PG Course

(For the candidates admitted from the academic year 2015-2016 onwards)

M.Sc. BOTANY PROGRAMME – Course Structure Under CBCS

(For the candidates admitted from the academic year 2015-2016 onwards)

S. No.	Sem	Paper	Hrs/ Week	Credit	Exam Hrs.	Marks		
						Internal	External	Total
1	I	Core Course 1 Plant Diversity I	8	5	3	25	75	100
2	I	Core Course 2 Plant Diversity II	7	5	3	25	75	100
	I	Core Course 3 (Practical)*	4					
	I	Core Course 4 (Practical)*	4					
3	I	Elective Course I Ecology, Phytogeography and Conservation Biology	7	5	3	25	75	100
4	II	Core Course 5 Morphology, Taxonomy and Plant products	4	5	3	25	75	100
5	II	Core Course 6 Anatomy, Embryology and Micro techniques	4	5	3	25	75	100
6	II	Core Course 3 (Practical)*	5	5	4	40	60	100
7	II	Core Course 4 (Practical)*	5	5	4	40	60	100
8	II	Elective Course II Horticulture and Nursery technology	7	5	3	25	75	100
9	II	Extra Disciplinary course – paper I Ethnomedicine and Pharmacognosy	5	5	3	25	75	100
10	III	Core Course 7 Molecular Biology	7	5	3	25	75	100
11	III	Core Course 8 Genetics, Plant Breeding and Plant pathology	7	5	3	25	75	100
12	III	Core Course 9 Microbiology	6	5	3	25	75	100
	III	Core Course 10 (Practical)*	4		4			
13	III	Elective Course III Forestry	6	5	3	25	75	100
14	IV	Core Course 11 Plant physiology, biochemistry and biophysics	6	5	3	25	75	100
15	IV	Core Course 12 Biotechnology	5	5	3	25	75	100
16	IV	Core Course 13 Research methodology bioinformatics and biostatics	5	5	3	25	75	100
17	IV	Core Course 10 (Practical)*	4	5	4	40	60	100
`18	IV	Project – Core Course 14	10	5	3			100
			120	90				
	* Exams will be held at the end of even semester							1800

Semester I

CORE COURSE I – PLANT DIVERSITY I

Course code : JSPBTA1
Hours per week : 7
Credit : 5
Internal Marks : 25
External Marks : 75

Unit I - Algae

Classification of algae by Bold and Wynne. Detailed study about thallus organization, reproduction (asexual and sexual). Phylogeny of algae.

Unit II - Algae

Salient features of major classes – Chlorophyta, Charophyta, Xanthophyta, Phaeophyta, Rhodophyta and life cycle. Ecological, Economic importance of algae - Pollution indicators, Algal blooms and Algicides.

Unit III Fungi

Classification (Alexopoulus and Mims); General features of fungi - mode of nutrition, thallus organization, fruit bodies : Salient features and economic importance of major classes (Mastigomycotina, Zygomycotina, Ascomycotina, Basidiomycotina, Deuteromycotina); Mycorrhiza (VAM).

Unit IV - Lichens

Classifications of lichens by Miller (1984); General features, distribution, thallus organization and reproduction - economic importance.

Unit V - Bryophytes

Classification (Watson, 1964); General features - origin, vegetative structure and reproduction - general features of major groups (Marchantiales, Jungermanniales, Anthoceretales, Funariales and Polytrichales), economic importance.

TEXT BOOKS:

- Vashista B.R, Sinha A.K & Singh V.P (2004) – Algae – S.Chand & Company Ltd. New Delhi.
- Sharma,O.P.(1986) - Text book of Algae - Tata McGraw-Hill, New Delhi.
- Kumar, H.D & Singh H.N. (1982) - A text book on Algae - Affiliates East - West Press, Madras.
- Vashista B.R & Sinha (2004) – Fungi – S.Chand & Company Ltd. New Delhi.
- Alexopoulus, C.J & Mims, C.W. (1979) - Introductory Mycology - Wiley Eastern Ltd., New Delhi.
- Vashista B.R & Sinha (2004) – Bryophyta – S.Chand & Company Ltd. New Delhi.
- Parihar, N.S (1974) - An Introduction to Embryophyta - I Bryophyta

REFERENCES: ALGAE:

- Bold, H.C & M.J. Wyne (1978) - Introduction to Algae - structure & reproduction – Prentice Hall, New Jersey.
- Chapman,V.J & Chapman (1973) - The Algae - ELBS & Macmillan, London.
- Fritsch, F.E (1935) - The structure & reproduction of the Algae (2 vols.) – Cambridge University Press, England.
- Kumar, H.D. (1985) - Algal Cell Biology - East West Press, New Delhi.
- Kumar, H.D. (1989) - Introductory Phycology - East West Press, India.
- Prescott, G.W. (1969) - The Algae: A Review - Nelson.
- Round, F.E., (1981) - The Ecology of Algae, Cambridge University Press, London.

- Scagel, R.F., Baadddoni, R.J., Rouse, G.E., Schofield, W.B., & Taylor, T.M.C. (1969) – Plant Diversity: An evolutionary Approach - Wadsworth, Belmont, California.
- South. R., G. Robin & A. Whittick (1987) - Introduction to Phycology, Blackwell Scientific Publications, Boston.
- Venkataraman G.S. & Others (1974) - Algae form & function - Today & tomorrow Publishers, New Delhi.

FUNGI:

- Bessey, E.A.(1979) - Morphology & Taxonomy of Fungi, Vikas Publishing House Pvt., Ltd., New Delhi.
- Bold, H.C & others (1980) - Morphology of Plants & Fungi - Harper & Row Publ. Inc., New York.
- Burnet, J.H.,(1971) - The fundamentals of Mycology, ELBS Publications, London.
- Gray W.D.(1959) - The Relation of Fungi to Human Affairs - Hery Holt & Co., Inc.

LICHENS:

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

BRYOPHYTES:

- Cavers, F. The Interrelationship of Bryophytes.
- Kashyap,S.R. The Liverworts of Western Himalayas & Punjab Plains I & II
- Prem Puri, 1973 - Bryophytes - A Broad Perspective, Atma Ram & sons, New Delhi.
- Smith,G.M. Cryptogamic Botany Vol. II
- Verdoon,F R. Manual of Bryology .
- Waston, E. V. The Structure and Life of Bryophytes .

CORE COURSE II – PLANT DIVERSITY II
(Pteridophytes, Gymnosperms, Paleobotany And Evolution)

Course code : JSPBTB1
Hours per week : 7
Credit : 5
Internal Marks : 25
External Marks : 75

Unit I – Pteridophytes

Classification (Reimers) - Origin and General features of major groups : Psilopsida, Lycopsida, Sphenopsida and Pteropsida.

Unit II – Pteridophytes

Variation in sporophytes – anatomy of sporophytes, stelar. Reproduction and life history, soral and sporangial evolution, heterospory and seed habit, evolution of gametophytes – Apospory and Apogamy.

Unit III - Gymnosperms

Classification (K.R. Sporne, 1967) – salient features of Gymnosperms (morphology, anatomy, evolution and Reproduction) A general character of following groups : Cycadales, Coniferales, Ginkoales and Taxales – economic importance of gymnosperms.

Unit IV – Paleobotany

A general account of geological time scale, Fossils: types, methods of fossilization, age determination. fossils of Algae, Fungi, Pteridophytes and Gymnosperms.

Unit V – Evolution

Concept of evolution and phylogeny – Morphological; Anatomical and embryological. Modern synthetic theory of evolution.

TEXT BOOKS:

- Vashishta.P.C.(2004)-Pteridophyta -S.Chand & Co. Ltd, New Delhi
- Parihar,N.S -The Biology and Morphology of Pteridophytes, Central Book Depot, Allahabad.
- Rashid.A. (1986) - An Introduction to Pteridophyta, Vani Educational Books, New Delhi.
- Sporne K.R. (1972) – The morphology of Gymnosperm - BII Publications, Madras.
- Vashita P.C. (1990) – Gymnosperms – S. Chand & Co. Ltd., India.
- M.P.Arora 1990. Evolutionary biology, Himalaya Publication House, Delhi. C.I.A. Arnold – An Introduction to Palaeobotany.

REFERENCES:

PTERIDOPHYTES:

- Eames, A.J.(1936) - Morphology of Vascular Plants - Lower groups, Tata Mcgraw Hill Publishing company Ltd., New Delhi.
- Smith,G.M (1955) - Cryptogamic Botany Vol. II, Tata Mcgraw Hill Publishing Co., Ltd., New Delhi.
- Sporne,K.R.(1972) - The Morphology of Pteridophytes, B.I. Publications, Madras.

- Sundara Rajan,S. - Introduction to Pteridophyta - New age International Publishers Ltd., Wiley Eastern Ltd., Madras.
- Bower. F. O.(1939) - The Ferns(Vol. I,II,III) - Today & tomorrow's Printers, New Delhi.
- Sharma, O.P. (1990) – Text Book of Pteridophyta, , Macmillan Indian Ltd., India

GYMNOSPERM:

- Bierhorst. D. (1970) – Morphology of Vascular plants.
- Chamberlain . C. – Gymnosperm structure & evolution, Univ. Chicago Press.
- Coulter & Chamberlin – Morphology of Gymnosperms – Central Book Depot, Allahabad.
- Foster A.S. & Gifford. E.M. (1965) – Morphology & evolution of Vascular Plants – W. H. Freeman & Co.,
- Maheswari. P. & Vasil V. (1960) – Gnetum : A monograph – CSIR Publication.

PALEOBOTANY :

- M.Kimura, 1983-The natural theory of molecular evolution, Cambridge University Press, Cambridge.

EVOLUTION :

- W.R.Atchlay & D.S. Woodnuff 1981. Evolution and speciation, Cambridge University Press, Cambridge.

ELECTIVE COURSE I – ECOLOGY, PHYTOGEOGRAPHY AND CONSERVATION BIOLOGY

Course code : JSPBTEC1
Hours per week : 7
Credit : 5
Internal Marks : 25
External Marks : 75

Unit I Ecology

Concepts of ecosystems, types. Food web, food chain and energy flow tropic level, ecological pyramids, productivity and bio-geochemical cycles (N, S). Ecological adaptation – Ecads, ecotypes, ecospecies.

Unit II Ecology

Environmental pollution – air, water, soil, thermal, noise, E-waste and radiation. Causes of Green house effect and Ozone depletion. Sources and characteristics of wastes **(**Tanneries, Sugar mills and Distilleries, Paper and Pulp mills), Effluent.

Unit III Ecology

Eco-Biotechnology - renewable crops for fuel, anaerobic digestion (biogas production), management, composting of waste. Bioremediation and phytoremediation.

Unit IV Phytogeography

Types of forests, range, dispersal and migration barriers, continental drift hypothesis – age and area hypothesis, endemism, peninsular, and Island floras. Introduction to Remote Sensing and its uses.

Unit V Conservation Biology

Significance of conservation. Current practices in conservation, habitat or ecosystem approaches, social approaches, *In situ* (Social forestry, botanical garden, National parks) and *Ex situ* (Cryopreservation, Gene Banks, Seed Banks, Pollen Banks, Tissue culture and biotechnological strategies), environmental education.

TEXT BOOKS:

- Odum, E.P. (1975) – Ecology (2nd Edn.,) – Oxford & IBH Publishing Co., New Delhi
- Sharma P.D (2005) – Ecology and Environment –Rastogi Publications, Meerut, India.

REFERENCES:

ECOLOGY

- Ambasht, R.S. (1974) – A text book of Plant ecology (3rd Edn.) Students' Friends Co., Varanasi, India.
- Agrawal, K.C. (1987) – Environmental biology – Agro – botanical Publications, India.
- Anathakrishnan, T.N. (1982) – Bioresoursces Ecology – Oxford & IBH Publ: & Co. New Delhi.
- Billings, W.B. (1965) – Plants and the ecosystem – Wardsworth Publ. Co., Inc., Belmont.
- Conard, H.S. ( ) – Plant Ecology – lowa state Press, Iowa.
- Dauvenmire, R.F. ( ) – Plant and environment (2nd Edn). – John Wiley.
- Kershaw. K.A. (1973) – Qunatitative and dynamic Plant Ecology – Edwards Arnold Publ. Ltd., London.
- Kormandy, E.J. (1978) – Concepts of Ecology (2nd Edn.,) - Prentice Hall of India (P) Ltd., New Delhi.

- Kumar, H.D. (1978) – Modern concepts of Ecology – Vikas Publishing House, New Delhi
- Levitt, J., (1980) – responses of plants to Environmental Stresses – Academic Press, N.Y.
- Mistra, R (1968) – The Ecology work book – Oxford & IBH Publishing & Co., Calcutta.
- Mistra R.C. (1974) – Manual of Plant Ecology – Oxford & IBH Publishing Co., New Delhi
- Odum, E.P. (1971) – Fundamentals of Ecology – W.B. Saunders & co., Philadelphia, USA.
- Puri, G.S., (1960) – Indian Foresh Ecology – Vol I & II – Oxford Book Co., New Delhi & Calcutta.
- Smith, J.M. (1974) – Models in Ecology – Cambridge University Press, Cambridge.
- Trivedi & Goel ( ) – Standard Methods of water analysis.
- Vashista, P.C. (1974) – A text book of Plant Ecology – Vishal Publications, Jullunder City, India.

PLANT GEOGRAPHY

- Cain, S.A. (1944) – Foundation of Plant Geography – Harper & Brothers, N.Y.
- Gates, D.M. (1980) – Biophysical Ecology – Springer Verlag, N.Y.
- Good, R. (1953) – The Geography of flowering Plants (2nd Edn.,) – Longmans, Green & Co., Inc., London.
- MacArthur, R.H. & E.O. Wilson (1967) – The theory of Island Biogeography – Princeton University Press, Princeton, N.J.
- Mani, M.S. (1974) – Ecology and Biogeography of India – Dr.W.Junk Publishers, The Haque.
- Margalef, R. (1968) – Perspectives in Ecological Theory – University of Chicago Press, Chicago.

Conservation Biology

- Frankel, O.H., A.H.D. Brown and Burdon J.J. 1995. The conservation of Plant Diversity, Cambridge University Press, Cambridg,e UK.
- Heywood V.H. 1995. Global biodiversity Assessment, UNEP. Cambridge University Press, Cambridge, UK.
- D.Briggs & S.M., Walters. 1997 Plant variation and evolution
- R.E.Leakey, W.F.Bynum & J.A.Barrett, 1979. The Illustrated origin species by Charles Darwin. Hill & Wang, New York.
- K.V.Krishnamurthy 2003, An Advanced Text Book on Biodiversity. Oxford and IBH Book Company, New Delhi.
- Virchow D *Conservation of genetic resources*, Springer Verlag, Berlin.
- Gray K Meffe, Ronald Carrol C *Principles of conservation Biology*, Sinaver Associates.

Semester I & II
Core Course III

PRACTICAL I – PLANT DIVERSITY I & II
(Algae, Fungi, Lichen, Bryophytes, Pteridophytes, Gymnosperms and Paleobotany)

Course code : JSPBTC2P
Hours per week : 4
Credit : 5
Internal Marks : 40
External Marks : 60

Algae

- Microscopic observation of algal types and their slides included in the syllabus.
- Section cutting of available algal specimens included in the syllabus.
- Identification of algal types in the algal mixture (only microscopic types).

Fungi

- Microscopic observation of slides of genera include in the syllabus.
- Section cutting of different plants infected by fungal strains included in the theory syllabus .

Lichen

- Observation of different thalli of Lichens.
- Microscopic observations of slides of *Usnea*.

Bryophytes

Morphological and anatomical study of representatives of the following: Marchantiales, Jungermanniales, Anthoceretales, Funarials and Polytrichales.

Pteridophytes

A study of the morphology, anatomy of the vegetative and reproductive parts of the saprophytes and gametophytes (wherever available) of living genera included in the syllabus and analysis of their slides.

Gymnosperms

A study of the morphology, anatomy of the vegetative and reproductive parts of the sporophytes and gametophytes (wherever available) of living genera included in the syllabus and analysis of their slides.

Paleobotany

Analysis of slides of fossil forms given in the syllabus.

Core Course IV
PRACTICAL II – TAXONOMY, ANATOMY, EMBRYOLOGY, HORTICULTURE, NURSERY TECHNOLOGY, ETHANOBOTANY AND PHARMACOGNOSY

Course code : JSPBTD2P
Hours per week : 4
Credit : 5
Internal Marks : 40
External Marks : 60

Taxonomy

Examination of polypetalous, gamopetalous, monochlamydeous, dichlamydeous and monocotyledonous flowers showing various stages of hypogyny, perigyny and epigyny. Study of plants belonging to the families given in the theory syllabus.

Anatomy

- Dissection of shoot apex in *Hydrilla* and whole mount
- Examination of LS of shoot and root apices through slides
- Demonstration of primary pit-fields in Onion epidermal peel
- Identification of different types of stomata – monocot and dicot types
- Identification of wood defects – spotters

Embryology

- Slides showing developmental stages of anthers, embryo sacs, endosperm and embryo.
- Dissection of endosperm haustoria – Cucurbitaceae – Cucumis, Papilionaceae – Peltophorum.
- Dissection of embryo – Tridax / Crotalaria.
- Methods of testing pollen viability using – (a) Alexander's stain; (b) acid-test

Horticulture and Nursery technology

- Field study to know the hybridization techniques
- Study of floral biology of one legume plant
- Study of different methods of Emasculation
- Field study to know the nursery techniques

Ethanobotany and Pharmacognosy

Field study (local & outside) – submission of field reports with photographs and ethanobotanical importance.

Semester II

CORE COURSE V – MORPHOLOGY, TAXONOMY AND PLANT PRODUCTS

Course code :

JSPBTE2

Hours per week : 5
Credit : 5
Internal Marks : 25
External Marks : 75

Unit I – Morphology

General Morphology of flowering plants : Structure, Types and modification of leaf and stem. Inflorescence: (Raceme, cyme, mixed and special types) Flowers : Structure of monocot and Dicot. Fruits: Types and structure.

Unit II – Taxonomy

Classification - Bentham and Hooker's, Engler and Prantl's, - System of classification – Numerical taxonomy, Chemotaxonomy and Cytotaxonomy – Herbarium technique. Nomenculture : ICNAFP (International Code for the Nomenculture of Algae,Fungi and Plants), Author, Citation.

Unit III – Taxonomy

Taxonomic study and economic importance of the following families: *Ranunculaceae, Magnoliaceae, Menispermaceae, Polygalaceae, Sapindaceae, Aizoaceae, Boraginaceae, Lamiaceae and Caryophyllaceae.*

Unit IV – Taxonomy

Taxonomic study and economic importance of the following families: *Aristolochiaceae, Moraceae, Loranthaceae ,Cannaceae, Zingeberaceae, Orchidaceae, Amaryllidaceae, Cyperaceae*.

Unit V – Plant Products

Origin, source and uses of the following group of substances with examples – Aromatic, Phenol, Flavanoids, Tannins, Quinines, Alkaloids and Terpenes.

TEXT BOOKS:

- Pandey BP *Taxonomy of Angiosperms*. S. Chand & Co. Pvt. Ltd., New Delhi
- Lawrence GH *Taxonomy of vascular plants*. MacMillan Co., New York.
  Krishnamurthy KV and Rao KN *Angiosperms*. S. Viswanathan Publications.

REFERENCE:

- Gamble JS *Flora of the Presidency of Madras*. Sri Gouranga Press, Calcutta.
- Rendle AB *The classification of Flowering plants*. Vikas Publishing House Pvt. Ltd., U.P.
- Vashista PC *Taxonomy of Angiosperms*. S. Chand & Co. Pvt. Ltd., New Delhi.
- Hill AW *Economic Botany*. Tata McGraw Hill, New Delhi.
- Dastur JF *Useful plants of India*. Tarapore.
- Baker GS *Plants and Cultivation*. Mac Millan Co., London.
  Sambamurthy AWS *Economic Botany*

CORE COURSE VI – ANATOMY, EMBRYOLOGY AND MICRO-TECHNIQUES

Course code : JSPBTF2
Hours per week : 5
Credit : 5
Internal Marks : 25
External Marks : 75

Unit I – Anatomy

General account and meristems theories. ultra structure of cell walls, xylem and phloem – distribution, structure.

Unit II - Nodal anatomy

Nodal anatomy - vascular differentiation of stem, root and leaf – cambial variants.

Unit III – Wood anatomy

Structure, identification, classification and uses of woods – physical, chemical properties of wood – defects in wood – natural defects - compression and tension wood - wood preservation.

Unit IV – Embryology

Anther development – pollen morphology, pollen stigma compatibility, megasporogenesis and female gametophyte, Sexual compatibility, Incompatibility, endosperm types, vegetative reproduction, Polyembryony and apomixis in plant improvement.

Unit V- Microtechniques

Introduction – importance of micro techniques – collection and preparation of materials – microtomes – types of microtomes; camera lucida – ocular micrometer – stage micrometer. Fixation – dehydration – clearing agents – embedding and block making – section cuttings – mountings. Different types of staining – double staining – safranin, fast green stain, triple staining.

TEXT BOOKS:

- Easu K *Plant Anatomy*, Wiley Eastern Ltd, New Delhi.
- Kollmann *Wood Science and Technology*, Vol I &II.
- Bhojwani SS and Bhatnagar SP *The Embryology of Angiosperms*, Vikas publishing house Pvt. Ltd., New Delhi
- Pattel LR, Bhalachander BL and Jeeraji H *An introduction to microtechnique*, S. Chand & S. Chand & Co. Pvt. Ltd., New Delhi.

REFERENCES:

- Gutter G *Plant Anatomy*, Edward Arnold Publications Ltd., London
- Fahn A *Plant Anatomy*, Pergoman press, Oxford.
- Maheswari P *An introduction to the Embryology of Angiosperms*, Tata McGraw Hill Publishing Co, Ltd., New Delhi
- Shukla RS and Chandel PS *Cytogenetics, Evolution and Plant breeding*, S Chand and Co, New Delhi.

ELECTIVE COURSE II – HORTICULTURE AND NURSERY TECHNOLOGY

Course code : JSPBTEC2
Hours per week : 7
Credit : 5
Internal Marks : 25
External Marks : 75

Unit I

Horticultural Crops: Physical control- (pruning and thinning) biological control- (graft combination) chemical control- (plant growth substances) Plant Propagation; Commercial horticulture: orcharding, vegetable farming, floriculture; Ornamental Gardening; Landscape Horticulture

Unit I

Nursery technology – introduction, scope, infrastructure, green house, mist chamber and glass house. Procurement and storage of seeds – seed collection, storage, quality, drying, cleaning, seed record. Seed pretreatment – physical and chemical methods.

Unit II

Procurement of polypots, manure, clay and sand. Preparing seed beds and mother beds – sowing seeds in poly pots and beds, transplanting potting; irrigation, weeding, mulching, protection from pests and diseases. Essentials of Nursery Management: Soil management - physical and chemical properties of soil, organic matter, compost, and soil condition;

Unit III

Hydroponic Culture its Media and Media Mixes ; Loam–based and non-loam based media, Use of Manures and Fertilizers in Horticultural Crop Production; Organic Farming. Importance of Horticulture - Brief history, classification, climate, soil, water and nutritional needs of horticulture.

Unit V

Market preparation of fruits and vegetables- harvesting and handling, grading, curing / drying, chemical treatment, radiation treatment, pre-cooling, packaging, transportation, refrigeration, cold storage, controlled and modified atmosphere storage; Food processing- freezing, bottling and canning, preserves.

REFERENCES:

- Edmand Musser and Andres *Fundamentals of Horticulture*. Tata McGraw Hill, New Delhi.
- Sundarajan JS, Muthuswamy JK, Shanmugavelu G and Balakrishnan R *A guide on horticulture*. Thiruvenkadam Printers, Coimbatore.
- Lex Lauries and Victor H Rice *Floriculture-Fundamentals and practices*. Tata McGraw Hill, New Delhi.
- Gardener *Basic Horticulture*. Mac Millan, New York.
- Randawa *Ornamental horticulture in India*. Today & Tomorrow Publications, New Delhi.
- *Introduction to Horticulture*. TMH Publication.
- Chaturvedi AN *Technology of forest nurseries.* Khanna Bandhu Publications, Dehra Dun.
- Katoch CD *Forest Nursery* Handbook, Periodical Experts Book Agency, New Delhi.
- Siyag PR *Afforestation Manual*. Tree Craft Communications, Jaipur.

EXTRA DISCIPLINARY PAPER I – ETHNOMEDICINE AND PHARMACOGNOSY

Course code : JSPBTED1
Hours per week : 5
Credit : 5
Internal Marks : 25
External Marks : 75

Unit I

Ethno medicine in India – perspective – plants in folk religion and methodology , flowers and fruits – ethno medicine of the tribal of India – native medicinal uses of plants – herbal remedies among the tribes.

Unit II

Introduction: Traditional and alternative systems of medicine – basic concepts of pharmacognosy – Study of plants parts containing drugs (Under ground parts, Aerial parts, and Whole plant) with examples – cultivation of medicinal plants in India and Tamil nadu.

Unit III

Remedial plants - Plants and their products with anti-bacterial, anti-fungal, anti-viral, anti-leprosy, anti-septic, anti-diabetic activity.

Unit IV

Medicinal plant biotechnology – medicinal herbs – plant tissue culture as source of biomedical products – phytochemistry and pharmaceuticals.

Unit V

Pharmacognosy : Processing of crude drugs – grinding, extraction– (hot water and organic solvents extraction) and protocols for partial and complete purification – drug adulteration – methods of drug evaluation – biological testing of herbal drugs.

REFERENCES:

- Peter B Kaufimann et al *Natural products from plants*. CRC Press
- Munson P *Principles of Pharmacology*
- Bernfeld *Biogenesis o natural compounds*
- Willis *A text book of Phamacognosy*
- Trees and Evans *Phamacognosy*

Semester III

CORE COURSE VII – MOLECULAR BIOLOGY

Course code : JSPBTG3
Hours per week : 6
Credit : 5
Internal Marks : 25
External Marks : 75

Unit I

Eukaryotes Cell Structure and Cell Organelles (Chloroplast, mitochondria, ribosomes, ER & golgi complex.)

Unit II

Nucleus – ultra structure and functions, Chromosome – structure, types and variation,- Programmed Cell Death (PCD), Cell division (mitosis and meiosis), cell cycle events and their genetic control.

Unit III

DNA structure , replication, types (circular and super helical DNA) DNA amplification (PCR). DNA Finger Printing, Polymerases, Primer mechanisms.

Unit IV

RNA Structure – Types - Genetic code – Gene expression and Gene regulation in eukaryotes. Translation : initiation, elongation, and termination, Protein Structure.

Unit V

Cell signaling – communication between cells and their environment – characteristic features of (Chloroplast and Mitochondria DNA) and G- protein , Transposons, Chromosome walking.

REFERENCES:

1.De Robertis, E.D.P., and De Robertis, E.M.F. (1980) cell and molecular biology – Saunders International Edn., Philadelphia.

2 .Du Praw, E.J. (1969) – Cell & Molecular biology – Academic Press, N.Y.

3. Freifelder, D(1986) – Molecular Biology – Jones & Barriet Publishing INC., Boston, Portola Valley.

4. Gunning, B.E.S. & Steer, M.W(1975) – Ultra – structure and the biology of cells – Edward Arnold.

5. Gustafson, J.P. (1984) – Gene manipulation in plant improvement, Plenum Press, N.Y.

6. Leadbetter, M.C. (1970) – Introduction to the fine structure of plant cells – Springer Verlag.

7. Levin, B (1974) – Gene expression: Vol.I Bacterial Genomes, Vol.II Eucaryotic chromosomes – Wiley Inter Science. London.

8. Levin, B. (1998) – Genes VI – Oxford University Press, London.

9. Packer, L.(1976) – Mitochondria: Bioenergetics, biogenesis and membrane structure Academic press, N.Y.

10. Rastogi, S.C. Sharma, V.N. Anuradha Tandon (91993) – concepts in Molecular Biology – Wiley Eastern Ltd.

11. Sheeler, P., & Bianchi, D.(1987) – Cell and Molecular Biology.

12. Verma, P.S. & S. Agarwal, V.K. (1998) – Concept of Molecular Biology – S.Chand & Co., New Delhi.

13. Gomperts, B.D. (1976) – The Plasma membrane: Models for its structure & Function Academic Press.

14. Risley, M.S. (1986) – Chromosome structure and function – Van Nostrand, Reinholt.
15. Rost, T.L. Gifford, Jr. & Ernest, M.(1977) – Mechanism and control of cell division – Academic Press, N.Y.
16. Segal, H.L. & Doyle, D.J. (1978) – Protein turnover and Lysosomal functions – Academic Press, N.Y.
17. Whaley, W.G. (1975) – The Golgi Apparatus, Springer Verlag.

CORE COURSE VIII – GENETICS, PLANT BREEDING AND PLANT PATHOLOGY

Course code : JSPBTH3
Hours per week : 6
Credit : 5
Internal Marks : 25
External Marks : 75

Unit I - Genetics

Basic account on Mendelian genetics, gene interactions – linkage and crossing over, gene mapping, Sex linked inheritance, Sex determination in plants. Cytoplasmic inheritance – male sterility, origin, induction and application. Ploidy – types and significance of ploids.

Unit II – Genetics

Mutation Chromosomal aberrations – Biochemical basis of mutation, Spontaneous, induced mutations, mutagenic agents – mutagens, reverse and suppressed mutations. General account of population genetics (Hardey Weinberg's Law).

Unit III - Plant Breeding

Objectives – Selection of characters – Selfing and crossing techniques – methods of selection Pureline, Mass, Bulk, Back cross method - Breeding methods in self-pollinated, cross pollinated, vegetatively propagated and apomictic plants.

Unit IV – Plant Breeding

Hybrid vigour – Production of hybrids. Genetic basis and application in plant breeding. Androgenesis, Gynogenesis, Pollination biology. Modern methods and application.

Unit V – Plant pathology

Objective – Infection – pathogen – pathogenicity – virulent, avirulent , Mode of infection. Pathogen replication. Host response – host pathogen – interaction, infection confirmation (Oozing method) . Bacterial blight disease in rice, Red root of sugarcane.

REFERENCES:

- Winchester AM *Genetics*. Oxford & IBH Publishing House, New Delhi.
- Strickberger MW *Genetics*. MacMillan Publishing Co., New Delhi
- Jain HK *Genetics –Principles, concepts and implications*. Oxford & IBH Publishing House, New Delhi.
- Gupta PK *Genetics*. Rastogi Publications, Meerut.
- Bhaudai MM *Practical Plant Breeding*. Oxford & IBH Publishing House, New Delhi.
- Allard *Principles of Plant Breeding*. John Wiley Publication.
- Hayes HK Immer FR and Smith DC *Methods of Plant Breeding,* Reinhold Publication, New York.
- Shukla RS and Chandel PS – Cytogenetics, Evolution and Plant breeding, S Chand and Co, New Delhi.

CORE COURSE IX – MICROBIOLOGY

Course code : JSPBTI3
Hours per week : 6
Credit : 5
Internal Marks : 25
External Marks : 75

Unit I

Five Kindom system by Whittaker (1969). General feature of virus, bacteria, Mycoplasma – classification, characteristics, Ultra structure, Nutrition, Reproduction, Isolation, Purification and Economic importance.

Unit II Food Microbiology

Microorganisms and diseases – food and water borne diseases of human beings. Control of microorganisms – physical, chemical and biological agents.

Unit III Soil Microbiology

Soil Microbiology - microbiology of fresh water and sewage, microorganisms – techniques for the study of microorganisms. Role of microbes in water purification and sewage treatment processes. Food spoilage and food preservation.

Unit IV Industrial Microbiology

Industrial Microbiology – fermentation – types of fermentors and their applications. Industrial production of ethanol, vinegar and citric acid. Antibiotics – classification, sources and production of penicillin, streptomycin and tetracycline, vaccines and enzymes.

Unit V Agricultural Microbiology

Agricultural Microbiology – Biofertilizers: Isolation, enumeration, commercial production and application of Azolla, Azosprillium, Rhizobium, Azotobacter and BGA; Role of microbes in phosphate solubilization.

REFERENCES:

- Casida LE *Industrial Microbiology*. Wiley Eastern, New Delhi.
- Martin Alexander *Introduction to Soil Microbiology*. Wiley Eastern, New Delhi.
- Subba Rao NS *Soil Microbiology*. Oxford & IBH Publishers, New Delhi
- Ketchum *Microbiology*. John Wiley & Son.
- Frazier NC *Food Microbiology*. Tata McGraw Hill, New Delhi.
- Pelezar J Chen ECS and Krieg R *Microbiology*. Tata McGraw Hill, New Delhi

ELECTIVE COURSE III – FORESTRY

Course code : JSPBTEC3
Hours per week : 6
Credit : 5
Internal Marks : 25
External Marks : 75

Unit I

Forests – definition – types of forests in India – role of forests. Silviculture – objectives – general principles – regeneration, natural and artificial – silviculture technique for some important species: *Azadirachta indica*, *Casuarina equisetifolia*, *Eucalyptus Sps*, *Tectona grandis*, *Pterocarpus santalinus* (redsandal)

Unit II

Objectives and principles of forest management – sustained yield. Yield regulation: principles and concepts – regular and irregular forests – Joint Forest Management (JFM).

Unit III

Fundamental principles of forest economics – socio-economic analysis of forest productivity – forest valuation – role of ICFRE (Indian Council for Forest Research and Education) in forest research and education. Indian forest act and its amendments.

Unit IV

Role of Forest Protection in Indian Forestry - Injuries caused by human being - Animals - Insects - Birds - Adverse climatic factors. Injuries caused by plants - Forest fire. Fire protection methods. Integrated pest management methods.

Unit V

Definition - Objectives of agroforestry - Classification of agroforestry systems - Allelopathy - Social forestry - its components and implementation at local and national levels - social attitudes and community participation- choice of species for agro and social forestry.

REFERENCES:

- Kormondy, E.J. 2005 Concept of Ecology. Prentice Hall of India, New Delhi.
- Clarke, GL 1954 Elements of Ecology, John Wiley and Sons, New York.
- Chapman, RN 1928 The quantitative analysis of environmental factors *Ecology* 9:111-122.
- Champion HG and Seth 1968 A revised Survey of the forest types of India, Government of India Press, Nasik

CORE COURSE XI– PLANT PHYSIOLOGY, BIOCHEMISTRY AND BIOPHYSICS

Course code : JSPBTJ4
Hours per week : 5
Credit : 5
Internal Marks : 25
External Marks : 75

Unit I

Physiology: Plant water relations – water transport process, diffusion, osmosis, water potential, chemical potential. Absorption of water, Stomatal movement. Mineral Nutrition: Nutrient uptake and transport mechanism, stress physiology.

Unit II

Photosynthesis: Photochemical reactions, electron transport pathway, photophosphorylations, C3 and C4, CAM cycles. Respiration: Glycolysis, TCA cycle and electron transport in mitochondria, Photorespiration. Growth and development: Plant growth regulators – auxins, cytokinins, gibberellins, abscisic acid ethylene.

Unit III

Carbohydrates: structure, classification and characterization of mono, di and polysaccharides. Lipids: Structure, classification and characterization.

Unit IV

Amino acids : Classification. Enzymes – classification and properties, isoenzymes. Michaelis-Menton equation and its significance.

Unit V

Biophysics: Bioenergetics, laws of thermodynamics, ATP bioenergetics, entropy and enthalpy, characteristics of solar radiation, solar energy.

REFERENCES:

- Salisbury FB Ross CW *Plant Physiology*, CPS Publishers and Printers, New Delhi
- Gill PS *Plant Physiology*, S. Chand & Co., New Delhi
- Delvin KM *Plant Physiology*, East West Press
- Mukerjee S and Ghosh AK *Plant Physiology*, Tata McGraw Hill Publishers Pvt. Ltd., New Delhi.
- Barker G *Understanding the chemistry of cell*, Edward Arnold, London
- Epstein HT *Elementary Biophysics*, Wesly Publications.

CORE COURSE XII –BIOTECHNOLOGY

Course code : JSPBTK4
Hours per week : 5
Credit : 5
Internal Marks : 25
External Marks : 75

Unit I

r-DNA Technology – tools of genetic engineering – vectors for gene cloning (plasmid, phages, cosmids, YAC, YEB). Shuttle vectors and expression vectors, Molecular enzymes - Restriction enzymes, Reverse transcriptase, Ligase.

Unit II

Cloning Strategies: cDNA synthesis, cloning and Genomic libraries. PCR Techniques: adaptors, Linkers, homopolymer tailing.

Unit III

Gene transfer to plants : Direct gene transfer (Protoplast transformation, Particle Bombardment, Electroporation, Microinjection) Indirect gene transfer (Agrobacterium mediated gene transformation – Ti Plasmid) Screening Strategies : Screening and Hybridization (, Southern blotting , Western blotting, ELISA, RAPD, RFLP) Sequencing.

Unit IV Tissue culture

Protoplast fusion, synthetic seeds, cybrids, micropragation, cell suspension culture and application.

Unit V

Applications of Biotechnology : In Agriculture (Insect, Herbicide). Medicine (insulin). Industry (antibiotic). Golden rice. Legal and ethical issues, IPR, Biosafety.

REFERENCES:

1. S.B. Primrose, R.M. Twyman and R.W. Old, (2001) Principles of gene manipulation, Blackwell Science.

2. Molecular cloning : A laboratory manual. J.Sambrook, E.F.Fritsch and T.Maiatis, Cold Spring Harbor Laboratory Press, New York, 2000.

3. Molecular biotechnology, S.B. Primrose, Blackwell Scientific Pub., Oxford, 1994. Plant biotechnology, J.Hammaond, P.McGarvey and V.Yusibov, Springer Verlag, 2000.

4. Plant biotechnology A.Slater, N.Scotta M.Fowler. 2003. Oxford University Press.

CORE COURSE XIII – RESEARCH METHODOLOGY BIOINFORMATICS AND BIOSTATISTICS

Course code : JSPBTL4
Hours per week : 5
Credit : 5
Internal Marks : 25
External Marks : 75

Unit I

Concept of research - essential steps in research – 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. Planning and preparation of thesis – Research journals – National and International – monographs – reprints – proof correction – Full paper – Short Communication – Review paper.

Unit II

Bioinformatics: Use of Computers in Biological research; Retrieval of information from internet; list of software and their applications; Proteomics – 2D gel, signal peptide, Genomics – definition, functional genomics

Unit III

Scope of Biostatistics, probability analysis – variable in biology, collection, classification and tabulation of data, graphical and diagrammatic representation, scale diagram, histogram, frequency polygon and frequency curves.

Unit IV

Measure of central tendency – arithmetic mean, median and mode - measure of dispersion – standard deviation and standard Error. DMRT (Dungan's Multiple Range Test)

Unit V

Simple correlation, correlation coefficient, regression, simple linear regression, basic ideas of significance test, hypothesis testing, level of significance, 't' test, 'chi' square ANOVA.

TEXT BOOKS:

- Gurumani N *Research Methodology for Biological Sciences*, MJP Publishers, Chennai.
- Ramakrishnan P *Biostatistics*, Saras Publication, Nagercoil
- Arora PN and Malhon PK *Biostatistics*, Imalaya Publishing House, Mumbai
- Palanichami S and Manoharan M *Statistical methods for biologists*, Paramount publications.

REFERENCES:

- Connor & Peter Woodford, Writing Scientific Paper in English Pitman, Medical Pub. Co.Ltd., England, 1979.
- Khan, I.A., and Khannum, A., Fundamentals of Biostatistics, Vikas Pub., Hyderabad, 1994.
- Kothari, C.R., Research Methodolgy – Methods and Techniques, Wiley Eastern Ltd., New Delhi, 1991.
- Sree Ramulu, V.S., Thesis Writing, Oxford & IBH Pub., New Delhi, 1988.
- Zar, J.H. Biostatistics Analysis, Prentice Hall International, England Cliffs, New Jersy, 1984.

Semester IV

CORE COURSE XIV – PROJECT

Course code : JSPBTN4
Hours per week: 10
Credit : 5
Marks : 100

Semester III & IV

Core Course X PRACTICAL III – CELL AND MOLECULAR BIOLOGY, GENETICS AND PLANT BREEDING, MICROBIOLOGY, FORESTRY, ECOLOGY, PHYTOGEOGRAPHY AND CONSERVATION BIOLOGY, BIOCHEMISTRY, BIOPHYSICS AND PLANT PHYSIOLOGY, PRINCIPLES OF BIOTECHNOLOGY

Course code : JSPBTM4P
Hours per week : 4
Credit : 5
Internal Marks : 40
External Marks : 60

Cell and molecular biology

- Squash and smear techniques – onion root tip and Rheo flower buds.
- Study of karyotypes and ideogram using suitable plant materials.
- Cell organelles – plastids, Mitochondria, Golgicomplex, ER, Nucelus, Ribosomes (Microphotographs showing the structure)

Genetics

- Working out the problems in genetics and drawing of genetic charts.

Plant Breeding

- Charts depicting mass selection, pure line selection, backcross breeding and double cross in Maize
- Study of different kinds of plant propagation

Microbiology

- Isolation of Rhizobium from root-nodules of legumes
- Gram staining of bacteria found in curd and root nodule
- Microbial analysis of milk by methylene blue reduction test

Study the following diseases

- Ring rot of potato (*Pseudomonas solanacearum*)
- Bacterial Blight of rice
- Vein clearing of Bhendi
- Little leaf of Brinjal

Forestry

- Field visit to study different types of forest.

Ecology, phytogeography and Conservation Biology

- Estimation of carbonate, bicarbonate and chloride content in water samples
- Study of plant distribution maps – continuous, discontinuous, circum polar, circum tropical and endemic distribution.
- Study of satellite maps.

Plant Physiology Experiments

- Determination of water potential in different tissues
- Determination of Chlorophyll a, Chlorophyll b and total chlorophyll by Arnon method
- Estimation of proteins by Biuret and Lowry's method
- Estimation of phenols

Biochemistry Experiments

- Extraction and estimation of starch
- Extraction and estimation of lipids
- Peroxidase E.C.1.11.1.7
- Catalase E.C.1.11.1.6
- Poly phenol oxidase E.C.1.10.3.2

Biophysics

- pH meter
- Spectrophotometer
- Centrifuge
- Electrophoretic apparatus (PAGE)

Biotechnology

- Isolation of genomic DNA from plant and bacterial sources. Demonstraion.
- Isolation of plasmid DNA from *E. coli.* Demonstraion.