Table - **3**: Common Course Structure for **P.G. Degree Programme in Science – M.Sc. (General)**[#](with effect from the academic year 2017-2018 onwards) M.Sc. BOTANY

Sem. (1)	Sub No. (2)	Subject Status (3)	Subject Title (4)	Contact Hrs./ Week (5)	Credits (6)
I	1	Core-1	**Algology and Bryology.**	6	4
	2	Core-2	**Mycology, Lichenology and Molecular Pathology.**	6	4
	3	Core-3	**Microbiology and Immunology.**	5	4
	4	Core-4	**Phytochemistry.**	5	4
	5	Core-5 **Practical - 1**	**Algology, Bryology,Mycology and Lichenology.**	4	2
	6	Core-6 **Practical – 2**	**Molecular Pathology Microbiology, Immunology and Phytochemistry.**	4	2
			Subtotal	**30**	**20**
II	7	Core-7	**Pteridophytes, Gymnosperms and Paleobotany**	5	4
	8	Core-8	**Genetics, Cell & Molecular Biology**	5	4
	9	Core-9	**Anatomy. Embryology and Morphogenesis**	4	4
	10	Core-10	**Entrepreneurship Botany**	4	4
	11	Core - 11	Field Work	4+	3
	12	Core-12 **Practical - 3**	**Pteridophytes, Gymnosperms,Paleobotany and Anatomy.**	4	2
	13	Core-13 **Practical - 4**	**Genetics, Cell & Molecular Biology, Embryology, Morphogenesis and Entrepreneurship Botany.**	4	2
			Subtotal	**30**	**23**

Sem. (1)	Sub. No. (2)	Subject Status (3)	Subject Title (4)	Contact Hrs./ Week (5)	Credits (6)
III	14	Core-14	**Taxonomy of Angiosperms and Economic Botany**	6	4
	15	Core-15	**Biochemistry and Biophysics**	6	4
	16	Core-16	**Computer Application and Bioinformatics**	5	4
	17	Core-17	**Research Methodology**	5	4
	18	Core-18 **Practical - 5**	**Taxonomy of Angiosperms, Economic Botany and Research Methodology**	4	2
	19	Core-19 **Practical - 6**	**Biochemistry, Biophysics, Computer Application and Bioinformatics**	4	2
			Subtotal	**30**	**20**
IV	20	Core-20	**Plant Physiology**	4	4
	21	Core-21	**Plant Ecology and Conservation Biology**	4	4
	22	Core-22	**Applied Biotechnology**	4	4
	23	Core-23 **Practical - 7**	**Plant Physiology and Applied Biotechnology**	4	2
	24	Core-24 **Practical - 8**	**Plant Ecology and Conservation Biology**	4	2
	25	**Elective - 1**	**ELECTIVE – Medicinal Botany and Dietetics**	3+	3
	26	**Core-25**	**Project**	7+	8
			Subtotal	**30**	**27**
			Total	**120**	**90**

+ Extra hours for the Project

For the Project, **f**lexible credits are b/w 5 – 8 &Hours per week are b/w 10 - 16.

Total number of credits ≥ 90 : 90

Total number of Core Courses : 25 (15 T + 8 P + 1 Prj. + 1 FW.)

Total number of Elective Courses / F.W. / S.T. : 1

Total hours : 120

CORE PAPER 1

PLANT DIVERSITY I - ALGOLOGY AND BRYOPHYTES

UNIT - I

General characters and interrelationships of Algae with other thallophytes. Classification of algae (Fritsch, 1935). A comparative study of the major groups – with special reference to their occurrence, thallus structure and life-history of: Chlorophyceae, Charophyceae, Bacillariophyceae, Phaeophyceae and Rhodophyceae and Cyanophyceae.

UNIT- II

Comparative account of pigments, cell wall components, reserve food, flagella, chromatophores, pyrenoids, eyespot and nucleus. Range of thalli diversity- Life-cycle patterns and alternation of generations.

UNIT- III

Economic importance of algae with special reference to food, industrial products and medicine. Role of algae in soil fertility. Algal blooms and Fossil algae.

UNIT - IV

General characters of Bryophytes and interrelationships. Classification of Bryophytes by Rothmaler (1951). General characters of major orders – Marchantiales, Jungermanniales, Anthocerotales, Sphagnales, Funariales and Polytrichales.

UNIT - V

Life cycle pattern and alternation of generations in Bryophytes. Origin of Bryophytes – Reproduction in Bryophytes. Fossil bryophytes with special reference to *Naiadita*. Ecological adaptations and economic importance of Bryophytes.

Practicals

Algae

Caulerpa, Ulva, Chara / Nitella, Padina, Dictyota, Turbinaria, Gracillaria, Oscillatoria and *Scytonema, and Anabaena.*

Bryophytes

Riccia, *Plagiochasma, Anthoceros, Funaria*

Record

To maintain a record note book for evaluation.

Field Trip

Algal collection trip and submission of 5 Herbarium Sheets.

Reference Books

1. The Algae-Chapman., V.J. & Chapman, D.J. Elbs and Macmillian, London, 1960.
2. Structure and Reproduction of the Algae. Vol. I & II., Fritsh, F.E. Camb. Univ. Press, 1965.
3. The Biology of the Algae., Round, F.W. Edward Arnold Publishers, London, 1973.
4. Text Book of Algae., Sharma, O.P. Tata McGraw Hill Publishing Co., New Delhi, 1986.
5. Introductory Phycology., Kumar, H.D. Affiliated East Press, NewDelhi.
6. The Algae – A review – Prescott, G.W. Bishen Singh & Mahendra Pal Singh, Dehra Dun and Otto Koelta Science Publishers, West Germany, 1969.
7. Text book of Algae – Sharma, O.P. Tata McGraw Hill Publishing Co., New Delhi, 1986.
8. Text Book of Botany, Algae (Revised edition), Pandey B.P., S. Chand & Co., New Delhi, 2000.
9. Text Book of Algae, Sharma, O.P., Tata McGraw Hill Publ. Co.Ltd., New Delhi, 1992.
10. Introduction to Phycology, South, G.R. & Whittick, A. Blackwell Scientific Publ., Oxford.
11. Botany for Degree students, Algae 9th revised edition, Vashista Sinha B.R., Singh, V.P., 2002, S. Chand & Co. Ltd., New Delhi.
12. . British Mosses and Liverworts – Watson, E.V. Cambridge, 1980.
13. Biology of Bryophytes-Chopra, R.N. and Kumar, P.K.Wiley Eastern Ltd., New Delhi, 1988.
14. Bryophytes – Prem Puri. Atma Ram & Sons, Delhi, 1981.
15. An introduction to Embryophyta Vol. II, Parihar, N.S., Central Book depot, Allahabad, 1967.
16. The Interrelationships of t
17. he Bryophyta – Cavers, F. Indian report S.N. Technico (Book House), Patna, 1981.

CORE PAPER 2

PLANT DIVERSITY – II MYCOLOGY, LICHENOLOGY AND MOLECULAR PLANT PATHOLOGY

UNIT - I

Classification of fungi proposed by Alexopoulous and Mims (1979). Morphology, structure, reproduction, and life history. General characters of fungi of the following: Mastigomycotina - Zygomycotina - Ascomycotina - Basidiomycotina and Deuteromycotina.

UNIT – II

Mode of nutrition - Reproduction and life cycle patterns. Homothallism and Heterothallism in fungi. Homokaryon and Heterokaryon. Parasexuality and heterokaryosis. Economic importance of fungi - food, medicine and biocontrol agents. Mycorrhizae - Structure and Symbiotic association. Types - Ectotrophic - endotrophic - application of mycorrhizae in agriculture.

UNIT – III

General account of Lichens. Classification of lichens by Miller (1984). Structure, nutrition and reproduction of the three major groups. Economic importance. Lichens as pollution indicators. Microchemical tests for lichens.

UNIT – IV

Concept of plant diseases - causes of plant diseases - role of environment and host nutrition, enzymes, toxins and growth regulators on pathogenesis. Symptoms and identification. Host-parasite interactions. Disease control methods - Cultural, Physical, Chemical and Biological methods.

Defense strategies - Morphological and Biochemical. Molecular basis of gene-for-gene hypothesis: R-gene expression and transcription profiling, cloning of resistance genes and marker-aided selection, pyramiding of R genes.

UNIT- V

Common plant diseases: Diseases of Cereal crops - wheat and rice; Pulse Crops - mung bean and pigeon pea; Oilseed crops - sunflower and groundnut and Cash crops like cotton and sugarcane.

Practicals

Fungi

Mucor / Pilobolus, *Agaricus, Xylaria, Polyporus, Puccinia.*

Lichens

Micropreparations of vegetative and reproductive parts of any foliose / fruticose lichens.

Mycorrhizae

Permanent microslides / photographs.

Molecular plant pathology

Etiology of diseases on wheat / rice, groundnut, sugarcane.

Any photographs / slides / phytochemicals relevant to molecular pathology (host - pathogen interactions).

To maintain a record note book for evaluation.

Reference Books

1. Introduction to Fungi. Webster, J. Cambridge University Press London, 1970.
2. Fungi., Srivastava, S., Pradeep Publications, Jalandhar, 1999.
3. The Biology of Lichens., Hale, M.E., Edward Arnold, Mayland. 1983.
4. Botany for Degree Students – Fungi, Vashista, B.R., S.C hand & Co., New Delhi, 1982.
5. College Botany Vol. I Fungi & Pathology, Pandey B.P., 1997.
6. A Text book of Plant Pathology, Bilgrami, K.S. & Dube, H.C., Vikas, New Delhi.
7. Plant diseases. Singh, R.S., Oxford & IBH, New Delhi.
8. A textbook of Fungi, Bacteria and Virus.1978. Dube, H., Vikas Publ.,
9. Mills Dallice *et al*., 1996. Molecular Aspects of Pathogenicity and Resistance: Requirement for Signal Transduction. APS, St Paul, Minnesota.
10. Parker, J. 2008. Molecular Aspects of plant Diseases Resistance. Blackwell Publ.
11. Gnanamanickam, SS (Eds). 2002. Biological Control of Crop Diseases. CRC Press, Florida.

CORE PAPER 3

MICROBIOLOGY AND IMMUNOLOGY

UNIT - I

Bacteriology: General characteristics - Classification (Bergey`s), Ultra structure of bacterial cell : Gram positive & Gram negative, Endospore, Staining methods-, Reproduction - Fission and sporulation. Isolation and cultivation of bacteria, Nutritional types. Bacterial growth- continuous & synchronous culture. Kinetics of growth. Determination of bacterial growth – Direct method: Haemocytometer - Viable plate count - Indirect method: Turbidity.

UNIT - II

Mycoplasma and Virology: Mycoplasma - structure and classification. Viruses - General characters, Classification, Structure, Multiplication. Viruses of Eukaryotes - Plant viruses. Viroids and prions. Bacteriophages- classification, - Lytic and lysogenic cycle

UNIT III

Food and Industrial Microbiology: The role of microorganisms in foods - Spoilage of fruits, vegetables, meats, poultry, eggs, bakery products, dairy products and canned foods - Food preservation - Introduction to industrial microbiology-- Microbiology of fermented milk products (Cheese, Yoghurt), beverages, wine and vinegar industry. Production of 1) organic acid- Acetic acid; 2) Enzyme- Amylase.

UNIT - IV

Environment and Agricultural Microbiology: Microorganisms in soil environments: Surface, subsurface and deep soil conditions. Microorganisms in various aquatic environments: Freshwater, Brackish-water, Marine - Microbes in the extreme environments and their adaptations. Indicator organisms. Microbial inoculants in agriculture: *Rhizobium*, *Pseudomonas*, BGA, - Microbial Herbicides- B*t* toxins.

UNIT- V

Immunology: Cells of the Immune System - Innate and Adaptive immunity - Antigens - Antigenicity and immunogenicity - B and T cell epitopes - Immunoglobulin: Structure, Function and Immunoglobulin classes. Antigen-Antibody reaction - Immune response during bacterial (Tuberculosis), parasitic (Malaria) and viral (HIV) infections, congenital and acquired immune-deficiencies.

Practicals

1. Preparation of culture media agar slant - agar plate.
2. Isolation of microbes by streak and pour plate method.
3. Isolation of soil microbes by serial dilution techniques.
4. Isolation and identification of Bacteria and Fungi from spoiled food.
5. Isolation of microbes from soil and water.
6. Gram staining of Bacteria.
7. Demonstration of bacterial mobility (Hanging drop method).

Reference books

1. Pelczar J.M., Chan E.C.S. and Kreig. R.N. 2008. Microbiology. 13th Reprint, Tata Mc Graw Hill Publishing Company Ltd, New Delhi.
2. G. Tortora, B. Funke and C. Case. 1995. Microbiology: An Introduction. 5th ed. Menlo Park, CA: Benjamin/Cummings.
3. J. Ingrahamand C. Ingraham. 1995. Introduction to Microbiology. Belmont, CA: Wadsworth.
4. Mathews, R.E.F., 1957. Plant Virology. Cambridge University Press. London.
5. Atlas, R.M. 2000. Microbiology - Principles of Microbiology. Mosby Year Book Inc, Missouri.
6. Black, J. 2007. Microbiology - Principles and Explorations. 7th Edition, Prentice Hall International, Inc, New York.
7. Brock, T.D. 2000. Biology of Microorganisms. 9th edition, Southern Illinois University, Carbondale.
8. Prescott, L.M., Harley, J.P. and Klein, D.A. 1996. Microbiology.3rd Edition, W.M.C. Brown Publishers, Chicago.
9. Salle, A.J. 1997. Fundamental Principles of Bacteriology. 7th Edition, Tata Mc Graw Hill Publishing Company Ltd, New Delhi.
10. Vijaya Ramesh, K. Food Microbiology, MJP, Chennai Immunology.
11. Kannan,T. Immunology, MJP, Chennai.
12. Mark Wheelis, 2010. Principles of Modern Microbiology, Jones and Bartlett, Cannada.
13. Richard, A., Godsby., Thomas, J., Kundf. Barbare A and Osborne, 2000. Kuby - Immunology W.H. Freemen and Company.
14. Rao C.V. A Text Book of Immunology, 2011. Narosa Publication House, NewDelhi.

CORE PAPER 4

PHYTOCHEMISTRY

UNIT- I

Phytochemistry - Scope of Phytochemistry. Importance in pharmaceuticals industry. Preparation of plant extracts - maceration, infusion, digestion, decoction, percolation, sonication, hot continuous extraction, aqueous alcoholic extraction, superficial fluid extraction and counter-current extraction. Parameters for selecting appropriate extraction method.

UNIT - II

Secondary metabolites - definition, classification, preliminary phytochemical screening by chemical test. Methods for separation and isolation of constituents. Synergy and polyvalent action of phytomedicines.

UNIT- III

Flavonoids: Definition, properties, classification, natural sources and therapeutic applications of flavonoids: Flavones, Flavanones Flavonols, anthocyanins. Alkaloids-Ephedrine, Serpentine and Morphine. Carotenoids-α and β-carotenes

UNIT - IV

Glycosides: Definition, properties, classification, natural sources, pharmacological and toxicological effects of glycosides. Terpenoids- β-Sitosterol, Glycyrrhizin. Phenolics - Coumarins and Tannins.

UNIT - V

Volatile oils - source, constituents, properties, extraction and utilization of Sandal wood oil, Lemon grass oil, Vetiver oil, Clove oil and Eucalyptus oil. Medicinal uses of resins.

Reference Books

1. Gurdeep Chatwal, 1983. *Organic Chemistry of Natural Products*, Himalaya Publishing House, Mumbai.
2. Jean Bruneton, 1999. *Pharmacognosy,* Second Edition, Lavoisier Publishers, Inc. USA.
3. Kokate, C.K., Purohit, A. P and Gokhale, S.R. 2004. *Pharmacognosy*, Nirali Prakashan Publications, Pune.
4. Nitin Suri, 2010. *Phytochemical Techniques*, Oxford Book Company.

5. Roseline, A. 2011. *Pharmacognosy*, MJP Publishers, Chennai.
6. Rumit M Shah and Rupesh T Nayak, 2012. *Pharmacognosy*, Global Academic Publishers, New Delhi. (Part I and Part II).
7. Wallis, T.E. 1985. *Text Book of Pharmacognosy*, CSB Publishers, New Delhi.
8. William Charles Evans, 2002. *Pharmacognosy*, Fifteenth edition, Harcourt Brace & Company, Asia Pvt. Ltd.

Practicals

1.Quantification of Antioxidants in the given samples:

A. Estimation of flavonoids, B. Estimation of Ascorbic acid, C. Estimation of β-Carotene

2.Preliminary Phytochemical Test:

A. Alkaloids, B. Tannins, C. Phenols, D. Glycosides and E. Saponins

3.Spotters- Photographs/images of oil extraction, structure of : Ephedrine, coumarins, β-Sitosterol, Glycyrrhizin

II SEMESTER

CORE PAPER 7

PLANT DIVERSITY – III. PTERIDOPHYTES, GYMNOSPERMS AND PALEOBOTANY

UNIT - I

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: *Rhynia, Lepidodendron, Sphenophyllum, Calamites*.

UNIT-II

Range of morphology, structure, reproduction and evolution of gametophytes and sporophytes of the following**:** *Angiopteris, Lygodium, Isoetes, Equisetum, Ophioglossum, Pteris, Polypodium, Salvinia, Marselia* and *Azolla*.

UNIT - III

Stelar evolution in Pteridophytes. Heterospory and origin of seed habit. Structure, development and evolution of sori and Telome theory. Economic importance of Pteridophytes.

UNIT - IV

A general account of the characteristic features of Gymnosperms. Origin of Gymnosperms. Classification of Gymnosperms (Sporne, 1965). General account of *Williamsonia*.

General account on the distribution, morphology, anatomy, reproduction and phylogeny of *Cycas, Araucaria, Ginkgo, Taxus, Ephedra, Gnetum.* Economic importance of Gymnosperms.

UNIT - V

Concepts of Palaeobotany, A general account on Geological Time Scale. Techniques for palaeobotanical study. Fossil types: Compressions, incrustation, casts, molds, petrifactions, coalballs and compactions.. Systematic and Nomenclature of fossil plants. Palaeoclimates and fossil plants. Role of fossil in oil exploration and coal excavation.

Practicals

Pteridophytes

Selaginella, Isoetes, Pteris, Adiantum, Salvinia and *Azolla*.

Fossil slides: *Rhynia, Lepidodendron, Sphenophyllum, Calamites*.

Gymnosperms

Cycas, Araucaria, Ginkgo, Taxus, Ephedra.

Fossil slides: *Lyginopteris, Heterangium, Cordaites* and *Medullosa*.

Prepration of double stained permanent slides each one from Pteridophytes and Gymnosperms

Reference Books

1. Parihar, N. S. 1985. The Biology and Morphology of Pteridophytes. Central Book Depot, Allahabad.
2. Rashid, A. 1986. An Introduction to Pteridophyta. Vani Educational Books, New Delhi.
3. Sharma, O. P. 1990. Text Book of Pteridophyta. Macmillan India Ltd., India.
4. Smith, G. M. 1971. Cryptogamic Botany. Vol. II. Bryophytes and Pteridophytes. Tata McGraw Hill, New Delhi.
5. Sporne, K.R. 1972. The Morphology of Pteridophytes. B.I. Publications, Madras.
7. Sundararajan, S. 2007. Introduction to Pteridophyta. New Age International Publishers, New Delhi.
8. Vashishta, P. C. *et al*., 2008. Botany for Degree Students: Pteridophyta. S. Chand and Co. Ltd., New Delhi.
9. Chamberlain, C.J. 1957. Gymnosperms Structure and Evolution. University Chicago Press, New York.
10. Sporne, K.R. 1974. The Morphology of Gymnosperms. B.I. Publications, New Delhi.
11. Vasishta, P.C. *et al*., 2006 Botany for Degree Students: Gymnosperms. S. Chand and Co. Ltd., New Delhi.
12. Arnold, C.A. 1947. An introduction to Paleobotany. McGraw Hill Book Co.
13. Nikias, K.J. 1981 Palaeobotany, Palaeoecology and Evolution. Praeger Publishers, USA.
14. Seward, A.C. 1919. Fossil Plants. Vol. I, II, III and IV. Cambridge University Press, London.

CORE PAPER 8

GENETICS, CELL AND MOLECULAR BIOLOGY

UNIT - I

Structure and functions of nucleus, nuclear envelope and nucleolus. Chromosomes. Cell cycle, Cell divisions: Mitosis-mitotic apparatus and its physiochemical characteristics and biochemical composition. Meiosis.

Sex determination in plants - theories of sex determination. Sex linked characters-primary, secondary and permanent. Sex- influenced and sex limited characters. Molecular basis of mutation- physical and chemical mutagens and their mode of action. Gene mutation.

UNIT - II

DNA- types (A, B, C & Z), Watson and Crick model of DNA, viral DNA, bacterial DNA, Mitochondrial and Chloroplast DNA. Dissociation and re-association kinetics of DNA, cot value, rot value and its significance. DNA synthesis and replication (prokaryote and eukaryote)-Enzymes involved, origin of replication, priming, DNA polymerases. Methylation of DNA.

UNIT - III

Damage and DNA repair mechanism – photo reactivation – excision repair - mismatch repair. Genetic recombination- generalised - site specific. Molecular mechanism-Holliday model. Lysogenic and lytic cycle - Bacterial Transformation - Transduction and Conjugation.

UNIT - IV

RNA-synthesis- types. RNA polymerases-role. Transcription-(Prokaryote, Eukaryotes), Initiation, elongation, termination, post transcriptional changes in RNA. Genetic code, Wobble hypothesis. Translation - ribosome assembly, formation of initiation complex, initiation factors, elongation and termination, translational inhibitors.

UNIT - V

One gene one enzyme hypothesis. Modern concept of genes. Fine structure of the gene - pseudoalleles. IS Element-transposons. Operon concept, *trp o*peron, *gal* operon. Positive and negative control - Catabolite Repression, Gene Regulation in Eukaryotes. Gene silencing.

Practicals

Solving problems involving:

1. Simple Molecular biology problems based on the theory syllabus.
2. Interactions of genes.
3. Chromosome mapping from test cross data.
6. Sex determination, Sex linked inheritance.
7. Identification of different stages of meiosis from suitable plant material.
8. Interpretation of micrographs.
9. Study of mitotic index from suitable plant material

Molecular Biology (demo)

1. Isolation of plant genomic DNA and its quantification by UV- spectrophotometric method.
2. Isolation of RNA and its quantification by UV - spectrophotometric method.

Spotters

Cot curve, DNA melting curve, Karyotype and idiographic analysis.

Reference Books

1. Benjamin Lewin, 2004. Genes VIII. Pearson Prentice Hall.
2. Channarayappa, 2006. Molecular Biology. Principles and Practices. Universities Press (India), Pvt. Ltd., Hyderabad.
3. David Freifelder, 2006. Molecular Biology. Narosa Publishing House, Madras, New Delhi.
4. Gupta, R.K. 2006. Genetics. Rastogi Publications.
5. Nicholl, DST, 2001. An Introduction to Genetic Engineering. Cambridge University Press.
6. Old, R.N. and Primrose, S.B. 2004. Principle of Gene Manipulation. Blackwell Scientific Publication, USA.
7. Power, C.B. 2007. Genetics Vols I & II. Himalaya Publishing House. Kundanlal Chandak. Industrial Estate. Ghat Road. Nagpur.
8. Satyanarayana, U. 2006. Biotechnology. Books and Allied (p). Ltd. Kolkatha.
9. Russel, P.J. 2010. iGenetics. Benjamin Cummings, Sanfransisco Boston NewYork.
10. Turner, P., A. McLennan, A. Bates, M.White, 2005. Instant notes Molecular Biology, Third Edition, Taylor & Francis.
11. Avinash Upadhyay and Kakoli Upadhyay, 2005. Fundamentals of Molecular Biology. First edition, Himalaya Publishing House.

CORE PAPER 9

ANATOMY, EMBRYOLOGY AND MORPHOGENESIS

UNIT - I

Meristem - Classification of meristems - apical meristem. Organization of shoot apical meristem (SAM) and root apical meristem (RAM). Cell to cell communication. Programmed Cell Death (PCD) - Vascular cambium - origin, structure, seasonal activity.

UNIT - II

Xylem, Phloem and their elements - primary and secondary structures. Secondary growth - periderm - structure development of lenticels. Anomalous secondary growth.

UNIT - III

Wood anatomy - physical, chemical and mechanical properties. Defects in wood - natural defects, knots and defects due to diseases. Reaction wood - Tension and Compression wood - Durability of wood. Ontogeny of dicot and monocot leaves. Kranz anatomy. Development of stomata, trichome development and Dendrochronology.

UNIT - IV

Microsporogenesis - Pollen wall, Pollen development Pollen storage, Pollen allergy, Megasporogenesis. Fertilization - barriers of fertilization. Endosperm - Types and haustoria. Organogenesis of dicot and monocot embryo. Apomixis and Polyembryony.

UNIT - V

Plant Morphogenesis - Definition – Polarity - as expressed in external and internal structures and in isolated cells. Symmetry - types. Differentiation as expressed in structure - effect of environment on differentiation - Factors controlling morphogenesis.

Practicals

Anomalous activity of cambium in *Boerhaavia, Bougainvillea, Achyranthes* and *Dracaena.*

Wood anatomy –any 4 common timbers (T.S, T.L.S and R.L.S)

Leaf anatomy - C_3 (rice) & C_4 – (*Cynodon*, *Zea mays*).

Dissection of globular / Cordate stage of embryos and endosperm haustorium from suitable seed.

Reference Books

1. Brown *et al.*, 1981. Text book of wood Technology Mc Graw Hill.

2. Clowers, F.A.L. 1961. Apical Meristems. Blackwell scientific Publication, oxford.
3. Cutter, E.G. 1978.Plant Anatomy, Edward Arnold Publishers Ltd; London.
4. Easu, K. 1953. Plant Anatomy. John Wiley& sons Inc; New York.
5. Fahn, A.1989. Plant Anatomy. Maxwell Pvt. Ltd., Singapore.
6. Metcalfe and Chalk. 1950. Anatomy of the Dicotyledons and Monocotyledons. Vol. I and II. Clarendon Press, oxford, U.K.
7. Singh, V., Pande, P.C and Jain, D.K.1987. Anatomy of seed plants. Rastogi Publications, Meerut.
8. Agarwal, S.B. 1990. Embryology of Angiosperms - a fundamental approach. Sahitya Bhawan, Agra.
9. Bhojwani S.S and Bhatnagar, S.P. 1981. Embryology of Angiosperms. Vikas Publishing House Pvt. Ltd., New Delhi.
10. Dwivedi, J.N.1998. Embryology of Angiosperms. Rastogi Publications, Meerut.
11. Maheswari, P. 1965. An Introduction to Embryology of Angiosperms. International Society of Plant Morphologies, University of Delhi.
12. Bard, J.1990. Morphogenesis. Cambridge University Press, London.
13. Bonner. J.T. 1965. Morphogenesis. Oxford & IBH Publications, Bombay.
14. Bryant, J.A and Francis, D. 1985.The Cell Division cycle in plants. Cambridge University Press, London.

CORE PAPER 10

ENTREPRENEURSHIP BOTANY

UNIT - I

Gardening: History, scope and importance of gardening - Types of Gardening: Water garden (Aqua Garden), Desert and Rock Garden (Xeric Garden), Kitchen Garden, Landscape Garden. Cultivation: Topiary, Bonsai, Nursery practices, Management and Marketing of garden plants.

UNIT - II

Olericulture and Floriculture: Major Vegetables of Tamilnadu- Onion & Brinjal. **Floriculture**: Aromatic flowers. Indoor cultivation of Flowers. Green, Poly and Glass Houses. Outdoor cultivation of Flowering Plants - *Rosa, Chrysanthemum,* and *Jasmine* Flower arrangement, cut flowers, Bouquet Making. Industrial uses of Flowers - Dyes preparation from flowers. Marketing Avenues.

UNIT - III

Organic Farming: Historical Account of Organic Farming - Impact of organic farming in the current scenario. Bio Composting - *Azolla* Cultivation. Vermicomposting - methods - Vermi Marketing.

UNIT – IV

Mushroom Cultivation: Brief History - Scope of Mushroom Cultivation of Paddy straw and Oyster mushroom - Medicinal and Nutritional value of mushrooms. Pathology of Mushrooms. Harvesting and Post harvesting technology - Marketing, Packing, Storage and recipes.

UNIT - V

Entrepreneurship - funding agencies (NABARD), Rural Banking, FAO, TNAU, - STEP (Science & Technology Entrepreneurship Programme) - Govt and NGO's, Yojana Schemes. Entrepreneurship Development Programme (EDP). Need and their significance.

Reference Books

1. Don Ellison, 2002. Garden Plants of the world. New Holland Publishers. V.K.
2. Valerie Bradley, 2006. The complete guide to House Plants. Readers Digest, New York.
3. Geoff Hamilton, 1993. Gardens of World - Practical Gardening Course, BCA London.

4. Reader's Digest Guide to Creative Gardening 1984, London.
5. Collin Levis 1997. Bonsai - A Care Manual. Chancellor Press London.
6. Anna Pavord, 1996. The New Kitchen Garden. Dorling Kindersley London.
7. Peter Mc Hoy., Barbara Segall and Stephanie Donaldson. 1997. Practical Small Gardening.
8. Pratibha Trivedi. 1996. Home Gardening ICAR, New Delhi.
9. Jane Fearnley 1995. Gardening Made Fast, Wedenfeld London.
10. Vijaya Ramesh, K. 2007. Food Microbiology, MJP Publisher, Chennai.
11. Suresh Gopalani, 2011. Fundamentals of Applied Nutrition.
12. Sumathi R. Mudambi, Shalini Roa, M.V. Raja Gopal, 2006. Food Science New Age International (P) Ltd., New Delhi.
13. Mridula Mirajkar and Sreelata Menon Food Science and Processing Technology (Vol. I &II) Kanishka Publishers, New Delhi.
14. Dhinesh kumar, 2009. Food Service and Catering Management Omega Publishers, New Delhi.
15. N.K. Jain 2011. Fundamentals of Food Science Technology Processing and Preservation. Cyber Tech Publications.
16. Ramani, A.V. 2009. Food Chemistry MJP Publishers, Chennai.
17. Hard, H.E. 2013. The Mushroom, MJP Publishers, Chennai.
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Note :

1. Students may be encouraged to visit TNAU / 1CAR Research Stations.
2. Visiting websites.
3. Referring News Letter / Booklets of CSIR, TNAU, DBT.
4. Recommended Readings:- Velan Ulagam / Naveena Velanmai, Pasumai Vikadan, Tholil Nutpu, Thottakkalai, Herbal Bio Tech., and Hindu Survey of Agriculture.

Practical:(spotters)

1.Kitchen garden/water garden/Rockery

2.Green house/Polyhouse/Glass house

3.Organic farming-Azolla cultivation/Vermicompost

4.Mushroom cultivation- Paddy straw/Oyster mushroom

5.Note on Funding agencies – EDP/NABARD