

M.Sc. Botany Curriculum
Maharaja Suhel Dev State University
Azamgarh

Academic Year 4th (Semester VII) Bachelor Research in Botany			
Paper Code	Title of the Paper/Course	Category of Paper/Course	Credits
B040701T	Microbiology	Compulsory	4
B040702T	Phycology and Bryophytes	Compulsory	4
B040703T	Pteridophytes and Gymnosperms	Compulsory	4
B040704T	Cell Biology	Compulsory	4
B040705P	Practical	Compulsory	4
	Minor Elective Paper from other Faculty	Compulsory	4
	Major Research Project	Compulsory	4
Semester Credits			28
Minor Elective Paper can be taken either in VII semester or in VIII Semester			

Academic Year 4 th (Semester VIII) Bachelor Research in Botany				
Paper Code		Title of the Paper/Course	Category of Paper/Course	Credits
B040801T		Plant Anatomy and Developmental Biology	Compulsory	4
B040802T		Taxonomy of Angiosperms	Compulsory	4
B040803T	Group A	Genetics and Genomics	Elective	4
B040804T		Plant Pathology	Elective	4
B040805T	Group B	Mycology	Elective	4
B040806T		Palaeobotany and Palynology	Elective	4
B040807P		Practical	Compulsory	4
		Major Research Project	Compulsory	4
Semester Credits				24
Cumulative Credits of Semester VII and VIII				52
Students have to select both papers from any group from given two Elective groups				

Academic Year 5 th (Semester IX) Master of Science in Botany				
Paper Code		Title of the Paper/Course	Category of Paper/Course	Credits
B040901T		Plant Physiology and Biochemistry	Compulsory	4
B040902T		Plant Biotechnology and Molecular Biology	Compulsory	4
B040903T	Group A	Plant Resource Utilization and Conservation	Elective	4
B040904T		Soil Science and Phytogeography	Elective	4
B040905T	Group B	Microbial Biotechnology	Elective	4
B040906T		Economic Botany	Elective	4
B040807P		Practical	Compulsory	4
		Major Research Project	Compulsory	4
Semester Credits				24
Cumulative Credits from Semester VII to IX				76
Students have to select both papers from any group from given two Elective groups				

DR. ABDULLAH
(Convenor)

1
Prof. M. J. Beg
(Member)

DR. M. A. Beg
(Member)



Academic Year 5 th (Semester X) Master of Science in Botany				
Paper Code		Title of the Paper/Course	Category of Paper/Course	Credits
B0401001T	Group A	Plant Ecology	Elective	4
B0401002T		Water Resource Management	Elective	4
B0401003T	Group B	Environmental Management and Technology	Elective	4
B0401004T		Cytogenetics, Plant Breeding and Biostatistics	Elective	4
B0401005T	Group C	Computer Application and Bioinformatics	Elective	4
B0409106T		Forest Ecology	Elective	4
B0401007P		Practical	Compulsory	4
		Major Research Project	Compulsory	4
Semester Credits				24
Cumulative Credits for All Semesters (VII to X)				100
Students have to select both papers from any two groups from given three Elective groups				

Students have to select both papers from any two groups from given three Elective groups

Academic Year 4 th (Semester VII) Bachelor Research in Botany			
Credits=04	Compulsory	Unit-I	Paper-I (Theory)
		Basis of bacterial classification, Bacterial isolation: Serial dilution and enrichment culture techniques. Maintenance and preservation of Bacterial culture. Unit- II Genetic analysis of Bacteria; conjugation, transformation and transduction: Lytic and Lysogenic. Transposons; types of transposons. Nitrogen metabolism; ammonification, nitrogen fixation nitrification and denitrification, Commercial use of bacteria. Unit -III Classification of plant viruses, characteristics and ultrastructure of viruses; Isolation, purification and characterization of Viruses. Chemical nature, replication, transmission of viruses, economic importance. Unit-IV General symptoms of Viral infection, Phytoplasma General characteristics and its role in causing plant disease.	
Microbiology (B040701T) Suggested Readings: <ol style="list-style-type: none"> 1. Madigan MT, Martinko JM, Bender KS, Buckley DH, Stahl DA (2014) Brock Biology of Microorganisms, 14 th edition, Benjamin Cummings, New York. 2. Stanier RY, Ingraham JL, Wheeels ML, Painter PR (1987) General Microbiology, 5th edition, MacMillan, Press Ltd, New Jersey. 3. Talaro KP, Chess B (2011) Foundations in Microbiology, 8th edition, McGraw-Hill, New York. 4. Willey JM, Sherwood L, Woollerton CJ (2013) Prescott's Microbiology, 9th edition, McGraw-Hill, New York. 5. Pelczar M.J, Chan E.C.S. and Krieg N.R. (2003) Microbiology. 5th Edition, Tata McGraw-Hill Publishing Company Limited, New Delhi. 6. McGraw-Hill Publishing Company Limited, New Delhi. Practicals; <ol style="list-style-type: none"> 1. Introduction to basic Microbiological Techniques and Lab safety. 2. Methods of sterilization, media preparation and culturing. Staining of Gram + ve and Gram - ve Bacteria Isolation and identification of bacteria from sewage, soil, decaying fruits and vegetables.			
Credits=04	Compulsory	Unit - I	Paper-II(Theory)
Principle of important system of classification of algae upto the rank of Classes. Algal reproduction and Life Cycle General, Economic and environmental aspect of algae. Algal Pigmentation. Unit- II General characters, occurrence, habitat, Cellular Organization, reserve food material and reproduction in the following classes.			

Phycology and Bryophytes (B040702T)	<ul style="list-style-type: none"> • Cyanophyceae; <i>Gloeothelella</i>, <i>Oscillatoria</i>, <i>Nostoc</i> and <i>Scytonema</i> • Chlorophyceae; <i>Chlorella</i>, <i>Hydrodictyon</i>, <i>Cladophora</i>, <i>Oedogonium</i> and <i>Chara</i>. • Phaeophyceae; <i>Ectocarpus</i>, <i>Dictyota</i> and <i>Laminaria</i>. • Rhodophyceae; <i>Batrachospermum</i>, <i>Polysiphonia</i> and <i>Gelidium</i>. • Xanthophyceae; <i>Botrydium</i> and <i>Vaucheria</i> • Bacillariophyceae; <i>Navicula</i>. <p>Unit – III</p> <p>Bryophytes: Origin and evolution of sporophytes, Classification, Geographical distribution, economic importance of bryophytes</p> <p>Unit-IV</p> <p>Comparative study of Morphology anatomy life history, Classification and phylogeny of Hepaticopsida; <i>Marchantia</i>, <i>Pellia</i>, <i>Porella</i>, <i>Plagiochasma</i> and <i>Takakia</i>, <i>Anthocerotopsida</i>; <i>Anthoceros</i> and <i>Notothylus</i> and <i>Bryopsida</i>; <i>Sphagnum</i> <i>Funaria</i>, <i>Polytichum</i>, Fossil Bryophytes.</p>		
Suggested Readings	<ol style="list-style-type: none"> 1. Puri P (1980). Bryophytes. Alma Ram & Sons, New Delhi. 2. Kumar HD (1988). Introductory Phycology. Affiliated East-West Press Ltd., New Delhi. 3. Morris J (1986). An Introduction to the Algae. Cambridge University Press, U.K. 4. Round FE (1986) The Biology of Algae. Cambridge University Press, U.K. 5. An Introduction To The Algae By Ian Morris 6. The Algae By V.I.D.J Chapman 7. The Structure And Reproduction Of Algae By F.E Fritsch 8. Phycology By Robert Edward Lee 9. Algae An Introduction to The Phycology By Hoek Christian Van Den 10. An Introduction To The Study Of Algae By V.J Chapman 11. Algae Anatomy Biochemistry, And Biotechnology By Laurabarsanti, Paoloqualteri 12. Diversity Of Microbes And Cryptogams, Algae By O.P.Sharma 13. An Introduction to Phycology by G.R. Soult, A.Whitlick. 		
Practicals	<ol style="list-style-type: none"> 1. Identification of the genera mentioned in Cynophyceae, Chlorophyceae, Bacillariophyceae, Xanthophyceae, Phaeophyceae and Rhodophyceae. 2. Identification of bloom forming algae. 3. Identification of Algal biofertilizers and toxic algae. 4. Morphological and anatomical structure of Bryophytes genera mentioned in class Hepaticopsida. Anthocerotopsida and Bryopsida. 5. Study of Sporophytes of the following genera. <i>Anthoceros</i>, <i>Funaria</i> and <i>Marchantia</i>. 		
Credits=04	Compulsory	Unit-I	Paper-III(Theory)
Pteridophytes and Gymnosperms (B040703T)	<p>Classification and origin of Pteridophytes: The vegetative sporophytes; stellar theory: Telome theory: The fertile sporophytes: sporangia; position, ontogeny. Types, structure. Heterospory and Seed. habit: Occurrence, cause and significance.</p> <p>Unit-II</p> <p>The gametophytes: Germination of fern spores, development of fern prothallus; Comparative study of Psilophyta; (<i>Psilotum</i>), Lycopsidea; (<i>Lycopodium</i>) and (<i>Selaginella</i>), Sphenopsida; (<i>Equisetum</i>), and Pteropsida; (<i>Nephrolepis</i>) and (<i>Marsilea</i>).</p> <p>Apospory and Apogamy.</p> <p>Unit-III</p> <p>Classification of Gymnosperms up to the rank of orders.</p> <p>General account of the Fossils of Medullosaceae (<i>Medullosa</i>), Pentoxylales (<i>Pentoxylon</i>), Cordiales (<i>Cordiales</i> sp.)</p> <p>Unit-IV</p> <p>General account of the following groups with special reference to the genera indicated in brackets: Ginkgoales (<i>Ginkgo biloba</i>), general anatomy, cone organization, life history and distribution, Ephedrales (<i>Ephedra</i> sp.) Gnetales (<i>Gnetum</i> sp.) and Welwitschiales (<i>Welwitschia</i> sp.)</p>		

**Phycology
and
Bryophytes
(B040702T)**

- Cyanophyceae; *Gleotrichia*, *Oscillatoria*, *Nostoc* and *Scytonema*
- Chlorophyceae; *Chlorella*, *Hydrodictyon*, *Cladophora*, *Oedogonium* and *Chara*.
- Phaeophyceae; *Ectocarpus*, *Dictyota* and *Laminaria*.
- Rhodophyceae; *Batrachospermum*, *Polysiphonia* and *Gelidium*.
- Xanthophyceae; *Botrydium* and *Vaucheria*
- Bacillariophyceae; *Navicula*.

Unit – III

Bryophytes: Origin and evolution of sporophytes. Classification, Geographical distribution, economic importance of bryophytes

Unit-IV

Comparative study of Morphology anatomy life history, Classification and phylogeny of Hepaticopsida; *Marchantia*, *Pellia*, *Porella*, *Plagiochasma* and *Takakia*, *Anthocerotopsida*; *Anthoceros* and *Notothylus* and *Bryopsida*; *Sphagnum* *Funaria*, *Polytrichum*, Fossil Bryophytes.

Suggested Readings

1. Puri P (1980). Bryophytes. Atma Ram & Sons, New Delhi.
2. Kumar HD (1988). Introductory Phycology. Affiliated East-West Press Ltd., New Delhi.
3. Morris J (1986). An Introduction to the Algae. Cambridge University Press, U.K.
4. Round FE (1986) The Biology of Algae. Cambridge University Press, U.K.
5. An Introduction To The Algae By Ian Morris
6. The Algae By V.J.DJ Chapman
7. The Structure And Reproduction Of Algae By F.E Fritsch
8. Phycology By Robert Edward Lee
9. Algae An Introduction to The Phycology By Hoek Christian Van Den
10. An Introduction To The Study Of Algae By V.J Chapman
11. Algae Anatomy Biochemistry, And Biotechnology By Laurabarsanti, Paologualtieri
12. Diversity Of Microbes And Cryptogams, Algae By O.P.Sharma
13. An Introduction to Phycology by G.R. South , A.Whittick.

Practicals

1. Identification of the genera mentioned in Cynophyceae, Chlorophyceae, Bacillariophyceae, Xanthophyceae, Phaeophyceae and Rhodophyceae.
2. Identification of bloom forming algae.
3. Identification of Algal biofertilizers and toxic algae.
4. Morphological and anatomical structure of Bryophytes genera mentioned in class Hepaticopsida. Anthocerotopsida and Bryopsida.
5. Study of Sporophytes of the following genera.
Anthoceros, *Funaria* and *Marchantia*.

Credits=04	Compulsory	Paper-III(Theory)
Pteridophytes and Gymnosperms (B040703T)	Unit-I	
	Classification and origin of Pteridophytes; The vegetative sporophytes; stellar theory: Telome theory: The fertile sporophytes: sporangia; position, ontogeny. Types, structure. Heterospory and Seed habit: Occurrence, cause and significance.	
	Unit-II	
	The gametophytes: Germination of fern spores, development of fern prothallus; Comparative study of Psilophyta; (<i>Psilotum</i>), Lycopoda; (<i>Lycopodium</i>) and (<i>Selaginella</i>), Sphenopsida; (<i>Equisetum</i>), and Pteropsida; (<i>Nephrolepis</i>) and (<i>Marsilea</i>). Apogamy and Apogamy.	
	Unit-III	
	Classification of Gymnosperms up to the rank of orders. General account of the Fossils of Medullosaceae (<i>Medullosa</i>), Pentoxylales (<i>Pentoxylon</i>), Corditales (<i>Cordaites</i> sp.)	
	Unit-IV	
	General account of the following groups with special reference to the genera indicated in brackets: Ginkgoales (<i>Ginkgo biloba</i>), general anatomy, cone organization, life history and distribution, Ephedrales (<i>Ephedra</i> sp.) Gnetales (<i>Gnetum</i> sp.) and Welwitschiales (<i>Welwitschia</i> sp.)	

Suggested Readings:

1. Bhatnagar SP, Moitra A (1996) Gymnosperms, New Age International Ltd Publication, New Delhi.
2. Parihar NS (1973) An Introduction to Embryophyta, Vol I (Bryophyta) and Vol II (Pteridophyta), Central Book Department, Allahabad.
3. Parihar NS (1996). The Biology and Morphology of Pteridophytes. Central Book Depot, Allahabad.
4. Rashid A (2011) An Introduction to Pteridophyta, 2 nd edition, Pub Vikas Publishing House Pvt Ltd, Noida.
5. Sambamurty AVSS (2005) A Textbook of Bryophytes, Pteridophyte
6. Sporne KR (1965). The Morphology of Gymnosperms. Hutchinson Univ. Library
7. Sporne KR (1967) Morphology of Gymnosperms, BI Publication, New Delhi.
8. Sporne KR 1991. The Morphology of Pteridophytes. B.I. Publ. Pvt. Ltd.

Practical:

1. Morphology and anatomy of vegetative and reproductive organs of following genera.
Psilotum, Isoetes, Dryopteris, Ophioglossum, Adiantum, Salvinia, Azolla and Lycopodium
2. Comparative study of the vegetative, reproductive parts and Anatomy of the following genera,
Gnetum, Cedrus, Ephedra, Thuja, Ginkgo and Taxus.

Credits=04	Compulsory	Paper-IV(Theory)
Cell Biology (B040704T)	Unit-I Cytoskeleton: microtubules, Microfilaments and intermediate filaments. Interphase nucleus and nucleolus, Nuclear pore complex (NPC). Cell organelles: structure & functions, endomembrane system: Plasmodesmata.	
	Unit-II Cell division: cell cycle, mitosis and meiosis; Control of cell division: cyclins, Cdks, cell cycle check points, spindle organization and chromosomal movement.	
	Unit-III Cell signaling: cell surface receptors, G-protein, GPCRs, second messengers, membrane derived messengers, serine/threonine kinases and receptor tyrosine kinase (RTKs).	
	Unit-IV uncontrolled cell division, tumor, cancer, apoptosis and programmed cell death in plants.	

Suggested Readings:

1. Brown WV & Berke MB (1974). Text Book of Cytology, Blackstains Sons & Co.
2. Brachet J & Mirsky AE (1959). The Cell, Academic Press, Vols. 16D
3. De Robertis EDP & De Robertis EMF 8. (2001). Cell and Molecular Biology, Lippincott Williams & Wilkins, Bombay.
4. Wolfe SL (1993). Molecular and Cellular Biology, Wordsworth Publ. Co., California, USA.
5. Sharma AK & Sharma A (1980). Chromosome Techniques. Theory and Practice, Butterworth.
6. Roy SC & Kumar KDC (1977). Cell Biology, New Central Book Agency, Calcutta.

Practicals:

1. Cytological Squash preparation of onion root tips to study mitosis.
2. Identify the stages of meiosis in squash preparation of onion floral buds and barley anther.

Academic Year 4th (Semester VIII) Bachelor Research in Botany

Credits=04

Compulsory

Paper-I(Theory)

**Plant Anatomy
and
Plant Developmental
Biology
(B040801T)**

Unit-I

The cambium, vascular and cork cambium its derivative tissues, differentiation of secondary phloem and Xylem. Structure of woods in relation to its weight, strength, durability and taxonomic significance. Anomalous secondary growth in roots and stems (monocots & dicots).

Unit-II

Cork cambium and its derivatives, function of cork and its uses, abscission layers. Origin of Lateral and adventitious roots, root-stem transition. Anatomy in relation to taxonomy & embryology.

Unit-III

Male Gametophyte- Microsporogenesis, tapetum and its role, pollen development. Female Gametophyte- Ovule development, Megasporogenesis. Organization of embryo sac, types of embryo sacs. Pollination- Mechanism and vectors, pollen germination and pollen tube growth.

Unit- IV

Fertilization and its control with special reference to incompatibility in flowering plant. Endosperms & its abnormalities, Embryo developments. Apomixis Polyembryony and its induction.

Suggested Readings:

1. A Plant Anatomy by (Pande 1978)
2. A principle and practices in plant morphology by (Raghuvanshi & Joshi 1971)
3. A text book of botany by Julius Sachs
4. Anatomy of Seed Plant By(Katherine Esau 1960)
5. Anatomy of the Dicotyledons and Anatomy of the Monocotyledons by Metcalfe and Chalk 1979
6. Bhojwani S. S. & Bhatnagar SP (2000). Embryology of Angiosperms (4th Revised and enlarged edition).
7. Burgess J (1985). An Introduction to Plant Cell Development, Cambridge University Press, Oxford.
8. Esau, K. (1993). Plant Anatomy, Wiley Eastern Ltd.
9. Fahn A (1982). Plant Anatomy 3rd Edn, Pergamon Press, Oxford.
10. Integrated plant anatomy by William C, Dickisons 2000
11. Larson PR (1995). The Vascular Cambium, Springer Verlag, Heidelberg, Germany.
12. Iqbal M (1990). The Vascular Cambium, R.S.P., Taunton, UK.
13. Iqbal M (1995). The Cambial Derivatives, Gebruder Borntraeger, Stuttgart, Germany.
14. Mahswari P (1950). An Introduction to Embryology of Angiosperms.

Practicals:

1. Anatomical study of anomalous behavior of the following stems
Dracaena, Boerhaavia, Nyctanthes, Achyranthus, Bignonia, Casuarina and Bougainvillea.
2. Study of special feature of the following roots,
Orchid, Aerial Root of Ficus and Tinospora.
3. Study of the leaf of Nerium, Ficus and Aloe.
4. Study of monocot and dicot embryo.
5. Isolation of pollinium
6. Elementary techniques of pollen germination

Credits=04

Compulsory

Paper-II(Theory)

**Taxonomy
of
Angiosperms
(B040802T)**

Unit-I

System of classification, History, outline of basic importance and shortcoming of following classifications.

- Bentham & Hooker
- Hutchinson
- Engler & Prantl

(History and development of APG)

Unit-II

Rules of Botanical Nomenclature, ICBN, Fields and Herbarium techniques, Plants Identification, Taxonomic key, Typification, introduction to taxonomic evidences from cytology, photochemistry, molecular biology data.

Unit-III

General knowledge of distinguishing features of the following families with special reference of best flora

Dicotyledons: Ranunculaceae, Magnoliaceae, Caryophyllaceae, Asteraceae, Rosaceae, Rutaceae, Anacardiaceae, Fabaceae, Myrtaceae and Combretaceae.

Unit-IV

Numerical Taxonomy in relation to Embryology Cytology and Anatomy, Chemotaxonomy.
Identification and economic use of following families:
Dicotyledons: Oleaceae, Asclepiadaceae, Boraginaceae, Scrophulariaceae, Bignoniaceae, Pedaliaceae, Acanthaceae, Verbenaceae, Lamiaceae, Polygonaceae, Piperaceae, Euphorbiaceae and Moraceae.
Monocotyledons: Orchidaceae, Aracaceae, Zingiberaceae, Cyperaceae and Poaceae

Suggested Readings:

1. Lawrence, B.M. Taxonomy of vascular plants, IBH publication Tata Mc Grew Hill.
2. Sharma, Trivedi B.S. Taxonomy, Kitab Mahal Prayagraj.
3. Naik, V.N. (1984). Taxonomy of Angiosperms. Tata McGraw-Hill, New Delhi.
4. Simpson, M.G. (2006). Plant Systematics. Elsevier Academic Press, New York.
5. Singh, Gurcharan (2007). Plant Systematics. Oxford & 1BH Publishing Co, New Delhi.

Practicals:

1. Students have to collect and submit at-least 100 plants properly pressed and mounted on herbarium sheet
2. Identification of angiospermic plants up to the level of family
Description of local plant in semi technique language.

Credits=04	Elective	Paper-III(Theory)
Genetics and Genomics (B040803T)	Unit-I Mendelism and Basic Principle of Heredity, Genetic Terminologies and their concept Mendel Laws of inheritance: Dominance, Monohybrid cross, Dihybrid cross and Trihybrid cross (Forked-line Method or Branch Diagram Method) with their probability, Law of Segregation, Law of Independent assortment, Test cross, Backcross and Chi-square Test	
	Unit-II Exception of Mendelism: Incomplete Dominance, Co-dominance, Multiple alleles, Pseudodominance, Over Dominance, Gene Interaction, Epistasis, Pleiotropy, Genomic Imprinting, Penetrance and Expressivity, Linkage and Recombination, Sex linked, influence Character, Inbreeding and outbreeding, heterosis and inbreeding depression.	
	Unit-III Morphology and type of chromosome Chromosomal Basis of Mendelism: Chromosome, Chromosome theory of Heredity, Sex linked Gene in Human, Sex determination in Human, Birds, Insect and other organism, Dosage compensation,	
	Unit-IV Sex linked and sex influenced characters, introduction and overview: Structural Genomics: Genetic and Physical Map, Entire Genome sequencing, Copy number variations and Single Nucleotide Polymorphism, Meta-genomics and Synthetic Biology	

Suggested Readings:

1. Strickburger M (1990). Genetics. MacMillan Publishing Company, New York.
2. Gardner J (1991). Principle of Genetics. John Wiley & Sons, New York.
3. Klug WS& Cummings MR (1997). Essential of Genetics. Prentice Hall Publishing Co., New Jersey.
4. Brown T (1989). Genetics: A Molecular Approach. Chapman & Hall, London.
5. Goodenough U (1984). Genetics. Sandir College Publishing, Philadelphia.
6. Lewin, B. (2007). Genes Vol. 9. Oxford University Press.

Pacticals:

1. Emasculation techniques.
2. Isolation of protoplast.
3. DNA extraction by centrifugation.
4. Chromosome mapping in eukaryotes.

Population Genetics. Problems in Restriction mapping of plasmids

Credits=04	Group-A	Optional	Paper-IV(Theory)
------------	---------	----------	------------------

Plant Pathology
(B040804T)

Unit-I

Importance & concept of disease in plants, variability in plant pathogen, Mechanism of attack by plant pathogen, effect of environment on disease development, plant disease forecasting.
Koch's Postulates, Disease symptoms, pathogen & disease triangle.

Unit-II

Transmission of plant diseases, isolation and purification of plant pathogens, Pathogenicity test, Principle and method of plant disease control.

Unit-III

Rots diseases with special reference to fruit and stem end rot of papaya. Damping off of seedlings of crop plants. Downy mildews of cucurbits. Rust of wheat and Barley. Powdery mildew of pea. Smuts and Bunts: Covered smut of Barley; loose smut of wheat and Bunt of rice. Wilt of sugarcane. Leaf spots: leaf spot of turmeric; Leaf blight of wheat. Blast disease of rice and mango anthracnose. Galls and other abnormalities: stem gall of coriander leaf curl of Peach.

Unit-IV

Plant disease: Causal organism, symptoms and management

- Bacterial diseases: Citrus canker and Tundu disease of wheat.
- Viral diseases: Mosaics of tobacco, YVM of Okra, papaya, potato and tungro of rice.
- Phytoplasmal diseases: Grassy shoot of sugarcane.
- Nematode diseases: Ear cockle of wheat

Suggested Readings

1. Agrios GN.(2005) Plant Pathology, Academic Press, Burlington.
2. John AL (1998) Plant Pathology and Plant Pathogens, Wiley-Blackwell, CRC Press, Publication, Boca Raton, USA.
3. Dickinson CM (2003) Molecular Plant Pathology, Bios Scientific Publisher, Oxford.
4. Bridge PD, Clarkson JM (1998) Molecular Variability of Fungal Pathogens, CAB, International, Oxford shire.
5. Singh RS (2008) Plant Diseases, Oxford and IBH Publishing Co Pvt Ltd, New Delhi.
6. Singh RS (2008) Principles of Plant Pathology, Oxford and IBH Publishing Co Pvt. Ltd, New Delhi.
7. Dhingra OD, James B, Sinclair (1995) Basic Plant Pathology Methods, CRC
8. Concise Encyclopedia of Plant Pathology by P. Vidhyasekaran

Practicals

1. Isolation of bacterial, fungal, and nematode plant pathogens of crop plants.
2. Study of mineral deficiency diseases of Tomato and French bean.
3. Measurement of fungal spore.
4. Preparation of culture media and sterilization.
5. A study of symptomatology, histopathology and identification of pathogen of various fungal diseases listed above.
6. Inoculation experiment with fungal and bacterial plant pathogen.
7. Field collection of 50 diseases plant specimen (fungal, viral and bacterial)

Study of Fungal bio-control agents.

Credits=04	Group-B	Elective	Paper-V(Theory)
Mycology (B040805T)	Unit-I		
	Outline classification as per Smith Ainsworth, Mims, Comparative account of Thallus structure and spore producing organs.		
	Unit-II		
	Interrelation life cycle pattern & Phylogeny of Myxomycotina, Zygomycotina, Ascomycotina, Basidiomycotina and Deuteromycotina.		
	Unit-III		
	Mode of nutrition of fungi and their physical and chemical requirement for growth and reproduction.		
	Unit-IV		
	Heterokaryosis, parasexuality, heterothallism, variation in fungi, hormonal control of sexual reproduction. Economic importance of fungi		

Suggested Readings:

1. Alexopoulos CJ, Minus CW, Blackwell M (1996) Introductory Mycology, John Cambridge.
2. Carlile MJ, Watkinson SC, Booday GW (2001) The Fungi, Academic Press,
3. Deacon JW, Blackwell M (1997) Introduction to Modern Mycology, Oxford.
4. Maheshwari R (2012) Fungi: Experimental Methods in Biology, CRC Press, Boca Raton, Florida.
5. Webster J, Roland WS (2007) Introduction to Fungi, Cambridge University Press,

6. Webster John (1980) Introduction to fungi, Cambridge University Press, Wiley and Sons, Inc, New York.

Practicals:

1. Identification of fungal cultures
2. Slides and specimens of *Synchytrium*, *Allomyces*, *Glomus*, *Emericella*, *Neurospora*, *Marchella*, *Fusarium*, *Colletotrichum*, *Melampsora*, *Phallus*, *Ustilago*, *Peronospora*, and *Stemonitis*.
3. Study of Symptomology of the following fungal diseases by taking sections and slide preparation: Downy mildews, Tikka disease, *Melampsora* rust, Wheat rust and White rust.
4. Identification of fungal cultures, slides and specimens of *Rhizopus*, *Aspergillus*, *Penicillium*, *Yeast*, *Fusarium*, *Alternaria*, *Cercospora*, and *Pythium*,
VAM fungi, *Trichoderma*. Study of Mycorrhizal colonization in roots of *Parthenium* and Study of Mushroom specimens.

Credits=04	Group-B	Elective	Paper-VI (Theory)
Palaeobotany and Palynology (B040806T)	Unit-I		
	Fossil history of Bryophytes, Pteridophytes and Gymnosperms: Principles of Paleobotany and geological time scale.		
	Unit-II		
	Process of fossilization and types of fossils; Method of study of fossils and carbon dating technique. General account of Bennettitales, Cordaitales, Glossopteridales, Ginkgoales.		
	Unit-III		
	Pollen Morphology and its germ pore, Caulpate condition in monocots and dicots		
	Unit-IV		
	Aeropalynology, Forensic Palynology and palaeopalynology and their role in taxonomic evidence, Pollen Allergy.		

Suggested Readings:

1. Stewart Wilson N, Paleobotany and Evolution of Plants.
2. S.R. Misha, Text Book Of Paleobotany.
3. Peter George, Introduction to Paleobotany.
4. G.Erdtman, Hand Book of Palynology: Morphology, taxonomy, ecology; an introduction to the study of Pollen grains & spores.
5. K.Bhattacharya M.R. Majumdar & S.G. Bhattacharya, A text book of Palynology.
P.K.K. Nair, Essential of Palynology.

Practicals:

1. Study of different types of fossils record.
2. Study of the pollen grains of Cyperus, Canna, Barley, Hibiscus, Jatropha, and Bougainvillea.
3. Study of pollen viability.
4. Study of pollen germination.

Academic Year 5th (Semester IX) Master of Science in Botany

Credits=04	Compulsory	Paper-I(Theory)
Plant Physiology and Biochemistry (B040901T)	Unit-I	
	Water relation: Absorption and transportation and loss of water, Transpiration regulation of opening and closing in stomata. Criteria of essentiality of mineral nutrients, mineral metabolism essential and non-essential elements, deficiency and toxicity of elements. Absorption and translocation of minerals, biological nitrogen fixation and metabolism. Photoperiodism and vernalization, and plant movements.	
	Unit-II	
	Photosynthesis light harvesting complex of higher plants light reaction of photosynthesis, photosynthetic carbon reduction pathway, Hatch slack pathway and crassulacean acid metabolism (CAM). Respiration: Types of respiration, mechanism, glycolysis, Tricarboxylic acid cycle, Electron Transport System, Fermentation, respiration quotient and photorespiration. Plant growth regulators, Auxins, Gibberellins, cytokinins, Ethylene, ABA (abscissic acid), Brassinosteroids, Jasmonates, Salicylic acid.	
	Unit-III	
	Composition, structure and function of carbohydrates, protein and lipids, Enzymes regulatory and active sites activation energy and isozymes. Enzyme kinetics Michaelis-Menten equation, classification of enzymes, prosthetic groups and cofactors.	
	Unit-IV	
	Bioenergetics: Laws of thermodynamics and its application biological system, concept of entropy, enthalpy	

and free energy, energy rich bonds and high energy compounds

Biochemical techniques: Chromatography, electrophoresis, centrifugation, spectrophotometry and tracer techniques.

Suggested Readings:

1. Devlin RM & Wilham FH (1986). Plant Physiology. CBS Pubs. and Distributors, New Delhi.
2. Hopkins WG (1995). Introduction to Plant Physiology, John Wiley & Sons. Inc., New York, USA.
3. Moore TC (1989). Biochemistry and Physiology of Plant Hormones. SpringerVerlag. New York, USA.
4. Singhal et al. (1999). Concepts in Photobiology. Photosynthesis and Phytomorphogenesis, NarosaPub. House, N. Delhi.
5. Taiz & Zeigler (2006). Plant Physiology 4th Edn. Sinauer Associates Inc., Publishers, Sunderland
6. Salisbury FB & Celon W (1986). Plant Physiology 3d Edn. CBS Publishers, New Delhi.
7. Voet & Voet (1995). Biochemistry 2nd Edn, John Wiley & Sons, Inc., New York, USA.
8. Nelson DL & Cox MM (2000). Lehninger Principles of Biochemistry. Macmillan Worth Publishers, Madison Av., New York
9. Lehninger AL (1993). Principle of Biochemistry. CBS Publishers, New Delhi.
10. Cooper, A (2004). Biophysical Chemistry. Royal Society of Chemistry, Cambridge Publication.
11. Hames, BD, Hooper NM & Houghton JD (1998). Instant Notes in Biochemistry. Viva Books, NewDelhi .
12. Wildon K& Walker J (2000). Practical Biochemistry: Principles and Techniques 5th Edn, Cambridge University Press.
13. Skoog, DA, Holler FJ & Timothy N (1998). Principles of Instrumental Analysis 5th Edn. Souders College Publishing.
14. Wise DL (1991). Bioinstrumentation and Biosensors. Marcel Dekker, New York.

Practicals:

1. Determination of osmotic pressure, diffusion pressure deficit and water potential.
2. Extraction of protein from germinating seeds of black gram.
3. Extraction of amino acids.
4. Determination of structure, size and frequency of stomata.
5. Determination of transpiration by photometer.
6. Study of effects of CO₂ concentration and light intensity on rate of photosynthesis.
7. Separation of major plant pigment by paper chromatography (PC) and TLC.
8. Calculate the R_f value of pigments.
9. R_f value determination of mixture of amino acid by PC and TLC.
10. Estimation of protein by Biuret method

Determination of chlorophyll a, chlorophyll b and total chlorophylls in C3 and C4 plants.

Paper-II(Theory)

Credits=04

Compulsory

Unit-I

Genetic Engineering of Plants: Objectives, strategies and approaches; transformation methods: Agrobacterium mediated biolistic approach, microinjection, electroporation and liposome mediated selection of transformants and their molecular characterization.

Unit-II

Application: Production of Transgenic plants viz herbicide resistant plants; engineering Plants for abiotic stress, senescence- tolerance and male sterility, environmental, social and legal implications. Production of genetically modified (GM) plants.

Unit-III

General Feature of Replication , DNA polymerase mechanism and their specialization, Mechanism of DNA Replication, initiation ,elongation and termination) in prokaryotes and eukaryotes ,

Unit-IV

Gene and chromosome, Chromatin , Histone and their variants
Nucleosomes :Nucleosomes assembly and Histone modification, A ,B and Z DNA, Renaturation and Denaturation kinetics

**Plant
Biotechnology
and
Molecular
Biology
(B040902T)**

Suggested Readings:

1. Hill W E (2000). Genetic Engineering. Hardwood Academic Publishers, the Netherlands.
2. Brown T (1995). Gene Cloning. Chapman & Hall, London.
3. Ranjan R (1996). Transgenic Plant. Agro Botanica,Bikaner
4. Sells J (1999). Genetic Engineering. Plenum Press, New York.
5. Tombs M (1990). Biotechnology and Genetic Engineering Reviews. Intercept,U.K.
6. Old RW& Primrose SB (1985). Principle of Gene Manipulation: An Introduction to Genetic Engineering, Blackwell
7. Alberts B, Bray D, Lewis J, Raf M, Roberts K& Watson JD (1989). Molecular Biology of the Cell, Garland Publishing inc., New York
8. Alcamo IE (1994). Fundamentals of Microbiology, The Benjamin/Cummings Publishing Co., New York.
9. Benjamin Lewin (2007). GenesIX, Prentice Hall.
10. Brachet J & Mirsky AE (1959). The Cell, Academic Press, Vols.
11. Brown WV & Berke MB (1974). Text Book of Cytology, Blackstains Sons & Co.
12. De Robertis EDP & De Robertis EMF (2001). Cell and Molecular Biology, Lippincott Williams & Wilkins, Bombay.

13. Evans DA Sharp WR & Amirato PY (1986), Handbook of Plant Tissue Culture. Macmillan Publishing Company, New York.
14. Lodish H, Berk A, Zipursky SL, Matsudaira P, Baltimore D & Darnell J (2000). Molecular Cell Biology. W.H. Freeman and Co., New York, USA.

Practicals:

1. Preparation of tissue culture media.
2. Surface sterilization of ex plant.
3. Organ culture.
4. Callus propagation, organogenesis, transfer of plant to soil.
5. Protoplast isolation and culture.
6. Extraction of DNA plant tissue.
7. Separation of DNA fragment by gel electrophoresis.

Credits=04	Group- A	Elective	Paper-III (Theory)
Plant Resource Utilization and Conservation (B040903T)	Unit-I Plant Introduction, Domestication, importance history, botany, cultivation and processing of cereals (Wheat, Maize, Rice) legumes/Pulses (Pisum, Cicer, <i>Cajanus</i>), Fibre yielding plants; Cotton (<i>Gossypium</i>), Jute (<i>Corchorus</i> sp), Sunhemp (<i>Crotalaria</i> sp)		
	Unit-II Medicinal plants opium poppy (<i>Papaver somniferum</i>), sarpgandha (<i>Rauwolfia serpentina</i>) Tulsi (<i>Ocimum</i>), Giloy (<i>Tinospora cordifolia</i>), and narcotics. Fumitories & masticatories, Beverage yielding plants, important wood and timber yielding plants Sissoo (<i>Dalbergia sissoo</i>), Sal (<i>Shorea robusta</i>), Teak (<i>Tectona grandis</i>), sugar and sugar yielding plants Sugar cane (<i>Saccharum officinarum</i>) Beet root (<i>Beta vulgaris</i>).		
	Unit-III Principles of conservation; in-situ and ex-situ conservation principles and practices NSC, Botanic gardens, BSI, NBPGR, ICAR, CSIR, DST and DBT & germplasm conservation.		
	Unit-IV Plant biodiversity (Type and measurement), Seed banks and cryobanks, Green revolution – benefits, Red Data Book, Sustainable development		

Suggested Readings:

1. Jain SK, Sinha BK & Gupta RC (1991). Notable Plants in Ethnomedicine of India. Deep Publications, New Delhi.
2. Chowdhery HJ & Murti SK (2000). Plant Biodiversity and Conservation in India: An Overview. Bishen Singh, Mahendraçal Singh, Dehradun.
3. Jain SK (1991). Contribution of Indian Ethnobotany. Scientific Publishers, Jodhpur.
4. Singh VK & Abrar MK (1990). Medicinal Plants and Folkories. Today & Tomorrows Printers&&Publishers, New Delhi.
5. Ghosh, AK (2008). A Comprehensive Handbook on Biodiversity, TERI, New Delhi.

Practicals:

1. Study of cereal and sugar yielding plants.
 2. Study of fiber yielding plants.
 3. Study of timber wood.
- Survey and collection of at least 20 medicinal plants from your locality.

Credits=04	Group-A	Elective	Paper-IV(Theory)
Soil Science and Phytogeography (B040904T)	Unit-I Soil: Its origin & development, process of soil formation and soil profile. Soil properties in relation to plant growth, Calcification, Podsolization and laterization.		
	Unit-II Physical Properties of soil: Texture, Structure, Density, Porosity and Permeability of soil. Soil -water energy concept, soil water quantities & their measurement		
	Unit-III Soil chemical properties: Chemical nature of soil, soil solution and nutrients, soil pH, Cation exchange phenomenon, Acidity, alkalinity and Salinity of soil		
	Unit-IV Soil organisms: Process of humification and mineralization, microorganisms and their roles to higher plants, Soil erosion and conservation. Plant geography: Distribution Patterns, Barriers, endemic. Concept of hotspot, age area hypothesis, Vegetational & floristic region of India.		

Suggested Readings:

1. N.C. Brady & R.R. Well "The Nature and Properties of Soils".

Practicals:

1. Determination Water holding capacity, Bulk Density, Porosity, and Permeability of soil
2. Determination of soil moisture.
3. Quick test for carbonate, nitrate and Phosphate
4. Determination of pH of soil by PH meter
5. Determination of conductivity of soil

Credits=04	Optional	Paper-V(Theory)
Microbial Biotechnology (B040905T)	<p>Unit-I Microbes in the production of alcohol, beer, wine and vinegar, Commercial production of antibiotics, therapeutics vaccines, biopesticide.</p> <p>Unit-II Soil Microbiology: Decomposition of organic matter in soil, cycling of essential elements in nature, biofertilisers, Microorganism in food processing, Cheese, butter, milk and bread.</p> <p>Unit-III Microorganisms in relation to biotechnology: Microbes and bioremediation, production of alcohol, beverages, organic acids, vitamins, antibiotics and enzymes.</p> <p>Unit-IV Role of Microorganism in sewage disposal and alternative source of energy, Microorganism and maintenance of environment.</p>	

Suggested Readings:

1. Pelizar MJ, Chan ECS&Krig NR (1993). Microbiology, McGraw Hill Book Co., New York
2. Purohit SS (1998). Microbiology: Fundamentals and Applications, Agrobotanica, Bikaner
3. Razdan MK (1993). An Introduction of Plant Tissue Culture. Oxford & 1BH, New Delhi.
4. Richard M, Twyman & Wisden W (1999). Advanced Molecular Biology, Viva Books Pvt. Ltd.
5. Roy SC & Kumar KDC (1977). Cell Biology, New Central Book Agency, Calcutta.
6. Sharma AK & Sharma A (1980). Chromosome Techniques. Theory and Practice, Butterworth.
7. Thorpe TA (1995). In Vitro Embryogenesis in Plant. Kluwer Publishers, Dordrecht.
8. Trever G, Faull J, Ketteridge S& Springham D (1995). Introductory Microbiology, Chapman & Hall, London

Practicals:

1. Fermentation.
2. Effect of biopesticide.
3. Isolation & identification of soil microorganism.
4. Isolation & identification of sewage microorganism.

Isolation & identification of Rhizobium.

Credits=04	Elective	Paper-VI(Theory)
Economic Botany (B040906T)	<p>Unit-I Origin of cultivated plants; various centre of origin criteria and various centre of origin. Origin and cultivation of wheat, rice, Maize, sugarcane, mustard and potato.</p> <p>Unit-II Spices and flavouring materials, vegetables, Gum and dye yielding plants, Latex yielding plants, Tea Coffee, rubber and insecticide yielding plants.</p> <p>Unit-III Wood: Types, Porous and non-porous with special reference to Sal, Sheesham, Teak and Pine wood and their distribution in India.</p> <p>Unit-IV Masticatories and Fumitories: Betel, Kattha, Supari, Tobacco and Opium and its derivatives like Brown sugar and Hashish and Cannabis.</p>	

Suggested Readings:

1. Encyclopedia of Plant and Crop Science by Robert M, Editor (Goodman)

Practicals:

1. Study of cereal and sugar yielding plants.
2. Study of fiber yielding plants.
3. Study of timber yielding plants.

Academic Year 5th (Semester X) Master of Science in Botany

Credits=04	Group-A	Elective	Paper-I (Theory)
Plant Ecology (B0401001T)	Unit-I Concept and Scope of Ecology: The environment interaction of factors and ecological niche, Plant communities' dynamics and development succession and climax, ecological adaptation and plant indicators.		
	Unit-II Population ecology, natality, mortality, survivorship and growth curves, biotic potential, carrying capacity and environmental resistance, r & K selection.		
	Unit-III Ecosystem: Concept of ecosystem, trophic structure, food chain, energy flow, productivity and energy subsidy, Biological diversity and mega diversity countries.		
	Unit-IV Green house effect, Climate change and global warming, Ozone depletion and acid rain. Environmental pollution and its control (Water, Air and Noise)		

Suggested Readings:

1. Pierzynski GM, Sims JT & Vance GF (2005). Soils and Environmental Quality. CRC, London.
2. Perk M (2006). Soil and Water Contamination from Molecular to Catchment Scale. Taylor & Francis. The Netherland.
3. Coley D (2008). Energy & Climate Change. John Wiley & Sons, London.
4. Tanez JG, Hernandez-Esparza M, Doria-Serano C, Fregoso-Infante A & Singh MM (2007). Environmental Chemistry, Fundamentals. Springer.
5. Suresh G (2007). Environmental Studies and Ethics. IK International, New Delhi.
6. Odum EP & Barrett GW (2005). Fundamentals of Ecology. V Edn, Thomson Asia, Pvt. Ltd.
7. Chapman JL & Reiss MJ (1995). Ecology Principles & Applications. Cambridge University Press.
8. Brady, NC, The nature and properties of soils, Prentice, Hall of India Pvt. Ltd.

Practicals:

1. Determination of Abundance, Density, Frequency and Dominance by quadrat method
2. Determination of similarity and dissimilarity Indices
3. Estimation of Carbonate, Bicarbonate, Chloride and Dissolved Oxygen from fresh water ecosystems
4. Morphological anatomical and physiological adaptations in Hydrophytes, Xerophyte and Epiphytes

Credits=04	Group-A	Elective	Paper-II (Theory)
Water Resource Management (B0401002T)	Unit-I Distribution of water resources, Lentic and Lotic Water bodies, Aquifers, Hydrological cycle, catchment infiltration, water shed management		
	Unit-II Physico-chemical properties of fresh water, water quality Parameter and standards. Water pollution and its sources, ground water.		
	Unit-III Water stress adaptation in plant, Role of plants in water management, Water borne diseases, water management strategies, management of ground water, rain water harvesting, Recharging of ground water, recycling of waste water.		
	Unit-IV Water prevention and control of pollution, Treatment technologies, Treatment of drinking water (Ion exchange, Reverse osmosis and water disinfection), Treatment technology, Domestic waste water treatment.		

Suggested Readings:

1. Ghosh, AK (2008). Simplifying Climate Change. TERI, New Delhi.
2. Sampson, Garey P (2005). The WTO and Sustainable Development, TERI, New Delhi.
3. Somayaji & Somayaji G (2009). Environmental Concerns and Sustainable Development. TERI, New Delhi.
4. Saikia, Ranjane (2009). Making Sense of Climate Change. TERI, New Delhi.
5. Lovejoy TE & Hannah L (2005). Climate Change and Biodiversity, TERI, New Delhi.

Practicals:

1. Physical properties of water (colour, turbidity, taste, odour and total solids)
2. Chemical properties of water (carbonate, bicarbonate, acidity alkalinity and pH)
3. Coliform test for potability of water

Credits=04

Group-B

Elective

Paper-III(Theory)

**Environmental
management and
Technology
(B0401003T)**

Unit-I

Basics of Environmental Science: Origin of Earth, Biotic-abiotic interaction, Decline in Biodiversity and the consequences. Environmental Phenomenon and Episodes: Ozone layer depletion, Climatic change. Occupational Health Hazards: Silicosis, Asbestosis, Carcinogens, Mutagens, Teratogens and Toxicity of Heavy Metals.

Unit-II

Non-conventional Energy: Hydrogen, Alcohol, Bio-diesel, Wind and Solar energy Water Management Technologies: Hydrological cycle, Water quality standards, Major sources of water pollution, basics of ground and surface water, Analysis of selected Physico-chemical properties of water (DO, BOD, COD, Nitrate, Phosphate, Chloride, pH, Acidity, Alkalinity, Turbidity, Electrical Conductivity, Temperature), Eutrophication and Aquaculture.

Unit-III

Air Quality Monitoring and Management: Composition of air, Major sources of air pollution. Indoor air pollution, Monitoring of SOX, NOx and O3 Solid Waste Management Technologies: Sources of solid waste, Solid waste disposal, Vermicomposting, R3 Principle, Noise Pollution and Abatement: Sources of noise pollution, Noise standards, Biological and behavioral effects of noise pollution.

Unit-IV

International Agreements on Environment: Treaties and Protocols of United Nations Conference on Human Environment-UNCHE (Stockholm, 1972), United Nations. Conference on Environment and Development- UNCED (Rio de Janeiro, 1992), World Summit on Sustainable Development- WSSD (Johannesburg, 2002). Environmental Legislation: Powers and functions of Central and State Pollution Control Boards, Wildlife Protection Act 1972, The Water (Prevention and control of pollution) Act 1974, Prevention and Control of Air Pollution Act 1981.

Suggested Readings:

1. Magill, PL., Holden, ER. & Ackley, C (1956). Air pollution Hand Book. MC Graw-Hill Book Co.
2. Coley, D. (2008). Energy & climate change, John Wiley & Sons. London.
3. Null, Air Pollution and plant life
4. Saxena, MM. Environmental analysis water soil and air
5. Fulekar, M. H. Environmental Biotechnology
6. Sawicki, E. Handbook of environmental genotoxicology
7. Lyons, J. J. Principles of air pollution meteorology
8. Mc Caul, J. Water Pollution

Practicals

1. Physical properties of water (colour, turbidity, taste, odour and total solids)
2. Chemical properties of water (hardness, Calcium, magnesium, carbonate, bicarbonate, acidity alkalinity and pH)
3. Determination of BOD and COD of sewage.
4. Determination of fluoride and arsenic from ground water

Credits=04

Group-B

Elective

Paper-IV(Theory)

**Cytogenetics
Plant Breeding
Biostatistics**

(B0401004T)

Unit-I

Basic of Cytogenetics and their concepts: Cell Cycle and architecture of chromosomes in prokaryotes and eukaryotes, Chromonemata, chromosome matrix, chromomeres, centromere, telomere, artificial chromosome construction, Karyotyping, Chromosome banding and painting- In situ hybridisation and various application., Chromosomes variation and their implications, Ploidy.

Unit-II

Applications of Cytogenetics :Fertilization in crop plant and their barriers, Role of polyploids and aneuploids in crop breeding, Evolutionary and genetic problem in crops, Synthesis of new crops (Wheat, Paddy, Cotton, Brassica) and hybridisation between different species, Production of haploid and dihaploids and doubled haploids in crop breeding.

Unit-III

Measure of central tendency, Data analysis and Graphs, Binomial, Poisson and normal probability distribution, Chi-sq test and Null hypothesis, Parametric and Non-parametric statistics.

Unit-IV

T-test, Z-test, U-test and F-test, Regression and correlation and ANOVA, Standard deviation, Variance, Sampling distributions and Errors.

Suggested Readings:

1. Razdan MK (1993). An Introduction of Plant Tissue Culture. Oxford & IBH, New Delhi.
2. Clark MS, Wall WJ (1996) Chromosomes: The Complex Code, Chapman & Hall, London.
3. Sharma AK, Sharma A (1985) Advances in Chromosome and Cell Genetics, Oxford & IBH Publishing Co, Kolkata.
4. Krebs JE, Lewin B, Goldstein ES (2011) Genes X, Sudbury, Massachusetts.
5. Gupta PK (2007) Cytogenetics, Rastogi Publication, Meerut.
6. Gardner EJ, Simmons MJ, Snustad DP (2006) Principles of Genetics, 8th edition, John Wiley & Sons, Wiley India Edition.
7. Alberts B, Bray D, Lewis J, Ralf M, Roberts K, Watson JD (1999) Molecular Biology of the Cell, Garland Publishing Inc, New York.
8. Allard RW (1999) Principles of Plant Breeding, 2nd edition, John Wiley and Sons, New York.
9. Hartl DL, Jones EW (2007) Genetics—Analysis of Genes and Genomes, 7th edition, Jones and Barlett publishers, Burlington.
10. David CA, et al., (2007) Epigenetic, 2nd edition, Cold Spring Harbor Laboratory Press, New York.
11. Spillane C, McKeown PC (2014) Plant Epigenetic and Epigenomics: Methods and Protocol, Springer Publisher, London.
12. Thorpe TA (1995). In Vitro Embryogenesis in Plant. Kluwer Publishers, Dordrecht.
13. Evans DA, Sharp WR & Amirato PY (1986). Handbook of Plant Tissue Culture Macmillan Publishing Company. New Yo.
14. Daniel W (1977). Biostatistics, John Wiley, New York.
15. Khan, IA & Khanum, A (1994). Fundamentals of Biostatistics. Ukaaz Publications, Hyderabad.

Practicals:

1. Line diagrams showing the plan of different methods of breeding self-pollinated crops- Mass selection, Pure line selection, Pedigree method,
2. Line diagrams showing the plan of different methods of breeding cross pollinated crops- Bulk Selection, Recurrent selection.
3. Methods of hybridization in rice, sorghum, bajra, cotton in standing crop in the field.
4. Assignments with problems for computing measures of central tendency and dispersion- mean, median and mode, standard deviation and standard error.
5. Assignment with problems for computing correlation and regression coefficients.
6. Assignment with problems for implementing t test.
7. Assignment with problems for computing ANOVA.

Credits=04	Group-C	Elective	Paper-V (Theory)
Computer Application and Bioinformatics (BO401005T)	Unit-I		
	Computer Fundamentals and programming Languages, Role of super computer in biology.		
	Unit-II		
	Historical background and scope of Bioinformatics, Transcriptomics and Proteomics, Metabolomics.		
	Unit-III		
	Data generation and data retrieval, generation of data, gene sequencing, Mass spectrometry, Microarray, Drug aided design, structure based and ligand based approaches, Molecular phylogeney, system biology and functional biology.		
	Unit-IV		
	Primary nucleotide sequence databases- EMBL, Gene bank, DDBJ. Protein sequence data bases- Swissprot/TrEMBL, PIR, Sequence motif data bases- Pfam, PROSITE. Dynamic Programming BLAST and FASTA, Phylogenetic analysis.		

Suggested Readings:

1. Computer Fundamental: B.Ram
2. Fundamental of Information Technology: Leon & Leon
3. MS Office: BPB Publication
4. A First course in Computers: sanjay Saxena
5. Computer Networks, Acme Learning: Anurajan Mishra
6. Gupta SP (1969). Statistical Methods, Sultan Chand & Sons, New Delhi.
7. Sundar Rao PSS & Richard J (1999). An Introduction to Biostatistics. A Manual for Students in Health Sciences, Prentice Hall of India Pvt. Ltd., New Delhi.
8. Rao S.S (1999) Networking Scenario in India New Lib-world 100(4) 160-68

Shen, M.2003. Microarray Analysis John Wiley Publication New York.
 Nevsner, J.2005. Bioinformatics & Functional Genomics John Wiley & sons new jersey.

practicals:

1. Working in MS Word , Excel and PPT
2. Elementary Practical Knowledge of C and Python
3. Use of software for molecular Phylogeny

Use of software for analysis of statistical data

Credits=04

Group- C

Elective

Paper-VI(Theory)

Forest Ecology
 (B0401006T)

Unit-I
 Human evolutionary dependence on forest: scope and relevance; forest types of India;
 Ecological morphology of rain forest flora

Unit-II
 Structure of forest ecosystem: Photosynthetic efficiency; leaf area and growth Nutrient cycling
 in tropical forest ecosystems.

Unit-III
 Reproductive strategy of tropical trees; Natural and artificial regeneration; Factor destructive to
 forest ecosystems; causes and effects of deforestation systems; Role of trees in combating air
 pollution.

Unit-IV
 Physico-chemical properties of forest soil; ecological significance of soil texture; soil biology and
 soil fertility, Comparison of forest and grassland. Accumulation and decomposition of forest
 litter; forest humus; the geochemical and biogeochemical cycling of nutrients.

Suggested Readings:-

1. Odum EP & Barrett GW (2005). Fundamentals of Ecology. V Edn, Thomson Asia, Pvt. Ltd.
2. Chapman JL & Reiss MJ (1995). Ecology Principles & Applications. Cambridge University Press.
3. Brady, NC, The nature and properties of soils, Prentice, Hall of India Pvt. Ltd.

Practicals:

1. Determination of Abundance, Density, Frequency and Dominance by quadrat method
 2. Determination of similarity and dissimilarity Indices
 3. Estimation of Carbonate, Bicarbonate, Chloride and Dissolved Oxygen from fresh water ecosystems
 4. Morphological anatomical and physiological adaptations in Hydrophytes, Xerophyte and Epiphytes
 5. Determination of Water Holding Capacity, Bulk Density, Porosity and Permeability of Soil
 6. Determination of Soil Moisture Quick test for carbonate and phosphate
 7. Determination of Soil pH by pH meter
- Determination of conductivity of soil