*, polymerase chain reaction. Cutting and joining DNA molecules: Restriction enzymes, joining DNA molecules with DNA ligases, adaptors, homopolymer tailing, joining DNA molecules without DNA ligases.

Unit-II: PLASMIDS AND PHASE VECTORS

pBR322, Ti-plasmid Bacteriophage λ, single standard DNA vectors - phage M_{13}, cosmids, Phagemids BAC, YAC, Expression vectors, Shuttle vectors.

Unit-III: CLONING, SCREENING AND SEQUENCING STRATEGIES

Cloning strategies: Cloning genomic DNA - Genomic DNA libraries, PCR as an alternative to genomic cloning. Cloning - Properties cDNA libraries, preparation of cDNA for library construction, full-length cDNA cloning.

Unit-IV: SCREENING STRATEGIES

Sequence - dependent screening, screening by hybridization, probe design, chromosome walking, screening expression libraries - immunological, south-western, north-western blotting, RAPD, RFLP, DNA foot printing.

Unit-V: SEQUENCING STRATEGIES

Basic DNA sequencing - Chain terminator sequencing, automated sequencing, Whole genome sequencing - Analysis of sequence data, DNA sequence databases and data base searches, site-directed mutagenesis. Gene transfer to plants: Agrobacterium mediated transformation, direct DNA transformation - Protoplast transformation, particle bombardment, electroporation and microinjection.

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Elective Course - III

PLANT TISSUE CULTURE

Unit-I

Introduction - History, Scope and Concepts of basic techniques in plant tissue culture. Laboratory requirements and organisation. Sterilization-filter, heat and chemical. Media preparation - inorganic nutrients, organic supplements, carbon source, gelling agents, growth regulators and composition of important culture media (MS, Whites and Gamborg's media).

Unit-II

Cell, tissue and organ culture - Isolation of single cells, selection and types of cells, tissue explants and organs for culture - Paper, raft nurse technique, Plating method, Microchamber techniques, cell suspension cultures - batch, continuous, chemostat culture - Synchronization of suspension culture, cellular totipotency, Cytological, cytochemical and vascular differentiations - Totipotency of epidermal and crown - gall cells.

Unit-III

Micropropagation - Clonal propagation of elite germplasm, factors affecting morphogenesis and proliferation rate, technical problems in micropropagation.

Organogenesis - formation of shoots and roots - Role of growth regulators and other factors, somaclonal and gametoclonal variations.

Somatic embryogenesis - Process of somatic embryogenesis, structure, stages of embryo development, factors affecting embryogenesis, synthetic seeds.

Unit-IV

Haploid production - Androgenesis, gynogenesis - Techniques of anther culture - segmentation pattern in microspore - isolated pollen culture - plantlets from haploids - diploidisation - factors influencing androgenesis, haploidy through gynogenesis, haploid mutants, utilization of haploids in plant breeding.

In vitro pollination - ovule and ovary culture, importance, techniques overcoming incompatibility barriers, embryo rescue.

Protoplast culture: Isolation of protoplasts - mechanical and enzymatic sources, culture of protoplasts, viability. Protoplast fusion - Spontaneous, mechanical, induced electrofusion, selection of somatic hybrids, cybrids, importance.

Unit-V

In vitro production of secondary metabolities - Classification of secondary metabolites, biosynthetic pathways, cell suspension cultures, immobilized cell cultures and biotransformation, elicitors and hairy root culture.

Cryopreservation and gene bank - Modes of preservation, preparation of materials for deep freezing, cryopotectors, storage strategies, assessment of successful cryopreservation, application and limitations.

Application of tissue culture in forestry, horticulture, agriculture and pharmaceutical industry.

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Elective Course - IV

HORTICULTURE AND LANDSCAPING

Unit-I

Importance of scope of horticulture - Divisions of horticulture - Climate, soil and nutritional needs - Water irrigation - Plant propagation method - Cutting, layering, grafting, budding. Stock - scion relationship, micropropagation by induction of rooting.

Unit-II

Principles and methods of designing outdoor garden - hedges, edges, fences, trees, climbers, rockeries, arches, terrace garden - Lawn making and maintenance - Water garden - cultivation of water plants. Layout for a model college garden.

Unit-III

Indoor gardening - Foliage plants, flowering plants, hanging basket, Bonsai plants - Training and pruning.

Floriculture - Cultivation of commercial flower crops - Rose, Jasmine and Chrysanthemum, Flower decoration - Dry and wet decoration.

Unit-IV

Classification of vegetables, cultivation of important vegetable - Tomato, potato, onion, cabbage and snake guard. Layout for a model kitchen garden.

Unit-V

Fruit crops - Induction of flowering, flower thinning, fruit setting, fruit development. Cultivation of important fruit crops - Mango, Grapes and Guava. Cultivation of tree species - Eucalyptus and Teak.

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Note: **No Practical for this paper.**

Elective Course - V

FOOD PRESERVATION AND PROCESSING

Unit-I

Food Preservation: Principles and methods - Perishable, semi-perishable and non-perishable foods - Methods of preservation - Temporary preservation - Asepsis, low temperature, antiseptics, pasteurization, electromagnetic radiation - Permanent preservation - Sterilization processing by heat, effect of acidification and antiseptics.

Unit-II

Preservation by salting, Preservation by sugar syrup - Preservation by concentration - Preparation of Jam Jelly - Role of pectin in Jam - Preservation by chemicals: Benzoic acid, parabenzene, sulphur-di-oxide, sulphites, nitrites diethylpyrocarbonates (DEPC), hydrogen peroxide, chlorine and CO_2.

Unit-III

Processing - Methods - Wet heating method by cookers. Microwave heating method - Processing of fruits and fruit products - Canning of fruits - Preparation of fruit juices - Squashes - Cordials - Preservation by antibiotics and irradiation.

Unit-IV

Vegetable and vegetable products - Canning of vegetables and pickles. Baked products: Classification of wheat - hard wheat, soft wheat, durum wheat, flour preparation, baking formulation, processing. Milk and milk products: butter, ghee, lassi, unfermented milk products, condensed milk, cheese, ice-cream and milk powder.

Unit-V

Food additives: Definitions, preservatives, antioxidants - colouring agents, emulsifier, stabilizers and thickening, bleaching and maturing agents, clarifying agents, anti-foaming agents, function of additives. Food adulteration - Adulterants and simple detection techniques - Food grades - Standards, laws and regulations.

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***Note*:** No Practical for this paper.

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