Botany Employability

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	mechanism and rate of speciation. Genetic variation-inbreeding depression, protein polymorphism, variation in nucleotide sequences. Formation of species.	
Unit-V	Evolution of sex in plants-Asexual reproduction, origin and evolution of sex organs, alternation of generations. Parthenogenesis and its applications.	**12hrs**

References:

1. Alberts, B. Bray, D. Lewis, Ralf M., Roberts, K and Watson, J.D. 1994. Molecular Biology of Cell. 3rd Edition Garland publishing co. New York.
2. Arumugam, N. 1992. Organic evolution. Saras Publication, Nagercoil.
3. Cain, S.A. 1944. Foundations of Plant Geography. Harper & Bros, NY.
4. Good, R.D. 1974. The Geography of flowering Plants. 3rd edition, Long Mans, London.
5. Jha, A. P. 1993. Genes and Evolution. Mac Millan India Ltd, New Delhi.
6. Kumar, H.D. 1992. Modern concept of Ecology. Eighth revised edition, Vikas Publishing House Pvt. Ltd. Bangalore.
7. Lawrence, G.H.M. 1965. Taxonomy of vascular plants. The McMillan Company, New York.
8. Radford, A.E. Dickinson, W.C. Massey, J. R. and Ben, C.R. 1974. Vascular Plant Systematics. Harper and Row, New York. London.
9. Shukla, R. S. and Chandel, P. S. 1989. Plant Ecology. S. Chand and Company Ltd. New Delhi.
10. Solomon, P. Elder, Berg, R. Linda and Martin, W. Diana 2003. Biology Brooks / cohe. Thomson learning. 6th edition. Prentice Hall University of Massachusetts, Amherst.
11. Stickberger, M.W. 1994. Evolution. Mac Millan Publishing co, New Delhi.
12. Strickberger, M. W, 2002. Evolution. Jones and Barlett Publishers. Sudbury.
13. Teresa Andesirk, Gerald Audesirk and Bruce, E. Byers. 2003. Biology-Life on Earth. 6th edition. Prentice Hall University of Massachusetts, Amherst.
14. Valentine, D.H. 1972. Taxonomy, Phytogeography and Evolution. Academic Press, London. New York.
15. Webber, P and Punnett, N. 1999. Physical geography and people Stanley. Thomas (Pub) Ltd. England.

	SCT-1.1: BIOSTATISTICS AND BIOINFORMATICS	48 hrs
Unit-I	Biostatistics -Introduction and scope of Biostatistics. Basic concepts of Biostatistics: Variables, constants, observation, data, population.	**2 hrs**
Unit-II	Types and collection of data: Sampling, primary data, Secondary data. Presentation of data: Line diagram, bar diagram, pie diagram, graphic presentation of data.	**4 hrs**
Unit-III	Measurement of central tendency: Mean, Median, Mode. Measures of dispersion: Range, Quartile deviation, Mean deviation, Standard	**6 hrs**

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	deviation, Standard error, Coefficient of variation.	
Unit-IV	Probability and Probability distribution: Binomial, passion and normal distribution. Testing of Hypothesis: Null hypothesis, alternative hypothesis, z test, t test and chi-square test.	**8hrs**
Unit-V	Correlation and regression: Scatter diagram, simple linear regression and nonlinear regression, correlation and correlation coefficient and application. One way and two way analysis of variance and multivariate analysis of variance.	**4hrs**
Unit-VI	Computer application: Knowledge of computer systems, hardware and software, CPU and other peripheral devices, software packages, programming language, scientific application of packages.	**8 hrs**
Unit-VII	Internet: The World Wide Web and local area network (LAN), wide area network (WAN). Information retrieval, communication using internet, web data base directories, search engine.	**8hrs**
Unit-VIII	Biological Databases, Bioinformatics tools, Sequence Alignment tool, Database Searching (BLAST, FASTA), Comparative genomics, Structural and Functional genomics in brief.	**8hrs**

References:

1. Bliss CK, Statistics in Biology, 1970.
2. Daniel WW, Biostatistics, 1995
3. Minieka E and Kuzeja Z.D. Statistics for businesses with computer application. 2001
4. Karne, Fundamental Concepts Of Bioinformatics 1ed, Pearson publishers, 2012
5. Patil C. S., Ajit Gangawane and Srinath Rao, Bioinformatics and Bioinformation (2011) APH Publishing Corporation. New Delhi.
6. Arumugam N., Gopi A., Sundaralingam R., Meena A., and Kumarasen V Biostatistics Computer Application Bioinformatics instrumentation (2010) Saras publication Nagarcoil (TN).
7. Irfan A Khan and Atiya Khanum, Emerging trends in Bioinformatics (2002) Ukaaz Publications Hyderabad.
8. Irfan A khan and Atiya Khanum, Recent advances in Bioinformatics (2002) Ukaaz Publications Hyderabad.
9. Padmini E. Biochemical calculations and Biostatistics (2007) Books and Allied (P.) Ltd. Kolkata
10. Sudara Rajan S. and Balaji R. Introduction to Bioinformatics (2003) Himalaya Publishing House.
11. Dhamu K. P. and Ramamoorthy K 2009 Fundamentals of Agriculture Statistics Scientific publishers (India) Jodhpur.
12. Sharrma T. R. 2009 Genome Analysis and Bioinformatics I. K. International Publishing House Pvt. Ltd. New Delhi.

SCP-1.1: BIOSTATISTICS AND BIOINFORMATICS	
Biostatistics	
	Measures of central tendency Measures of Dispersion Correlation and Regression
Bioinformatics	
	<u>Biological Databases</u> a) Nucleotide Database 1. GenBank 2. Embl 3. DDBJ b) Protein Database 1. Swiss-Prot 2. PDB **Sequence collection from NCBI** **Alignment Tool** 1. PSA (Pairwise Sequence Alignment-Align tool) 2. MSA (Multiple Sequence Alignment- clustal w tool) **Database Searching Tool** 1. BLAST 2. FASTA

HCT-2.3: GENETICS AND EVOLUTION		48 hrs
Unit-I	Mendelian principles, alleles, linkage and crossing over, genetic maps. Sex determination in plants. Extrachromosomal inheritance, somatic cell genetics. Inheritance of quantitative characters.	**8hrs**
Unit-II	Concept of genes – fine structure of gene, split genes, overlapping genes, included genes. Recombination in bacteria and phages – conjugation, transformation and transduction.	**8hrs**
Unit-III	Gene expression in prokaryotes and in eukaryotes.	**4hrs**
Unit-IV	Genetic engineering – Restriction endonucleases, ligase, vectors, gene cloning techniques, polymerase chain reaction, southern and northern blotting.	**6hrs**
Unit-V	Origin of life, chemical evolution, molecular evolution. Theories of evolution – Lamarckism, neo-Lamarckism, Darwinism, neo-Darwinism, Mutation theory and synthetic theory.	**6hrs**
Unit-VI	Population genetics and evolution – Mendelian population, gene pool, gene frequency, genetic drift, founder effect, genetic polymorphism. Hardy-Weinberg law, mechanism of speciation	**8hrs**
Unit VII	Molecular Evolution: Concepts of neutral evolution, molecular divergence and molecular clocks; Molecular tools in phylogeny, classification and identification; Protein and nucleotide sequence analysis; origin of new genes and proteins; Gene duplication and divergence.	**8hrs**

References:

1. Goodenough U, 1990. Genetics. Armugam N, 1992. Organic evolution.
2. Basu.S.B. and M.Hossain.2004. Principles of Genetics. Books and Allied (P). Ltd, Kolkatta.
3. Benjamin, Levin. 2004. Genes VIII.
4. Benjamin Lewin (2000). Genes VII. Oxford university press. Blackwell Science Ltd.
5. Peter Snustad D, Michael J Simmons (2010). Principles of genetics (V Edn). John Wiley and Sons.
6. Daniel L Hartl, Elizabeth W Jones (2009). Genetics: Analysis of genes and genomes (VII Edn). Jones and Bartlett publishers.
7. Endress PK, 1994. Diversity and evolutionary biology of tropical flowers.
8. Gardner E J, Simmons M J, Snustad D P (1991). Principles of Genetics (III Edn). John Wiley andSons Inc.
9. Gardner, E.J. 1972. Principles of genetics. Willey Eastern Pvt.Ltd.
10. George Ledyard Stebbins (1971). Process of Organic evolution.
11. Gupta, P.K, 2000. Gentics.Rasatogi publications, Meerut.

12. Gurbachan and S. Miglani, 2000. Basic Genetics, Narosa Publishing House, New Delhi.
13. Gurbachan S Miglani (2002). Modern Synthetic theory of evolution.
14. Katy Human (2006). Biological evolution: An anthology of current thought. The Rosen publishing
15. MaxtoshiNei, Sudhir Kumar (2000). Molecular Evolution and phylogenetics. Oxford University
16. Monroe W Strickberger (1990). Evolution. Jones and Bartlett publishers Press.
17. Reigner, R.A. A. Michalis and M.M. Green, 1976. Glossary of Gentics and Cytogenetics. Springer-Verlag, New York.
18. Robert J Brooker (2009). Genetics: Analysis and principles (III Edn). McGraw Hill.
19. Roderic D M Page, Edward C Holmes (1998). Molecular Evolution: A phylogenetic approach.
20. Sinnot, E.W. Dunn, L.E. and Dobzhansky, T. 1973. Principles of Genetics. McGraw Hill. New York.
21. Snustad D P, Simmons M J (2000). Principles of Genetics (III Edn). John Wiley and Sons.
22. Stickberger MW, 1994. Evolution.
23. Strickberger (2005). Genetics (III Edn). Prentice Hall of India Pvt. Ltd.
24. Strickberger, M.W. 1976. Genetics. Mac Millan. New York.
25. Swaminathan, M.S, P.K.Gupta and V.Singa. 1983. Cytogenetics of crop plants. Macmillan India Ltd, New Delhi.
26. Swanson, C.P. 1972. Cytology and Cytogenetics. Mac Millan. New York.

SCT-2.1: METHODS IN PLANT SCIENCE		48 hrs
Unit-I	Microscopy – Principles and working mechanism of transmitted and incident microscopy. Principles, working mechanism and uses of Dark field microscopy, polarization microscopy, fluorescence microscopy, phase contrast microscopy. Electron microscopy – TEM, SEM, STM.	**8hrs**
Unit-II	Processing of plant material for light and electron microscopy. Principles and uses of microtomy; Fixing of plant material, dehydration, staining procedures.	**6hrs**
Unit-III	Centrifugation techniques – differential, density gradient centrifugation. Spectroscopic methods – ultraviolet and visible spectroscopy, Raman spectroscopy, nuclear magnetic resonance technique, fluorescence and mass spectroscopy.	**8hrs**
Unit-IV	Isolation and purification of RNA, DNA (genomic and plasmid) and proteins, different separation methods. Generation of genomic and cDNA libraries in plasmid, phage, cosmid, BAC and YAC vectors. Expression vector and expression of protein in brief, Autoradiography, Method of DNA sequencing, micro array technique.	**12hrs**
Unit-V	Techniques of protein isolation, purification and separation –	**10hrs**

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	chromatographic techniques, ion exchange, gel filtration affinity chromatography, high performance liquid chromatography. Electrophoresis techniques – agarose, polyacrylamide electrophoresis, capillary and immuno-electrophoresis.	
Unit-VI	Principles and applications lasers, tracer techniques in biology, radiolabel ling –carbon dating, molecular imaging of radioactive material, safety guidelines. .	**4 hrs**

References

1. Ackerman E A, Ellis L E E, Williams L E (1979). Biophysical Science. Prentice-Hall Inc.
2. Berlyn GP and Miksche JP. 1976. Botanical micro-techniques and cytochemisty.
3. Chang R (1971). Basic principles of spectroscopy. McGraw Hill.
4. Friefelder D. Physical Biochemistry. W H Freeman and Co.
5. Garry D Christian, James E O'reilvy (1986). Instrumentation analysis. Alien and Bacon, Inc.
6. Gordon MH and Macrae M. 1987. Instrumental analysis in the biological sciences.
7. Henry B Bull (1971). An Introduction to physical biochemistry. F A Devis Co.
8. Mahadevan A, Sridhar R (1996). Methods in Physiological Plant Pathology. Sivakmi Publications.
9. Perkampus H (1992). UV-VIS Spectroscopy and its applications. Springer-Verlag.
10. Pesce A J, Rosen C G, Pasty T L. Fluorescence Spectroscopy: An introduction for Biology and
11. Robyt JF and White BJ, 1987. Biochemical techniques: theory and practice.
12. Salle A J (1974). Fundamental principles of Bacteriology. McGraw Hill.
13. Stanford J R (1975). Foundation of Biophysics. Academic press.
14. Wilson K and Walker JM.1994. Principles and techniques of practical biochemistry.
15. Allan peacock, H. 1966. Elementary Microtechnique. Edward Arnold Publ.
16. Bancroft, J.D, 1967. An introduvction to Histochemical technique. Appleton, Century Crofts, New York.
17. Berlyn, P.G, 1986. Botanical microtechnique and cytochemistry.
18. Duddington, C.L, 1960. Practical microscopy. Pitman publ.
19. Gahan, P.B, 1984. Plant histochestry and Cytochemistry--- An introduction. Academic press, U.K.
20. George, E.F. and Sherrington, P.D. 1984. Plant propagation by tissue culture. Freeman Publishers, London.
21. Gray, P. 1964. Hand book of basic microtechnique. MacGrawHill , New Delhi.
22. Jayaraman, J. 1992. Tecniques in Biology.HigginBothams Pvt Ltd, Chennai.
23. Johnson, D.A, 1940. Plant microtechnique. MacGrawHill , New Delhi.
24. Kelkar, S.S ., P.M. Kare and H.J. Jhala 1984. Gel immuno diffusion techniques in the Research laboratory medicine. New Delhi.
25. Kiernan, J.A, 1990. Hisological and Histochemical Methods. Theory and practice. Permagon press, U.K.
26. Krishnamurthy, K.V, 1988. Methods in plant histochemistry. Viswanathan printers and publishers, Chennai.

27. Lindsley, K. 1992.Plant tissue culture manual. Kluwer Academic publishers.
28. McClung, C.L, 1961. Hand book of Microscopic technique. MacGraw Hill, New Delhi.

SCT-2.1: PLANT GENETIC ENGINEERING		48 hrs
Unit-I	Introduction to Genetic Engineering: Concepts and scope of genetic engineering. Milestones in Plant Recombinant DNA Technology. Importance of gene manipulation in future perspectives.	**2hrs**
Unit-II	Tools in Genetic Engineering: Enzymes in genetic engineering - Restriction endonucleases- types and action, All DNA modifying enzymes. Cloning vectors: Plasmids isolation and purification- Ti Plasmid, pBR322, pUC –series. Phage vectors-M13 phage vectors, Cosmids-Types, Phasmids or Phagemids, Shuttle vectors-types. YAC and BAC vectors, Lambda phage vectors, Lamda phage DNA as a vectors. Cloning vectors and expression vectors.	**10hrs**
Unit-III	Techniques for plant Transformation: Integration of plant tissue culture in to plant transformation protocols. Introduction, *Agrobacterium* mediated gene transfer, The Ti-plasmid, The process of T-DNA transfer and integration, Practical applications of Agrobacterium-mediated plant transformation, Transformation in Planta, Direct gene transfer methods.	**8hrs**
Unit-IV	The genetic manipulation of herbicide resistance: The use of herbicide in modern agriculture, Strategies for engineering herbicide resistance, The environmental impact of herbicide-resistant crops. The genetic manipulation of pest resistance: GM strategies for insect resistance. The *Bacillus thuringiensis* approach to insect resistance, The Copy Nature Strategy, Insect resistant crops and food safety. The genetic manipulation to plant disease resistance: Plant pathogen interaction, Natural disease resistance pathways-Overlap between pests and diseases, Biotechnological resistance to disease resistance. Transgenic approaches to viral disease resistance.	**12hrs**
Unit-V	Engineering stress tolerance: The nature of Abiotic Stress, The nature of Water deficit stress, Targeted approaches towards the manipulation of tolerance to specific water deficit stresses.	**4hrs**
Unit-VI	The Improvement of crop yield and quality: The genetic manipulation of fruit ripening, engineering plant protein composition for improved nutrition, The genetic manipulation of crop yield by enhancement of photosynthesis.	**4hrs**
Unit-VII	Molecular Farming/Pharming: Metabolic engineering of plants. Carbohydates and lipids, Molecular farming of proteins, Economic consideration of molecular farming.	**4hrs**

succulents), epiphytes and halophytes

HCP-2.2 CELL AND MOLECULAR BIOLOGY

1. Study of cell division – Mitosis (*Allium cepa, Allium sativum, Rhoeo*)
2. Study of Meiosis - (*Allium cepa, Helianthus, Tredescantia* flower buds)
3. Karyotype analysis – ideogram – preparation of ideogram
4. Isolation of genomic DNA from leaf tissue
5. Agarose Gel electrophoresis.
6. Separation of protein by SDS.
7. Isolation of RNA from plants.

HCP-2.3: GENETICS AND EVOLUTION

1. Study of life cycle in *Drosophila melanogaster.*
2. Observation of mutant flies.
3. Special type of chromosome in *Drosophila melanogaster.*
4. Genetics problem in Mendelian inheritance, gene interaction, quantitative inheritance, multiple alleles, sex linkage and genetic map.
5. Application of Hardy –Weinberger law in gene frequencies.
6. Models and photographs related to genetics.

SCP-2.1: METHODS IN PLANT SCIENCE

1. Isolation of plant pigments and paper chromatography.
2. Estimation of protein by UV-Visible spectrophotometer.
3. Estimation of DNA by UV-Visible spectrophotometer.
4. Fixation of plant materials, dehydration, sectioning, staining and analysis.
5. Estimation f chlorophyll pigments by spectrophotometer

SCP-2.1: PLANT GENETIC ENGINEERING

1. Isolation of genomic DNA from bacteria/plants and purification by agarose gel electrophoresis.
2. Restriction analysis of plasmids, gel purification of DNA, small and large scale purification of plasmids.
3. Preparation of competent *E. coli* cells. Bacterial transformation and recovery of plasmid clones.
4. Gene cloning in plasmids, analysis of recombinant plasmids.
5. DNA amplification by PCR, RT-PCR
6. Analysis of DNA and RNA and Protein by Southern and Northern and Western blotting.
7. Demonstration: Plant tissue culture-preparation of Murashige and Skoog medium, shoot

	Xylem: Ontogeny, Phylogeny, Evolution, ultra-Structure and function. Phloem: Ontogeny, phylogeny, Evolution, Ultra structure of sieve tube elements and functions.	
Unit-VI	Primary and secondary growth: Anamolous primary structures with special reference to *Nyctanthus*, *Achyranthus*. Anamolus secondary growth with reference to *Boerrhavia, Bignonia, Leptadinia, Piper, Tinospora, Thunbergia coccinea*.	**8hrs**
Unit-VII	Wood anatomy, Softwood, Hard wood, Ring and Diffuse porous wood, Xylem parenchyma, Ray parenchyma.	**4hrs**
Unit-VII	Epidermal tissue system: Types of stomata, trichomes and glands.	**2hrs**

References:

1. Clegg, CJ and Cox G. (1974) Anatomy and Activities of Plants- A guide to the study of flowering plants.
2. Cutler, D. F. (1978) Applied Plant Anatomy, Longman, New York.
3. Cutler E. Plant Anatomy: Experiments and interpretation. Part-1. Cell and Tissues Edword, Arnold, London (1969).
4. Cutter E. Plant Anatomy: Experiments and interpretation. Part-2. Organs. Edward, Arnold, London (1971).
5. Eames E. J. and McDaniel's (1947). An introduction to plant anatomy, Mc Grew Hill, New York and London.
6. Esau, K. (1960) Anatomy of seed plants. John Wiley and Sons.
7. Esau, K. (1965) Plant Anatomy, 2nd Edition.
8. Esau, K. (1965). Vascular differentiation. Hort, Rinehert and Winston, New York.
9. Fahn, A. (1974) Plant Anatomy, 2nd Edition, Pregmon.
10. Krishnamurthy. K. V. methods in Plant Histo-Chemsitry. Vishwanathan, S. Madras, 1988.
11. Roy, K. (2006) Plant Anatomy, New Central Book Agency (P) Limited. Calcutta.
12. Maheshwari P. (1950). An introduction to embryology of Angiosperms. McGrew Hill, New York.
13. Bhojwani S. S. and Bhatnagar S. P. (2000). The embryology of Angiosperm (4th revised and enlarged edition) Vikas Publishing house, New Delhi.
14. Raghavan V. (1997). Molecular embryology of flowering plants. Cambridge University press, Cambridge.
15. Raghavan V. (1986). Embryogenesis in angiosperm- A development and experimental studies. Cambridge University Press New York USA.
16. Raghvan V. (1987). Molecular Biology of flowering plants Cambridge University Press New York USA.
17. Shivanna K. R. and Sawhney V. K. (eds) 1997. Pollen Biotechnology for crop production and improvement. Cambridge University, Cambridge.

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SCT-3.1 ECONOMIC BOTANY		48 hrs
Unit-I	**Introduction:** Plants in commerce and industry. General account: History, methods of cultivation and uses of economic crops.	**2hrs**
Unit-II	Study and utility of the useful parts of the following: Cereals and Millets- Rice, Wheat, Maize, Barley, Sorghum and Millets. Pulses: Red gram, Green gram, Black gram, Horse gram, Pea, Cow pea, Bengal gram. Oil Yielding plants: Sunflower, Safflower, Groundnut, Linseed, Rape seed. A brief introduction to horticultural plants. Floriculture.	**12hrs**
Unit-III	Study and utility of the useful parts of the following: Sugar yielding plants- Sugar cane and Sweet potato. Spices and condiments- Ginger, Turmeric, Cardamom, Cinnamon, Clove, Saffron, All spice, Black pepper, Nutmeg, Red pepper, Coriander, Cumin, Fennel and Vanilla,	**10hrs**
Unit-IV	Study and utility of the useful parts of the following: Fibre- Cotton, Jute, Flax, Hemp, Sann hemp, China grass, Coconut and Kapok. Timber yielding plants- Tectona, Dalbergia and Rosewood. Dyes- Indigo, Henna: Masticatories and fumitories: Areca nut, Beetle leaf, Tobacco. Rubber- Para rubber and other substitutes Gums- Gum Arabic, Karya gum	**12hrs**
Unit-V	Medicinal Botany: Scope and Importance of Medicinal Plants. Indigenous Medicinal Sciences. Ethnomedicinal plant Gardens. Important medicinal plants and their uses. Palaeoethnobotany. Folk medicines of ethnobotany, ethnomedicine, ethnoecology, ethnic communities of India. Application of natural products to certain diseases- Jaundice, cardiac, infertility, diabetics, Blood pressure and skin diseases.	**12hrs**

References

1. Hill, A.F. 1952. Economic Botany, TataMcGraw Hill
2. Kocchar, S.L. 1998. Economic Botany of Tropics.
3. Kochar, L.S. 1981. Economic Botany in the Tropics, Macmillan
4. Pandey, B.P. 2000. Economic Botany. S. Chand & Company, New Delhi.
5. Pandey, S.N. and Chandha, A. 1999. Economic Botany. Vikas Publishing House Pvt. Ltd. New Delhi.
6. Peter B. Kaufman *et al.*, 1999. Natural Products from Plants
7. Purseglove, J.W. 1972. Tropical Crops-Monocotyledons and Dicotyledons.

SCT-3.1 MEDICINAL PLANTS AND PHYTOCHEMISTRY	48 hrs

Unit-I	Ethnobotany and Ethnomedicine: A brief account at world level and in India. A brief account on therapeutic values of important plant drugs of different taxonomic groups. Classification of medicinal plants.	**10hrs**
Unit-II	Pharmacognosy: Raw drug analysis, microscopic, macroscopic, Characteristics, preliminary chemical analysis, qualitative and quantitative analysis of raw drug using Colorimetry, Spectophotometry, Chromatography (*Senna, Datura, Cinchona, Ginger, Nuxvomica, Withania, Rauwolfia, Emblica*)	**10hrs**
Unit-III	Cultivation of medicinal and aromatic plants: Cultivation practice, disease and pest control, harvesting and storage of medicinal plants, post-harvest care, deterioration and disintegration of active compounds during storage and its control. (*Dioscorea, Isabgol, Senna, Liquiorice, Rauwolfia, Costus, Withania, Citronella, Vetiver, Artimisia, Acorus, Vanilla*)	**12hrs**
Unit-IV	Phytochemistry - Occurrence, classification and properties of Alkaloids, Steroids, Terpenoids, Lectins, Non Protein Amino acids. Pesticidal, and Insecticidal properties of compounds of plant origin	**8hrs**
Unit-V	Medicinal oil: occurrence, distribution and importance of aromatic and non-aromatic oils of plant source. Use of vegetable oil as food, medicine and industry..	**4hrs**
Unit-VI	Plants in the treatment of Stress, Heart diseases, Cancer, AIDS, anti-fertility, anti-microbial activity	**4hrs**

References:

1. Kirtikar K. R. and Basu B. D. 1932 Indian Medicinal plants.
2. Nadakarni, A. K. 1954 Indian Materia MedicaVol I and II
3. Sivarajan V. V. and Indira, B. 1994 Ayurvedic drugs and their plant sources. Oxford &IBH Publishing Co, New Delhi.
4. Trease, G. E. and Evans, W. L. 1983 Pharmacognosy 12th ed. Bailliere Tindall, London.
5. Vaidya, B. 1982. Some controversial drugs in Indain medicine. Chaukambica Orientalia, Varanasi.
6. Harborne, J. 1984 Phytochemical methods. Ed Chapman & Hall, London
7. Mann, J., Davidson, R. S., Hobbs, J. B., Benthorpe, D. V. and Harborne Natural products, Longman Scientific and Technical Co, Essex
8. Smith, P. M. 1976 The Chemotaxonomy of plants Edward Arnold, London.
9. Rastogi, R.P. and Mehrotra, B.N. 1991. Compedium of Indian medicinal plants Vol.I&II. Publishers. Central Drug Research Institute Lucknow and Publications and Information Directorate New Delhi
10. Vijay adnhaleshi C 2004 Compendium on Controversial Drugs, Jagdguru Sriman Madhwacharya Moolamahasamsthana Sri Raghavendraswamy Matha, Manthralayam.

SCT-3.1 BIODIVERSITY AND CONSERVATION		48 hrs
Unit-I	Species concept: Concept and importance of biodiversity, Earth summit 1992, and agenda 21, species diversity, genetic diversity, ecosystem diversity, Biodiversity of the world, India and Karnataka, Hotspots of world and India, Mega biodiversity centres of world and India. Origin centers of crop plants.	**10hrs**
Unit-II	Loss of Biodiversity: Casual factors of threat, Impact of habitat loss and habitat fragmentation, Categories of treat endangered, vulnerable, rare, threatened and extinct. Red Data Book. Environmental impact assessment, sustainable development.	**10hrs**
Unit-III	Biodiversity Conservation: Objectives, implication and action plans, International and National organizations for conservation of natural resources. In situ conservation – protected areas, biosphere reserves, national parks, sanctuaries and sacred groves. ex situ – conservation, botanical gardens, gene banks, medicinal conservation parks, herbal gardens.	**10hrs**
Unit-IV	International organizations for biodiversity conservation- IUCN, Species survival commission (SSC), convention on biological diversity (CBD), CITES, TRAFFIC, WWF. Plant genetic resources: Conservation, gene bank- methods, types, NBPGR, IPGR.	**10hrs**
Unit-V	Biodiversity conservation Legal aspects: Legal aspects of biodiversity in India. Policy and priority setting. Biodiversity conservation future strategies for India.	**8hrs**

References

1. Ramakrishna, P.S. 1991. Ecology of Biological innovation in the Tropics. National Trust of Ecology and International science Publication, New Delhi.
2. Ramakrishna, P.S., Das, A.K. and K.G. Saxena. 1996. Conserving Biodiversity for Sustainble Development. INSA, New Delhi.
3. Hambler, C. 2004. Conservation. Cambridge University Press.
4. Southwood, T.R.E. and Henderson. 2000. Ecological methods. Blackwell Science Ltd., Oxford.
5. Pandey, A.K. (ed.) 1995. Taxonomy and Biodiversity. CBS, New Delhi.
6. Khoshoo, T.N. 1994. India's Biodiversity Tasks a need. Curr. Sci., 67: 577-582.
7. Myers, N. 1990. Threatened Bio and as 'hot spots' in tropical forests. The Environmentalists, 8: 187-2008.
8. Richard B. Primack. 1993. Essentials of Conservation Biology.
9. Heywood, V.H. & Watson, R.T. 1995. Global Biodiversity Assessment.
10. Negi, S.S. 1993. Biodiversity and its Conservation in India.
11. Glasson, J., Therivel, R. & Chadwick, A. 1995. - Introduction to environment impact assessment. UCL Press Ltd., London.

12. Heywood, V.H. & Wyse Jackson, R.S. (eds.), 1991. - Tropical Botanical Gardens- their role in conservation and development. Academic Press, San Diego.
13. Nayar, M.P. 1996. - Hot spots of endemic plants of India, Nepal, and Bhutan. TBGRI, Trivandrum. 12. Nayar, M.P. & Sastry, A.R.K. 1987, 1989, 1990. - Red Data Book of Indian Plants (3 vols.).
14. Walter, K.S. & Gillett, H.J. 1998. - IUCN Red List of threatened plants. The World Conservation Union, Cambridge. M

HCP-3.1 SYSTEMATIC BOTANY OF ANGIOSPERMS.
1. Description of plants using technical terms
2. Identification of plants to species using flora
3. Preparation of dichotomous key for identification.

HCP-3.3 REPRODUCTIVE BIOLOGY AND PLANT ANATOMY
1. Endosperm/ Embryo dissection
2. Observation of slides of Microsporogenesis and megasporogenesis.
3. Pollen germination and viability
4. Preparation of permanent slides of free hand /paraffin Sections
5. Wood anatomy study based on T.S., T.L.S. and R.L.S.
6. Dermal tissue system.

SCP-3.1: ECONOMIC BOTANY
1. Field survey for collection of economically important plants of the region.
2. Study of locally available economic products of plant origin.
3. Study of important medicinal plants and their uses.

SCP-3.1: MEDICINAL PLANTS AND PHYTOCHEMISTRY
1. Identification of medicinal plants.
2. Identification of raw drugs- pharmacognistic studies.
3. Identification of controversial drugs.
4. Preliminary tests for the occurrence of secondary metabolites.
5. Estimation of alkaloids
6. Estimation of Phenols
7. Estimation of Essentail oils.

SCP-3.1: BIODIVERSITY AND CONSERVATION
1. Field survey of important plants of the region.

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2. Study of the characters and threatened plants included in the theory.
3. Survey of important timber yielding trees of the region.
4. Determination of the minimum size of the quadrat suitable for an area using 'species area curve' method.
5. Determination of Importance Value Index (IVI) of the plant species in the community by quadrant method.
6. Study of Phytogeographic maps of world and India.
7. Map of Hot spots, Continental drift.

	OE-3.1 PLANT PROPAGATION TECHNIQUES	48hrs
Unit-I	Plant propagation- History, scope and importance. Propagation structures with reference to greenhouse equipment and media.	**3hrs**
Unit-II	Seed propagation; Germination, type of seed dormancy and breaking, techniques of seed production and handling principles.	**6hrs**
Unit-III	Vegetative propagation: Techniques of propagation a) Cuttings: Stem cuttings – hard wood, semi hard wood, soft wood and herbaceous, leaf cuttings, leaf bud cuttings, root cuttings. b) Layering: Simple layering, compound, tip layering, stool, air, serpentine and trench layering. c) Budding: T – budding patch budding, chip budding, ring budding. d) Grafting: Whip and tongue, wedge and cleft, bark, side grafting, approach. e) Propagation by specialized stems and roots	**12hrs**
Unit-IV	Micropropagation – Techniques and applications in forestry and horticulture.	**5hrs**
Unit-V	Advantage, limitations and applications of vegetative propagation, clones, genetic variation in asexually propagated plants, different methods.	**5hrs**
Unit-VI	Seed propagation: Seed production, types of seed sowing, harvesting, drying and thrashing, storage, types of storage, pathogens in storage and their control, seed health, purity, vigor, and tests to check. Dormancy types, factors affecting dormancy, methods to overcome dormancy, advantages of dormancy. Seed germination and viability tests seed protectants; priming. Coating, pelleting, Classes of seeds; breeder seeds, nuclear seeds, founder seeds, certified seeds and cultivar seeds, seed act 1966, seed certification. Liner production and hardening of seedlings, seed certification, seed act	**12hrs**
Unit-VII	Propagation methods of some selected plants – Citrus, Grape, Mango, Mulberry, Hibiscus, Rose, Croton, Eucalyptus.	**5hrs**

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References

1. Abbottt, A.J. and Atkin, R.K. 9eds.) 1987 Improving vegetatively propagated crops. Academic press, New York.
2. Bose, T.K., Sadhu, M.K., & Das, P., 1986. Propagation of Tropical and Subtropical Horticultural crops, NowyaPrakash, Calcutta.
3. Hartmann and Kester, 1983. Plant propagation.
4. Hartmann, H.T., Kester E.D., Davis, F.T., and Geneve, R.L. 1997. Plant propagation. Principles and practices. Prentice Hall of India Private Limited, New Delhi.
5. Krishnamurthy. H.M. 1981. Plant Growth substances including application in Agriculture.
6. L.M. Pierik 1987. In vitro culture of Higher plants MurtinusNijhoff pub. Dordrecht.
7. M.K. Razdan 1994. An Introduction to Plant tissue culture, Oxford and IBH Pub. Co., PVT. Ltd., Bombay and Calcutta.
8. Mac Donald, B. 1987. Practical woody plant propagation for nursery growers. Portland, OR: Timber press.
9. Sadhu, M.K. 1989. Plant propagation Wiley eastern Ltd. N. Delhi.
10. Hartman, H.J. 1990. Plant Propagation: Principles and practices. Prentice Hall, New Delhi.
11. Sadhu, M.K. 2000. Plant Propagation. New Age Publication, New Delhi.
12. Schwalz, M. 1975. Guide to commercial hydroponics. Israel University, Jerusalem.
13. Sharma, V.K. 1996. Plant nurseries. Techniques, production and management. Indian Pub. New Delhi.

OE-3.1 PLANT DIVERSITY AND HUMAN WELFARE		48hrs
Unit-I	Plant diversity and its scope- Genetic diversity, Species diversity, Plant diversity at the ecosystem level, Agrobiodivesity and cultivated plant taxa, wild taxa. Values and uses of Biodiversity: Ethical and aesthetic values, Precautionary principle, Methodologies for valuation, Uses of plants, Uses of microbes.	**12hrs**
Unit-II	Loss of Biodiversity: Loss of genetic diversity, Loss of species diversity, Loss of ecosystem diversity, Loss of agrobiodiversity, Projected scenario for biodiversity loss, Management of Plant Biodiversity: Organizations associated with biodiversity management-Methodology for execution-IUCN, UNEP, UNESCO, WWF, NBPGR; Biodiversity legislation and conservations, Biodiversity information management and communication	**14hrs**
Unit-III	Conservation of Biodiversity: Conservation of genetic diversity, species diversity and ecosystem diversity, In situ and ex situ conservation, Social approaches to conservation, Biodiversity awareness programmes, Sustainable development.	**10hrs**
Unit-IV	Role of plants in relation to Human Welfare; a) Importance of forestry their utilization and commercial aspects b) Avenue trees, c) Ornamental plants of India. d) Alcoholic beverages through ages. Fruits and nuts: Fruit crops of Karnataka and their commercial	**12hrs**

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	importance. Wood and its uses.	

References:

1. Krishnamurthy, K.V. (2004). An advanced text book of biodiversity - Principles and Practices. Oxford and IBH Publications Co. Pvt. Ltd. New Delhi.

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SCT-4.1 PLANT BREEDING		48 hrs
Unit-I	Introduction: Objectives of plant breeding, important achievements and future prospects, Genetic variability and its role in plant breeding, Domestication and centres of origin of cultivated plants.	**4 hrs**
Unit-II	Systems of reproduction in plants: Reproductive system; sexual and asexual Pollination; cross and Self-pollination control mechanism, Incompatibility, male sterility and their types, Apomixsis	**10 hrs**
Unit-III	Hybridization: Methods of hybridization and its role.Inter-varietal, inter specific and inter generic crosses. Heterosis and inbreeding depression.	**8 hrs**
Unit-IV	Breeding for resistance: abiotic stresses (drought and salinity), biotic stresses (disease and insects).	**10hrs**
Unit-V	Mutation breeding: Mutations (Spontaneous and induced), Chemical and physical mutagens.Methods of mutation breeding, Limitations and achievements of mutation breeding.	**8 hrs**
Unit-VI	Molecular breeding : Molecular marker system, RFLP, RAPD, AFLP, SSR and SNPs.Methods and importance of marker assisted breeding	**8 hrs**

References

1. Al Chaudhari, H.K. (1984). Elementary principles of plant breeding Oxford IBH..New Delhi lards R W (1995). Principles of Plant Breeding. John Wiley and Sons, Inc.
2. Allard, R.W, 1960. Principles of plant breeding. John Willeg, New York.
3. Chaudhary, H. K. (2001) Plant Breeding Theory and Practice, Oxford IBH Ltd, New Delhi, India
4. David Allen Sleper, John Milton. (2006). Breedign Field Crops. Blackwell Publishing Ltd.
5. Dwivedi and Singh (1980) Essentials of Plant Techniques, 2nd Ed., Scientific Publishers. Moan Bhavan Udaipur, India.
6. Gardner, E.J. (1972). Principles of genetics. Willey Eastern Pvt.Ltd.
7. Ghahal G S and Gosal S S (2002). Principles and procedures of Plant Breeding. Narosa Publishing House.
8. Gupata P. K. (2007) Genetics, Plant Breeding and Evolution. Rastogi Publication, Meerut, India
9. Gupta P. K. (1996) Cytology, Genetics, Evolution and Plant Breeding. Rastogi Publication, Meerut, India.
10. Hays, K.K. Immer, F.R. and Smith, D.C. (1985). Methods in plant breeding .Tata McGraw Hill. Newyork.
11. Neal.C.Stopskopf. (1999). Plant Breeding Theory & Practices. Scientific Publishers, Jodhpur.
12. Sharma J R (1994). Principles and practices of Plant Breeding. Tata McGraw-Hill Publishers
13. Sing B. D. (1996) Plant Breeding and Evolution.

14. Singh B D (1996). Plant Breeding: Principles and methods. Kalyani Publications Sinha, U and Sinha U., (1976). Cytogenetics, Plant breeding and Evolution. Vikas pub & Co, New Delhi.
15. Singh,B.D. 1996. Principles of plant breeding. Oxford IBH. New Delhi.
16. Singh,B.D. 2001. Plant Breeding, Principles and Methods. Kalyani Publications, , New Delhi
17. Sinha, U and U.Sinha, 1976. Cytogenetics, Plant breeding and Evolution. Vikas pub & Co, New Delhi.
18. Swaminathan, M.S, P.K.Gupta and V.Singa. (1983). Cytogenetics of crop plants. Macmillan India Ltd, New Delhi.

SCT-4.1 PLANT BIOTECHNOLOGY		48 hrs
Unit-I	Plant tissue culture: Scope and Importance of plant tissue culture-Media composition and types, hormones and growth regulators- explants for organogenesis, somaclonal variation and cell line selection, production of haploid plants and homozygous cell lines. Micro propagation, somatic embryogenesis, protoplast culture and somatic hybridization. Selection and maintainance of cell lines, cryopreservation, germplasm collection and conservation, plant tissue culture certification.	**8hrs**
Unit-II	Plant transformation techniques: Mechanism of DNA transfer – Agro bacterium mediated gene transfer, Ti and Ri plasmids as vectors, role of virulence genes; design of expression vectors; 35S promoter, genetic markers, reporter genes; viral vectors and binary vectors. Direct gene transfer methods-particle bombardment, electroporation and microinjection. Binary vectors.	**8hrs**
Unit-III	Metabolic engineering of plants: Plant cell culture for the production of useful chemicals and secondary metabolites (Hairy root culture, Biotransformation, Elicitation) - pigments, flavonoids, alkaloids; mechanism and manipulation of shikimate pathway. Commercial production of enzymes, biodegradable plastics, therapeutic proteins, edible vaccines and antibiotics using transgenic technology.	**8hrs**
Unit-IV	Plant Development: Plant growth regulators- auxin, gibberlins, cytokinins, abscicic acid and acetylene. Biological nitrogen fixation, importance and mechanism.Biofertilizers- production, VAM, Rhizobium, Azotobacter, Mycorhiza, Actinorhiza Vermicomposting technology and Biopesticides.	**6hrs**
Unit-V	Gene Manipulation Technology: Crop improvement, productivity, performance and fortification of agricultural products–Bt cotton, Btbrinjal. Herbicide resistance, viral resistance, bacterial resistance, fungal resistance crops. Golden rice and transgenic sweet potato.Stratagies for engineering stress tolerance. Transgenic plants; Current status of transgenic plants in India and other countries,	**10hrs**

	Ethical issues associated with GM crops and GM food; labelling of GM plants and products. Importance of integrated pest management.	
Unit-VI	Post-harvest technology: RNAi and antisense RNA technology for extending shelf life of fruits and flowers (ACC synthase gene and polygalactoronase); delay of softening and ripening of fleshy fruits (tomato, banana, watermelons). Post-harvest protection of cereals, millets and pulses.	**8hrs**

References

1. Alan Scragg, 2005. Environemntal Biotechnology. II Edition. Oxford University Press. New York.
2. Bernard R. Glick and Jack J. Pasternak, 2001. Molecular Biotechnology – 2nd edition, ASM press Washington DC.
3. Brown, C.W, I.Campbell and F.G. Priest, 1987. Introduction to Biotechnology. Blackwell scientific publications, Oxford.
4. Chawla, H.S, 2000. Introduction to Biotechnology. Oxford & IBH Publishing Co Pvt. Ltd, New Delhi.
5. Chrispeels M.J.et al. 1994. Plants, Genes and Agriculture-Jones and Bartlett Publishers, Boston.
6. Gamborg O.L. and Philips G.C.Plant cell, tissue and organ culture (2nd Ed.) Narosa Publishing House. New Delhi.1998.
7. Gistou, P and Klu, H.Hand book of Plant Biotechnology (Vol. I & II).John Publication.2004.
8. Gupta, P.K. 2003. Biotechnology and Genomics, Rastogi Publisher, Meerut.
9. Halford N.G. Plant biotechnology: current and future applications of genetically modified crops. John Wiely Publishers.2006.
10. Hammond,J , P. Mc Garvey and V. Yusibov . 2002. Plant Biotechnology –New products and applications, Springer – Verlag, Heidelberg.
11. Hammound J, P McGravey&Yusibov.V. Plant Biotechnology, Springer verlag. 2000.
12. Hans-Peter Schmauder. 2005. Methods in Biotechnology. Taylor & Francis. London.
13. Heldt. 1997. Plant Biochemistry and Molecular Biology. Oxford and IBH Publishing Co. Pvt.Ltd. Delhi.
14. Ignachimuthu, S.1997. Plant Biotechnology, Narosa publishing House, New Delhi.
15. John.A.Thomas. 2004. Biotechnology and safety Assessment. II Edition. Taylor & Francis. London.
16. Kirakosyan A and Kaufman P.B.Recent Advances in Plant Biotechnology (1st Ed.).Springer Publishers. 2009.
17. Kumar, H.D. 2004. A textbook on Biotechnology – 2nd edition, Affiliated East West press Pvt., Ltd., London.
18. LydianeKyte and John Kleyn. Plants from test tubes, An introduction to Micro propagation (3rd Ed.). Timber Press, Portland. 1996.
19. Marx, F.L, 1989. A revolution in Biotechnology. Cambridge University press, New York.
20. Murray D.R. Advanced methods in plant breeding and biotechnology.Panima Publishing Corporation.1996.

21. NickoloffJ.A.Methods in molecular biology, Plant cell electroporation and electrofusion protocols-Humana press incorp, USA. 1995.
22. Ranat, K.G. and J.M. Merillon. 2003. Biotechnology: Secondary Metabolites. Oxford & IBH Publishing Co. Pvt. Ltd, New Delhi.
23. Rani Pathak. 2007. Introduction to Biotechnology. Atlantic Publishers & Distributors (P) Ltd., New Delhi.
24. Rastogi, S.C. 2007. Biotechnology- Principles and Applications. Narosa Publishing House, New Delhi.
25. Sawahel W.A. Plant genetic transformation technology. Daya Publishing House, Delhi.1997.
26. Slatu A .The genetic manipulation of plant. Oxford University Press.2003.
27. Sridhar, S. 2005. Enzyme Biotechnology, Dominant publishers and Distributors, New Delhi.
28. Trevan M.D, S. Boffey, K.J Goulding and P.Stanburg, 1977. Biotechnology: The Biological principles. TATA McGraw – Hill, New Delhi.
29. Walker, J.M. and R. Repley. 2006. Molecular Biology and Biotechnology. IV Edition. Panima Publishing Company, New York.

SCT -4.1 ETHNOBOTANY AND IPR		48hrs
Unit-I	Ethnobotany: Introduction, concept, scope and objectives; Ethnobotany as an interdisciplinary science. The relevance of ethnobotany in the present context; Ethnic groups and Ethnobotany: Major and minor ethnic groups or Tribals of India, and their life styles. Forest Vs. ethnic groups; Plants in Tribal life with reference to Magico-religious rituals and social customs. Sacred groves.	**12hrs**
Unit-II	Methodology of Ethnobotanical studies: a) Field work b) Herbarium c) Ancient Literature d) Archaeological findings e) temples and sacred places f) Protocols.	**10hrs**
Unit-III	Role of ethnobotany in modern Medicine with special examples; Medico-ethnobotanical sources in India with special reference to Karnataka; Tribals Vs. Agriculture: Shifting, Podu and Jhum cultivation. Role of ethnic groups on surrounding environment. Crop Genetic sources. Endangered taxa and forest management (participatory forest management).	**12hrs**
Unit-IV	Ethnobotany and legal aspects. Ethnobotany as a tool to protect interests of ethnic groups. Sharing of wealth concept with few examples from India. Ethnobotany as a source (recent) of already known drugs: a) Withania as an antioxidant and relaxant b) Sarpagandha in brain ailments c) Becopa and Centella in epilepsy and memory development in children d) Phyllanthus fraternus in diabetic and viral jaundice e) Artemisia as a powerful cerebral antimalarial agent and its possible use in tuberculosis. Biopiracy, Intellectual Property Rights and Traditional Knowledge.	**14hrs**

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References:

1. Plant Physiology, biochemistry and molecular biology. David, T: Dennis and Davis Turnip. Longman.
2. Scientific and technical U.K. 1990.
3. Plant Biochemistry Voet, D and Voet J.G. International
4. Outlines of biochemistry. 5th edition Con E.E. and Stump P.K. 1995. Willey
5. Principles of biochemistry, Lehnenger, A.L. 1982 CBS Publication
6. Biochemistry, Strayer W.H. 1976. Foreman Company.
7. Introduction to Plant Physiology. Willium G. Hopkins and Norman P. A. Huner
8. Plant Physiology. Lincoln Taiz and Eduardo Zeiger. International Edition
9. Plant Biochemistry. P.M. Dey and J.B. Harborne
10. Plant Biochemistry. Hans-Walter Heldt
11. Physicochemical and Environmental Plant Physiology. Park S. Nobel.

OE-4.1 MEDICINAL BOTANY		48hrs
Unit-I	History, Scope and Importance of Medicinal Plants. Indigenous Medicinal Sciences; Definition and Scope-Ayurveda: History, origin, panchamahabhutas, saptadhatu and tridosha concepts, Rasayana, plants used in ayurvedic treatments, Siddha: Origin of Siddha medicinal systems, Basis of Siddha system, plants used in Siddha medicine. Unani: History, concept: Umoor-etabiya, tumors treatments/ therapy, polyherbal formulations.	**12hrs**
Unit-II	Conservation of endangered and endemic medicinal plants. Definition: endemic and endangered medicinal plants, Red list criteria; In situ conservation: Biosphere reserves, sacred groves, National Parks; Ex situ conservation: Botanic Gardens, Ethnomedicinal plant Gardens. Propagation of Medicinal Plants: Objectives of the nursery, its classification, important components of a nursery, sowing, pricking, use of green house for nursery production, propagation through cuttings, layering, grafting and budding.	**14hrs**
Unit-III	Sources of financial aids for medicinal plant cultivation: Aims and objectives, Functions and activities of the board, Schemes and Projects for Financial assistance, Funding of projects; Procedure for processing project proposal for approval, Implementation and monitoring.	**12hrs**

Unit-IV	Ethnobotany and Folk medicines. Definition; Ethnobotany in India: Methods to study ethnobotany; Applications of Ethnobotany: National interacts, Palaeo-ethnobotany. Folk medicines of ethnobotany, ethnomedicine, ethnoecology, ethnic communities of India. Application of natural products to certain diseases- Jaundice, cardiac, infertility, diabetics, Blood pressure and skin diseases.	**10hrs**

References

1. Trivedi P C, 2006. Medicinal Plants: Ethnobotanical Approach, Agrobios, India.
2. Purohit and Vyas, 2008. Medicinal Plant Cultivation: A Scientific Approach, 2nd edn. Agrobios, India.
3. Yoganarasimhan S N. Medicinal Plants of India- Vol 1- Karnataka, Interline Publishing Pvt. Ltd.

	OE-4.1 AESTHETIC BOTANY	48 hrs
Unit-I	**Phytogeography:** Climate and Vegetation of the world Floristic regions of the world. Phytogeographical regions of India; Endemism; Concept of hotspots, hot spots of the world. Forest types of India	**8hrs**
Unit-II	**Gardening** Garden Design: Scope and objectives of gardening; Style of gardens (Formal, Informal); Types of gardens (English, Mughal and Japanese) Components of garden; Planning of outdoor gardens- Small, Residential, Larger Home Garden, Roof Garden, Terrace Garden, Industrial garden, Housing complex, Indoor gardening Garden Features and Ornamentation: Water, Garden pool, Stream, Waterfall, Fountain, Rocks, Roads, Walks, Pavements and Steps, Walls fences and Gates, Hedges, Edges, Arches, Statues, Towers.	**12hrs**
Unit-III	**Floriculture** Nursery production and management: Scope, Site, Soil, Environment, Layout, Manure, Fertilizers, Maintenance, Garden tools, Culture and Garden calendar, Types, Nursery beds, Pest & Disease management. Propagation of ornamental plants by seeds, bulbs, layering, cuttings, grafting, budding & tissue culture. Plant disorders including nutrition, pests and diseases, and chimaeras Ornamental ferns and their propagation; herbaceous perennials, Annuals & Biennials: Important Genera and Species, their importance in garden designs.	**14hrs**
Unit-IV	**Landscaping** Landscape Design: Definition, objectives and scope, Landscape	**14hrs**

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	elements of construction and designing of Residential, Commercial, Bungalow, Public area, Hotel, Educational Institute and religious places Palms and Cycas: Characteristics, propagation, culture, pest and disease, importance and uses, genera and species of palms and Cycads. Bamboo and conifers: Genera, species and varieties Lawns & Grasses: Planting methods, maintenance, pest management Ornamental succulents, Cacti Polyhouse technology: Scope and objectives of floriculture.	

References

1. Randhawa GS and Mukhopadhyay A. 2004. Floriculture in India. Allied Publishers Pvt. Limited. 72
2. Swarup Vishnu. 2003. Garden Flowers. National Book Trust
3. Hartmann HT, Kester DE, Davies FT and Geneve RL. 2002. Plant Propagation – Principles and Practices. Prentice Hall India Ltd.
4. Royal Horticultural Society"s Encyclopedia of Gardening.