Karnataka State Women's University, Vijayapur

M.Sc. Botany Choice - Based Credit System (CBCS) Syllabus

CORE SUBJECT: BOTANY – [Post Graduate]

Course code	Course name	Credits				Marks										Remark
						C1			C2			C3			Total	
		L	T	P	Total	L	T	P	L	T	P	L	T	P		
Semester I																
HCT-1.1	Phycology, Mycology, Bacteria and Virus	04			04	15			15			70			100	
HCT-1.2	Bryophytes and Pteridophytes	04			04	15			15			70			100	
HCT-1.3	Gymnosperms and Paleobotany	04			04	15			15			70			100	
SCT-1.4	Biostatistics and Bioinformatics	04			04	15			15			70			100	
HCP-1.5	Phycology, Mycology, Bacteria and Virus			02	02			07			07			36	50	
HCP-1.6	Bryophytes and Pteridophytes			02	02			07			07			36	50	
HCP-1.7	Gymnosperms and Paleobotany			02	02			07			07			36	50	
SCP-1.8	Biostatistics and Bioinformatics			02	02			07			07			36	50	
	Total	**16**		**08**	**24**	**60**		**28**	**60**		**28**	**280**		**144**	**600**	
Semester II																
HCT-2.1	Ecology and Phytogeography	04			04	15			15			70			100	
HCT-2.2	Cell and Molecular Biology	04			04	15			15			70			100	
HCT-2.3	Genetics and Evolution	04			04	15			15			70			100	
SCT-2.4	Methods in Plant Science Genetic engineering (optional)	04			04	15			15			70			100	
HCP-2.5	Ecology and Phytogeography			02	02			07			07			36	50	
HCP-2.6	Cell and Molecular Biology			02	02			07			07			36	50	
HCP-2.7	Genetics and Evolution			02	02			07			07			36	50	
SCP-2.8	Methods in Plant Science			02	02			07			07			36	50	
OE-2.9	Neutraceuticals	04				15			15			70			100	
	Total	**20**		**08**	**24**	**75**		**28**	**75**		**28**	**350**		**144**	**700**	
Semester III																

HCT-3.1	Systematic Botany of Angiosperms	04			04	15			15			70			100	
HCT-3.2	Plant Anatomy and Embryology	04			04	15			15			70			100	
HCT-3.3	Medicinal plants and Phytochemistry	04			04	15			15			70			100	
SCT-3.4	Economic Botany and Conservation of Biodiversity	04			04	15			15			70			100	
HCP-3.5	Systematic Botany of Angiosperms			02	02			07			07			36	50	
HCP-3.6	Plant Anatomy and Embryology			02	02			07			07			36	50	
HCP-3.7	Medicinal plants and Phytochemistry			02	02			07			07			36	50	
SCP-3.8	Economic Botany and Conservation of Biodiversity			02	02			07			07			36	50	
OE-3.9	Plant Propagation Techniques	04				15			15			70			100	
	Total	**20**		**08**	**24**	**75**		**28**	**75**		**28**	**350**		**144**	**700**	
Semester IV																
HCT-4.1	Plant Physiology	04			04	15			15			70			100	
HCT-4.2	Plant Breeding	04			04	15			15			70			100	
SCT-4.3	Plant Biotechnology	04			04	15			15			70			100	
HCP-4.4	Plant Physiology			02	02			07			07			36	50	
HCP-4.5	Plant Breeding			02	02			07			07			36	50	
SCP-4.6	Plant Biotechnology			02	02			07			07			36	50	
HCPW-4.7	Project work			**10**	**10**									**150**	**150**	
	Total	**12**		**16**	**28**	**45**		**21**	**45**		**21**	**210**		**258**	**600**	
	Programme total														**2600**	

L- Lecture, T- Tutorial, P- Practical.

HCT- Hard Core Theory, SCT- Soft Core Theory, OE- Open Elective, HCP- Hard Core Practical, SCP- Soft Core Practical.

HCPW- Hard Core Project Work/Dissertation.

The project evaluation marks 150 are a total of 100 marks for dissertation, 25 marks for presentation and 25 marks for viva.

SEMESTER I

HCT-1.1: PHYCOLOGY, MYCOLOGY, BACTERIA AND VIRUSES		52 Hours
Course objectives: • To understand the occurrence, basic structure, organization and reproduction of algae, fungi, lichen, viruses and bacteria. • To understand the reproduction and economic importance of algae, fungi, lichens, viruses and bacteria. **Possible outcomes:** By studying this course the students will learn about general account and economic importance of algae, fungi, lichens, viruses and bacteria with their impact on human life. **Programmespecific outcomes:** • Understand the structure, function of algae, fungi, viruses and bacteria. • Identify algae and fungi in their natural habitat on the basis of characters. • Develop the cultures of algae and fungi.		
Unit-I	Phycology: Introduction and History, with special reference to Indian work. Distribution and important systems of classification in Algae. Comparative account of Algal pigments. Structure and function of cell wall, flagella, food reserves, pyrinoids, eye spot and their importance in classification.	**8hrs**
Unit-II	Thallus organization, reproduction and life-cycle of the following: Cyanophyta, Chlorophyta, Xanthophyta, Bacillariophyta, Pheophyta and Rhodophyta.	**12hrs**
Unit-III	Economic importance of Algae: Algae as food and medicine, Algal blooms and toxic Algae.	**2hrs**
Unit-IV	Mycology: introduction, diversity, general characters and classification of Fungi. (As per Alexopolous and Mims). Morphology, ultra-structure of fungal cell. Reproduction and life cycle in Myxomycotina, Mastigomycotina, Zygomycotina, Ascomycotina, Basidiomycotina and Dueteromycontina. Heterothallism and Parasexuality.	**12hrs**
Unit-V	Detailed account of economic importance of Mushroom: Cultivation, edible and poisonous mushrooms fungi.	**6hrs**

Unit-VI	Lichens: General account and systematic of Lichens. Structure of thallus, reproduction and ecological significance.	**4hrs**
Unit VII	Viruses and Bacteria: Viruses: General account of plant and animal viruses. Transmission of plant viruses. Structure and reproduction in TMV and T4 phage. Prions and viroids.Bacteria: Ultrastructure, classification,Bergey's Manual Trust, reproduction, nutrition and economic importance.	**8hrs**

References:

1. AlexopoulosCJ (1963). Introduction to Mycology.
2. Chapman VJ and Chapman DJ(1973) The algae.
3. Biligrami K.S. and Saha L.S. (1992). A text book of Algae.
4. Jackson D.F. Algae and Man.
5. Burnett, J.H. Fundamentals of Mycology.
6. Aneja K. R. Experiments in Microbiology, Plant Pathology and Biotechnology 2003 New Age International (P) Limited, Publishers, New Delhi.
7. E Rosenberg, Microbial biology.
8. M. Pelezar, DR Reid and ECS Chan, Microbiology
9. R.C.Dubey and Maheshwari.D.K.2002.A text book of Microbiology.S.C Chand and Co. Ltd.Ramnagar,NewDehli.
10. Sullia S.B and Shantaram.S.1998. General Microbiology. Oxford and IBH Publishing Co. Pvt. Ltd. New Dehli
11. Sharma O. P. and Shivani Dixit 2001 Experiments and Techniques in Microbiology, Plant Pathology, Ecology and Soil Science, Pollution, Biochemistry and Plant physiology PragatiPrakashenmeerut.

HCT-1.2: BRYOPHYTES AND PTERIDOPHYTES		52 Hours
Course objectives: • To understand the classification and evolution of Bryophytes and Pteridophytes. • This course is intended to provide the basic understanding of morphology and reproduction in Bryophytes and Pteridophytes and their Economic importance. **Possible outcomes:** After studying this paper students will be able to classify Bryophytes and Pteridophytes. They will also be able to describe heterospory, origin of seed habit and evolutionary trends in stele and spore producing organs. Besides above, they will also be able to understand the economic importance and experimental works in Bryophytes and Pteridophytes. **Programmespecific outcomes:** • The students will learn about the structure and reproduction of certain selected species of Bryophytes and Pteridophytes. • Understand the structure and life cycle of different bryophytes. • Understand the structure and life cycle of different pteridophytes.		
Unit-I	**Bryophytes:** Introduction, distribution origin, evolution and classification, economic and ecological importance.	**8hrs**
Unit-II	Range in thallus structure, anatomy and evolutionary tendencies in sporophytes (Progressive sterilization of sporogenous tissue)	**8hrs**
Unit-III	Reproduction, life history, inter-relationships and affinities of various groups (Marchantiales, Jungermaniales, Anthocerotales, Sphagnales and Polytrichales) of Bryophytes.	**10hrs**
Unit-IV	Pteridophytes: Introduction, general characters, origin, evolution and classification.	**8hrs**
Unit-V	Psilopsida: Comparative account of Psilophytales and Psilotales. Lycopsida: Range in vegetative and reproductive structures in Lycopodials and Isoetales. Heterospory and seed habit. Sphenopsida: Range in vegetative and reproductive structure Pteropsida: Range in vegetative and reproductive structure, sori and sporangia in ferns.	**12hrs**
Unit-VI	Stelar and soral evolution, economic importance and experimental work in Ptridophytes.	**6hrs**

References

1. Puri, P. 1980. Bryophytes. Atma Ram and Sons, Delhi.
2. Parihar, N. S. 1996. Bryophytes. Central Book Depot, Allahabad.
3. Parihar, N. S. 1996. Biology and Morphology of Pteridophytes. Central Book Depot, Allahabad.
4. Sporne, K. R. 1991. The Morphology of Pteridophytes. B.I. Publishing Pvt. Ltd., Bombay
5. Manju C Nair, Rajesh K.P. and Madhusudanan P.V. Bryophytes of Waynad in Western Ghats. Malabar Natural History Society, Kozikode.

HCT-1.3: GYMNOSPERMS AND PALEOBOTANY		52 Hours
Course objectives: • This course is intended to provide the basic understanding of morphology and reproduction in Gymnosperms and their Economic importance. • It also give details of Geological time scale and an understanding of the past history of the biosphere and evolution of plants through fossils. **Possible outcomes:** After successfully completing this course, the student will be able to recognize morphological, anatomical and reproductive characteristics of Gymnosperms and the extinct Bryophytes, Pteridophytes and Gymnosperms. The student will understand the evolutionary history of plant kingdom. **Programmespecific outcomes:** • The students will learn about the structure and reproduction of certain selected species of Gymnosperms. • Learn few representatives of fossil forms. • Study the different types of fossils of extinct plants/ flora. • Study the evolutionary affinity between Cordiatales, Cycadales, and Coniferales.		
Unit-I	Gymnosperms-Introduction Distribution, General characters, Origin, Evolution and Classification of Gymnosperms.	**6hrs**
Unit-II	Comparative account of habit, anatomy and reproduction of Cycadales: Cycas and Zamia. Coniferales: Pinus, Araucaria, Thuja. Gnetales: Gnetum,Ephedra andWelwitschia Ginkgoales: Ginkgo	**20hrs**
Unit-III	Economic importance of Gymnosperms. Experimental works in Gymnosperms	**4hrs**
Unit-IV	Paleobotany - Objectives, Nomenclature and Geological time scale	**4hrs**
Unit-V	Fossilization and types of fossils, techniques for fossil study, factors affecting fossilization.	**6hrs**
Unit-VI	Study of morphology, anatomy and evolutionary trends of following group of fossil plants: Psilophytales, Lepidodendrales, Calmitales, Filicales, Coenopteridales, Pteridospermales, Bennettitales, Pentoxylales, Cordiatales, Cycadales, Coniferales.	**12hrs**

References:

1. Bhatnagar, S.P. and Moitra, A. 1996. Gymnosperms. New Age International Pvt. Ltd., New Delhi.
2. Coulter and Chamberlin, J. M. 1978. Morphology of Gymnosperms.
3. Dutta, S.C. 1973. An introduction to Gymnosperms.
4. Sporne, K. R. 1967, Morphology of Gymnosperms.
5. Stewart W. N. and Rathwell G.W. 1993. Palaeobotany and Evolution of Plants.
6. Shila A. C. and Mishra S. D. 1975. Essentials of Palaeobotany.

SCT-1.4: BIOSTATISTICS AND BIOINFORMATICS		52 hrs
Course objectives: • To study about basics of statistics and utilization of statistical method in biology. • To study about modern tools of bioinformatics an inter-disciplinary subject to help the biologists in research perspectives. **Possible outcomes:** The course will give knowledge about data collection, processing and interpretation of biological samples through statistical methods. The course will give knowledge about modern tools of bioinformatics. Students will learn necessary skills in the use of databases and online tools related to biological data. **Programmespecific outcomes:** • The students will know the basic principles of biostatistics and computer applications inbiology. • Understand the fundamental concepts ofbiostatistics. • Learn about the computer and imbibecomputer skills for biological datamanagement and graphical presentation. • Be enlightened about the need for computerapplications, programs and techniques forbiology. • In bioinformatics they will gain deepunderstanding of using computer to visualize, explore and model sequence analysis.		
Unit-I	Biostatistics -Introduction and scope of Biostatistics. Basic concepts of Biostatistics: Variables, constants, observation, data, population.	**4hrs**
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.	**4hrs**
Unit-III	Measurement of central tendency: Mean, Median, Mode. Measures of dispersion: Range, Quartile deviation, Mean deviation, Standard deviation, Standard error, Coefficient of variation.	**8hrs**
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-I	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-II	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-III	Biological Databases, Bioinformatics tools, Sequence Alignment tool, Database Searching (BLAST, FASTA), Comparative genomics, Structural and Functional genomics in brief.	**8hrs**

HCP-1.5: PHYCOLOGY, MYCOLOGY, BACTERIA AND VIRUSES	
<u>Phycology</u>	
	Cynophyta*: Microcystis ,* *Spirulina, Scytonema and Oscillatoria* Chlorophyta : *Chlymydomonas, Volvox, PediastrumScenedesmus, Hydrodictyon* Diatoms : *Pinnate and Centric – Synendra, Pinnuria, Navicula&Cyclotella* Xanthophyta : *Botrydium* Phaeophtae : *Dictyota and Ectocarpus* Rhodophyta*: Polysiphonia and Gracillaria* Economic important product : *Agar-Agar, Spirulina tablets*
<u>Mycology</u>	
	Phycomycetes : *Mucor, Phytophthora, Saprolegnia* Ascomycetes : *Saccharomyces, Xylaria, Aspergillus,Peziza* Basidiomycetes : *Polyporus, Lycoperdon, Ustilago,Agaricus* Duetoromycetes : *Alternaria , Cercospora, Cladosporium*
<u>Viruses and Bacteria</u>	
	Staining of Bacteria (Positive,Negative& Gram's staining) Demonstration of Bacterial motility by hanging drop method Test for coliform Bacteria- Streak plate method Viral disease of Tobacco,Papaya&Bhendi.

HCP-1.6: BRYOPHYTES AND PTERIDOPHYTES	
Bryophytes: Study of vegetative habit, Anatomy and Reproductive Structures of the following taxa:	
	Targionia, Marchantia, Porella, Pellia *Anthoceros, Notothallus* *Sphagnum, Polytrichum&Bryum* Comparative structure of sporophytes of Bryophytes
Pteridophytes: External morphology, Anatomy & reproductive structures of the following:	
	Psilotum and Lycopodium *SelaginellaIsoetes, Equisetum* *Ophiglossum and Botrychium* *Angiopteris, Pteris&Hymenophyllum* *Marselia, Salvinia and Azolla*

HCP-1.7: GYMNOSPERMS AND PALEOBOTANY	
Gymnosperms : Study of vegetative habit, Anatomy and reproductive structure of the following	
	Cycas and zomia *Pinus, Taxus and Thuja* *Gnetum,Ephedra, Welwitschia* *Ginkgo*
Paleobotany: Study of fossil forms using moulds, charts, photography and slides	
	Lepidodedron *Calamites* *Leginopteris* Geological Time scale using chart

SCP-1.8: 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

SEMESTER II

<table>
<tr><th colspan="2">HCT-2.1 ECOLOGY AND PHYTOGEOGRAPHY</th><th>52 hrs</th></tr>
<tr><td colspan="3">Course objectives:
This course aims to introduce the students to the concepts and principles of ecology, population, community and ecosystem structure and function and application of these concepts to solve environmental problems.
To understand the importance of environment and the problems related with it at global and local level.
Possible outcomes:
Students will understand the importance of nature surrounding us and their role. Students will know the disturbance of climatic changes on human beings. Students will understand the evil effect of global warming and UV radiation.By understanding these concepts, the student will be able to develop attitude, value system and ethics towards environment related issues.
Programmespecific outcomes:
The students get to understand the basicconcepts of geology, pedology, ecology,autecology, synecology, phytogeography and advanced ecology.
Know the establishment of ecosystem,vegetation, plant succession and adaptations.</td></tr>
<tr><td>Unit-I</td><td>Ecology: concept of autecology and synecology, aim and scope, ecological factors- temperature, edapic, topographic, climatic and biotic factors</td><td>6 hrs</td></tr>
<tr><td>Unit-II</td><td>Ecosystems: structure, abiotic and biotic components, food chain, food web, ecological pyramids, energy flow</td><td>4hrs</td></tr>
<tr><td>Unit-III</td><td>Population Ecology: growth curves, ecotypes, ecads, hydrosere and ecological succession, xerosere, concept of climax vegetation</td><td>4hrs</td></tr>
<tr><td>Unit-IV</td><td>Ecological Adaptations: Morphological, anatomical and physiological responses of plants, hydrophytes, xerophytes, epiphytes, halophytes, heliophytes and sciophytes</td><td>6hrs</td></tr>
<tr><td>Unit-V</td><td>Community Ecology: methods of studying natural vegetation by quadrants, bisects, transects. Remote sensing and GIS</td><td>3hrs</td></tr>
<tr><td>Unit-VI</td><td>Environmental pollution: Introduction, causes, effects and control measures of water pollution, air pollution, soil (Land) pollution, noise pollution, acid rain, global warming, ozone depletion and public</td><td>7hrs</td></tr>
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Unit VII	Phytogeography: Theory of land bridges, theory of continental drift, theory of glaciations. Phytogeographic regions of the world and India. Endemism, hotspots. Endemism in Western Ghats.	**10hrs**
Unit VIII	Biodiversity: Magnitude, Assessment, Importance, Conservation, Utilization.Conservation of Biodiversity: Current practice in conservation in India and abroad:Strategies for *in situ* conservation – Protected areas, Wildlife sanctuaries, National parks,Biosphere reserves, Mangrooves.Strategies for *ex situ* conservation – Botanical Gardens, Seed banks, *in vitro* conservationOrganizations involved in resource conservation IUCN, WWF, UNEP, and UNESCO.	**12hrs**

References

1. Agarwal S.B. and M. Agarwal. 2000. *Environmental pollution and responses*.
2. Ambasht, R. S. (1976) *Principles of Ecology* (I st Eds.) Students Publications, Varanasi, India.
3. Arumugam, N (1996) *Concept of Ecology* (VII th Eds.) Saras Publication, Kanyakumari, India.
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6. Chapman J.L. and M. J. Reiss. 2000. Ecology: Principles and applications.
7. Dash, M. C. (1994) *Fundamentals of Ecology*. Tata McGraw Hill Publication Comp. Ltd. New Delhi, India
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10. Forman R T T, Godron M (1986). *Landscape Ecology.* John Wiley & Sons.
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12. Krebs C J (2008). *Ecology: The Experimental Analysis of Distribution and Abundance* (VI Edn).Benjamin Cummings Publ.
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14. Levin S A (Ed) (2000). *Encyclopedia of Biodiversity*. Academic Press.
15. Mayhew P J (2006). *Discovering Evolutionary Ecology: Bringing Together Ecology and Evolution*.Oxford University Press

16. Miller G T (2004). *Environmental Science.* Thomson.
17. Odu, E. P. 1996. *Fundamentals of Ecology*.
18. Odum E P, Barrett G W (2005). *Fundamentals of Ecology*. Thomson Asia Pvt. Ltd.
19. Pianka E R (2000). *Evolutionary Ecology* (VI Edn). Benjamin Cummings.
20. Primack R B (1998). *Essentials of Conservation Biology*. Sinauer Associates.
21. PullinA S (2002). *Conservation Biology*. Cambridge University Press.
22. Ramakrishnan P S (1991). *Ecology of Biological Invasion in the Tropics*. International Scientific Publications.

HCT-2.2 CELL AND MOLECULAR BIOLOGY		52 hrs
Course objectives: • To understand the structure and function of basic components of prokaryotic and eukaryotic cells, especially its membrane organization and organelles. • To introduce to rapid contemporary changes witnessed in plant molecular biology. • Basic organization of genetic material and the realms of events associated with replication and gene expression will be examined. **Possible outcomes:** Students will gain knowledge about the basic and fundamental organization of life and genetic material and their applications. It will also impart knowledge about the regulation of molecular mechanisms involved in the control of gene expression and regulation. **Programmespecific outcomes:** • By the end of this course students will be able to understand the structure of cells in relation to the functional aspects. • The students will be able to learn about the basics of cell and its inclusionsto understand the difference betweenprokaryotic and eukaryotic cells. • To study the details of the plant cell wall,cytosol and cytoplasmic organelles. • To understand the properties of nucleic acids(DNA &RNA) and their synthesis • To study the details of protein synthesis andcell signalling.		
Unit-I	Prokaryotic cell, ultrastructure of mycoplasma, bacteria. Structure of eukaryotic cell. Plasma membrane – organization and function. Cytoskeleton – microtubules, cilia and flagella. Structure and function of endoplasmic reticulum, Golgi complex, Ribosomes, mitochondria, chloroplast, lysosomes and peroxisomes. Structure and function of nucleus and nucleolus.	**10hrs**
Unit-II	Structure and organization of eukaryotic chromosome, centromeric and telomeric structure, Law of DNA constancy and C-value paradox. Special chromosomes – B-chromosomes, polytene and lampbrush chromosomes.	**8 hrs**
Unit-III	Mechanism of cell division: Cell cycle regulatory enzymes and proteins, chiasma formation, mechanism of recombination, synaptonemal complex.	**4 hrs**
Unit-IV	Chromosomal Aberrations: types and evolutionary significance.	**6hrs**

	Numerical changes in chromosomes – euploidy, haploidy, polyploidy, aneuploidy and evolutionary significance.	
Unit-V	Mutageneis – physical and chemical mutagens, molecular basis of mutation, DNA repair mechanism. Transposable elements, transposon tagging of genes, genetic and evolutionary significance.	**4 hrs**
Unit-VI	DNA replication, transcription (RNA synthesis and processing), DNA and RNA polymerases, genetic code, translation.	**10 hrs**
Unit VII	Cell communication: Membrane transport principles-active and passive transport, Brief on cell signaling with reference to plant systems.	**4hrs**
Unit VIII	Gene isolation and characterization through PCR, RAPD, RFLP, AFLP, SSR markers, structural and functional genomics.	**6hrs**

References

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2. Bob B Buchanan, Wilhelm Gruissem, Russel L Jones (2000). *Biochemistry and Molecular biology of plants. I K International Pvt. Ltd.*
3. Bruce Alberts, Alexander Johnson, Julian Lewis, Martin Raff, Keith Roberts, Peter Walter (2002). *Molecular biology of the cell* (IV Edn). Garland Science, Taylor and Francis group
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6. Darlington, C.D. 1987. *Recent advances in cytology*. J A Churchil. London.
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9. David P Clark (2010). *Molecular biology*. Elsevier.
10. De Robertis& De Robertis, 2004. *Cell and Molecular Biology*. Lippincott. Williams and Wilkins. USA.
11. Freifelder, 1990. *Molecular Biology*, Narosa Publishing House, New Delhi.
12. Jain, H.K. 2000. *Genetics*, Oxford & IBH, New Delhi

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15. Peter Porella, 1998. *Introduction to Molecular Biology*, McGraw – Hill, New York.
16. Rastogi, S.C. 2004. *Cell Biology.* New age International Pub. New Delhi.
17. Robert J Brooker (2009). *Genetics: analysis and principles* (III Edn). McGraw Hill.
18. Schuler MA and Selinski, R. 1989. *Methods in molecular Biology*
19. Sharma. A.K. and Sharma, A. 1980. *Chromosome Techniques Theory and Practice*. Oliver and Boyd, London.
20. Singh and Tomar.2004. *Cell Biology*. Rastogi Publishers, Meerut.
21. Swanson, C.P. 1972. *Cytology and Cytogenetics*. Mac Millan. New York.
22. Walker, J.M and R. Rapley, 2003. *Molecular biology and Biotechnology*, IV Edition. Panima Publishing Corporation, Bangalore.

HCT-2.3: GENETICS AND EVOLUTION		52 hrs
Course objectives: • This course is intended to provide the basic understanding of genetic, Inheritance, variation. • The paper will deal with Mendelian and non-Mendelian inheritance, quantitative genetics, molecular markers and linkage mapping. • Evolutionary biology is to teach past history & origin of living organisms. Describes concepts, theories & experimental evidences that support origin of high order organism from primitive one. **Possible outcomes:** The students are expected to have better understanding of basic principles of Mendelian inheritance, concept of linkage and mutagenesis. It also develops the understanding of management of inherited diseases. Learners will certainly understand how biological organisms including human beings have evolved, survived with natural adaptations possibilities of destruction for the survival of human beings & other organisms. **Programmespecific outcomes:** • The students will be able to acquireknowledge about the nature and function of genes and processes of inheritance as they influence the characteristics of populationsand species. • Understand the basic concepts of mendeliangenetics, its variations and applications • Familiarize with the various concepts ofevolution • The students will understand the concepts of microbial and human genetics and genetic mapping.		
Unit-I	Mendelian principles, alleles, linkage and crossing over, genetic maps. Sex determination in plants. Extrachromosomal inheritance, somatic cell genetics. Inheritance of quantitative characters.	**10hrs**
Unit-II	Concept of genes – fine structure of gene, spit 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-	**8hrs**

	Darwinism, Mutation theory and synthetic theory.	
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**

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SCT-2.4: METHODS IN PLANT SCIENCE		52 hrs
Course objectives: • To acquire the knowledge about biological techniques. • To know about the basic concepts, principles and significance of various analytical and molecular techniques. • To understand the various anatomical techniques. **Possible outcomes:** The course will nurture the knowledge on biological samples especially plant samples. The course will give an expertise in understanding the various important biological techniques to be employed in the field of botany. **Programmespecific outcomes:** • The course will nurture the knowledge on biological samples especially plant samples. • The course will give an expertise in understanding the various important biological techniques to be employed in the field of botany.		
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.	**10hrs**
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.	**10hrs**
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 – chromatographic techniques, ion exchange, gel filtration affinity	**10hrs**

	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

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28. McClung, C.L, 1961. *Hand book of Microscopic technique*. MacGraw Hill, New Delhi.

HCP-2.5 ECOLOGY AND PHYTOGEOGRAPHY
1. Study of frequency and density of herbaceous plants by quadrate method 2. Determination of moisture content and water holding capacity of different types of soils 3. Estimation of alkalinity of water samples 4. Morphological and anatomical adaptation in hydrophytes, xerophytes (succulents and non-succulents), epiphytes and halophytes 5. Study of ecological instruments, visit to meteorological station is compulsory 6. Bacteriological analysis, physical, chemical parameters, pH, turbidity, TDS, BoD, CoD, temperature and other organic elements 7. Visit to effluent treatment plant to study recycling of waste water nearby industry 8. Floristic regions, Climatic regions and Forest types of India.

HCP-2.6 CELL AND MOLECULAR BIOLOGY
1. Study of cell division – Mitosis (*Allium cepa, Rhoeo, Urgenia, Scilla*) 2. Study of Meiosis - (*Allium cepa, Helianthus, Tredescantia*flower buds) 3. Karyotype analysis – ideogram – preparation of ideogram 4. Study of chromosomal aberrations and polyploidy. 5. Isolation of genomic DNA from leaf tissue 6. Agarose Gel electrophoresis. 7. Separation of protein by SDS. 8. Isolation of RNA from plants.

HCP-2.7: 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.

HCP-2.8: METHODS IN PLANT SCIENCE

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

<table>
<tr><th colspan="2">OET-2.9NUTRICEUTICALS</th><th>52hrs</th></tr>
<tr><td colspan="2">Course objectives:
To impart the concept of nutraceuticals and functional ingredients in foods, and to determine their role in health and disease prevention.
To learn about various phytochemicals-their sources, functions and usefulness.
To illustrate the importance of food safety, food quality, food laws and regulations in Food industry.
Possible outcomes:
Students will acquire basic knowledge on the physiology of human nutrition and the importance of nutraceuticals in the context of the human well-being. Nutraceuticals/bioactive compounds familiarize students with the scientific evidence about the role of diet and dietary components in the modulation of risk factors associated with chronic diseases and human health. The study enables the students to understand the concept of food safety and their role in the human health and well-being.
Programmespecific outcomes:
Gain knowledge about functional foods and nutriceuticals.
Have thorough knowledge about the health effects
Be familiar with applications in industry.
The student will be able to recognize functional food products that are nutritionally logical, technically feasible, and that also are in compliance with FDA regulatory guidelines.</td><td></td></tr>
<tr><td>Unit-I</td><td>Nutriceuticals as science: Importance of nutriceuticals in human health; basic food types, cultural diets, fast foods, street foods, junk foods; functional foods; food pyramids; classification of nutrients and their functions; anti-nutritional factors. Industrial fortification, forms of nutrient supplementation, vitamin and mineral supplements; biofortification, fortified crops; Golden Rice; energy drinks and infant food formulae; dietary supplements, health benefits; nutriceuticals on the market.</td><td>13hrs</td></tr>
<tr><td>Unit-II</td><td>Plant and animal based nutriceuticals: Antioxidants, saponins, vitamins, minerals, carotenoids, amino acids, gum and resins, chitin, chitosan, glucosamine, chondroitin, cod liver oil; Algal nutriceuticals (Spirulina, Sea weeds); Bacterial nutriceuticals, Probiotics (youghurt), Prebiotics and Synbiotics; fermented foods in health care. Lipid, carbohydrate and protein based nutriceuticals; dietary fibers, source and health benefits. Recommended Daily Allowances.</td><td>13 hrs</td></tr>
<tr><td>Unit-III</td><td>Neutriceuticals in health and disease: In preventive and protective medicine, in cancer treatment, cholesterol and obesity control. Nutriceuticals from home garden (Aloe, Honey, Turmeric, Saffron, Ginseng, Neem, fruits, spices, herbs, Bramhi, Tulasi, Bitter guard,</td><td>13 hrs</td></tr>
</table>

	Fenugreek, Asafoetida, Ginger, Pepper, Garlic, Onion, Betel leaves). Diets in pregnancy, geriatric diets, paediatric diets; diets in diabetes and hypertension. Cosmeceuticals, plant based cosmeceutics in skin, hair, eye and dental care.	
Unit-IV	Legal control of food safety and standards: National and international regulation of food and nutriceutical standards. The Food Safety and Standards Authority of India: Food Safety and Standards Act, 2006, Indian National Codex Committee, US Foods and Drugs Administration, Codex Alimentarius Commission.	**13 hrs**

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on Nutrition and the United Nations Children's Fund. Official Websites of Food Safety and Standards Authority of India and Codex Alimentarius Commission.

SEMESTER III

HCT-3.1 SYSTEMATIC BOTANY OF ANGIOSPERMS		52 hrs
Course objectives: To acquire the fundamental knowledge of plant systematics. To know about the basic concepts and principles of plant systematics. To know how to identify the plants. To create awareness of the f taxonomic relationships in plant systematic studies. **Possible outcomes:** The course will nurture the knowledge on classification of plants. The course will give an expertise in understanding characteristic features of various plant families. **Programmespecific outcomes:** • The students are able to understand about Plant taxonomy and their systematic classification systems • Are able to understand about modernapproaches in taxonomic studies. • Enlightened about the role of taxonomy in conservation of biodiversity.		
Unit-I	Introduction and History of Plant Taxonomy. Botanical Survey of India- a brief account. International Code of Botanical Nomenclature (ICBN/ICN), salient features, important rules and recommendations. Binomial nomenclature, Botanical gardens of world and India. Maintenance and importance of herbaria.	**10hrs**
Unit-II	The species concept, Taxonomic hierarchy, species, genus, family and other categories. Material basis of systematics; correlation, weighting, variations of characters and isolation	**6hrs**
Unit-III	**Systems of classification:** 1. Artificial- Linneaus 2. Natural- Bentham and Hooker 3. Phylogenetic systems a. Transitional- Engler and Prantl b. Intentional-Charles Bessay and Hutchinson c. Modern phylogenetic-Takhatajan, Cornquist A brief note on APG III system of classification	**6hrs**
Unit-IV	Taxonamy in relation to Anatomy, Embryology, Palynology, Cytology, Phytochemistry and Serology. A brief account of Numerical taxonomy.	**6hrs**
Unit-V	**Study of diagnostic,variability and systematic position of the following:-** **Dicotyledons:** Magnoliaceae, Nymphaeaceace, Papaveraceae, Urticacecae, Menispermaceae, Casuarinaceae, Nyctaginaceae, Malvaceae, Passifloraceae, Euphorbiaceae, Amaranthaceae, Droseraceae, Podostemaceae, Loranthaceae, Fabaceae, Caesalpiniaceae, Mimiosaceae, Meliaceae, Sapindaceae, Linaceae, Scrophulariaceae, Bignoniaceae, Acanthaceae, Lamiaceae, Rubiaceae, Asteraceae, Chenopodiaceae, Apocynaceae,Zygophyllaceae, Polygonaceae;	**20 hrs**
Unit-VI	**Monocotyledons-** Alismataceae, Araceae, Cyperaceae, Poaceae, Commelinaceae,	**4hrs**

	Zingiberaceae, Liliaceae, Dioscoreaceae, and Orchidaceae.	

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<table>
<tr><th colspan="2">HCT-3.2 PLANT ANATOMY AND EMBRYOLOGY</th><th>52 hrs</th></tr>
<tr><td colspan="2">Course objectives:
To study the plant anatomy which facilitate the process of understanding the internal structures of various plant parts and their significance.
To study the development of male and female gametes, pollination and fertilization reveals the various steps involved in development of new plant.
Possible outcomes:
The course will illustrate anatomy of various plant parts. The course will make the learners understanding about various stages of development. The student will be able to know details about various tissue system in plants. The students will also understand the scope and importance of anatomy and embryology in plants. In addition, they will clearly understand the seed-to-seed developmental aspects of angiosperms.
Programmespecific outcomes:
Understand photo morphogenesis and seedling development
Evaluate the root developments, flower development in plants
Study the reproduction in plants with the help of male female gametophyte
Study of microspogesis and megasprogenesis.
Understand pollen-pistil interacting and seed development.</td><td></td></tr>
<tr><td>Unit-I</td><td>Introduction and History, Primary and Secondary cell walls, Ultra Structure and Chemistry of cell wall.
Theories of organization of root and shoot apical meristems.
Cambium: General account.
Xylem: Ontogeny, Phylogeny, Evolution, ultra-Structure and function.
Phloem: Ontogeny, phylogeny, Evolution Ultra structure of sieve tube elements and functions.</td><td>12hrs</td></tr>
<tr><td>Unit-II</td><td>Primary and secondary growth: Anamolous primary structures with special reference to Nyctanthus, Achyranthus. Anamolus secondary growth with reference to Boerrhavia, Bignonia, Leptadinia, Piper, Tinospora, Thunbergiacoccinea.
Wood anatomy, Softwood, Hard wood, Ring and Diffuse porous wood, Xylem parenchyma, Ray parenchyma.</td><td>12hrs</td></tr>
<tr><td>Unit-III</td><td>Epidermal tissue system: Types of stomata, trichomes and glands.</td><td>2hrs</td></tr>
<tr><td>Unit-IV</td><td>Embryology: Introduction, History and scope of Embryology</td><td>12hrs</td></tr>
</table>

	Microsporogenesis: Development, types and functions of tapetum. Role of tapetum in pollen development, sporopollinin, pollen allergy. Male gametophyte: Development of pollen tube, pollen mitosis, vegetative and generative cells and heterospory. Megasporogenesis: Megaspore, diad, tetrad and coenomegaspore. General account of mono, bi and tetra sporicembrosac development (No type studies of tetrasporicembryosac). Female gametophyte: Organization of mature Embryo sac, Ultra structure of Egg apparatus, Nutrition of Embryo sac.	
Unit-V	Pollination: Brief account of Structure, Histo-Chemical details of Style and Stigma, Pollen germination, Pollen embryo sac. Self-incompatibility. Fertilization: Path of entry of Pollen tube, Site of pollen discharge. Double fertilization.	**6hrs**
Unit-VI	Endosperm: Types of Endosperm development, Endosperm haustoria, and function. Embryogenesis: Monocot and dicot embryo development. Apomixis: A general account, causes, significance and genetics of apomixes and Polyembryony.	**8hrs**

References:

1. Clegg, CJ and Cox G. (1974) Anatomy and Activities of Plants- A guide to the study of flowering plants.
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<table>
<tr><th colspan="2">HCT-3.3 MEDICINAL PLANTS AND PHYTOCHEMISTRY</th><th>52 hrs</th></tr>
<tr><td colspan="2">Course objectives:
To study the concept of Ethanobotany and Ethanomedicine.
To identify the most important medicinal plants.
To provide the basic information on pharmacognosy including: taxonomy of the crude drugs, their cultivation and medicinal importance.
To describe the basic methods of extracting the active components from plants and how to identify them.
State the phytochemical classification and memorize the main categories of active components, contained in medicinal plants.
Possible outcomes:
Learner will definite witness the role of plants in survival of human beings and other organism. They will also well verse with contribution made by our primitive people in exploration of plant knowledge to alleviate common diseases and development of system of medicine. Students will be able to Identify the biological source, morphology, cultivation, collection, drying, packing, storage, medical as well as non-medical uses of plants and plant secretions. Students will also be able to identify the different chemical constituents present in plants their biosynthetic origin, characterization, natural occurrence and pharmacological action.
Programmespecific outcomes:
Learner will definite witness the role of plants in survival of human beings and other organism.
They will also well verse with contribution made by our primitive people in exploration of plant knowledge to alleviate common diseases and development of system of medicine.
Students will be able to identify the biological source, morphology, cultivation, collection, drying, packing, storage, medical as well as non-medical uses of plants and plant secretions.
Students will also be able to identify the different chemical constituents present in plants their biosynthetic origin, characterization, natural occurrence and pharmacological action.</td><td></td></tr>
<tr><td>Unit-I</td><td>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.</td><td>12hrs</td></tr>
<tr><td>Unit-II</td><td>Pharmacognosy: Raw drug analysis, microscopic, macroscopic, Characteristics, preliminary chemical analysis, qualitative and quantitative analysis of raw drug using Colorimetry, Spectophotometry, Chromatography (Senna, Datura, Cinchona,</td><td>12hrs</td></tr>
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	Ginger, Nuxvomica, Withania, Rauwolfia, Emblica)	
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. Plants in the treatment of Stress, Heart diseases, Cancer, AIDS, anti fertility, anti-microbial activity.	**8hrs**

References:

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10. Vijay adnhaleshi C 2004 Compendium on Controversial Drugs, JagdguruSrimanMadhwacharyaMoolamahasamsthana Sri RaghavendraswamyMatha, Manthralayam.

SCT-3.4 ECONOMIC BOTANY AND CONSERVATION OF BIODIVERSITY		52 hrs
Course objectives: • The course is also designed to provide the knowledge about economic importance of various plants. • To learn the diverse human uses of plants and plant products. • To acquire an increased awareness and appreciation of plants and plant products encountered in everyday life. **Possible outcomes:** The study will develop a basic knowledge of taxonomic diversity and important families of useful plants and Increase the awareness and appreciation of plants & plant products encountered in everyday life. Students will be able to appreciate the diversity of plants and the plant products in human use. **Programmespecific outcomes:**		
Unit-I	**Introduction:** Plants in commerce and industry. General account: History, methods of cultivation and uses - Rice, Wheat, maize, Tea, Coffee, Rubber, Sunflower, Safflower, Groundnut, Lin seed, Cotton, Jute, Coconut, Agave, Teak, Mahagony and Vegetable sponges.	**12hrs**
Unit-II	Family, useful parts and Chemical constituents: Cardamom, Cinnamom, Clove, Ginger, Pepper, Coriander, Fennel, Henna, Indigofera, Butea, Arecanut, Beetle Leaf, Tobacco, Turmeric and Vanilla, **Herbal drugs:** Roots, stem, wood, leaves, flowers, fruits and seed.	**12hrs**
Unit-III	Introduction to Biodiversity: Concept, importance of biodiversity with reference to natural resources, genetic resources, maintaining ecosystem and abiotic resources.	**4hrs**
Unit-IV	Levels of Biodiversity: Species, Genetic, Ecosystem, Habitat, Plant and Animal Biodiversity in India, Kinds of Biodiversity – Alpha, Beta and Gamma.	**3hrs**
Unit-V	Loss of Biodiversity: Loss of genetic diversity, Loss of species diversity, Loss of ecosystemdiversity, Loss of agrobiodiversity, Projected scenario for biodiversity loss.	**3hrs**
Unit-VI	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.	**6hrs**

Unit-VII	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.	**6hrs**
Unit-VIII	Role of plants in relation to Human Welfare: Importance of forestry their utilization and commercial aspects, Avenue trees, Ornamental plants of India, Fruit crops of Karnataka and their commercial importance. Wood and its uses.	**6hrs**

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2. VeenaArora 202 Natraj Publishers, Dehradun Publisher : The Biological DiversityAct ,
3. EdtHeyword, V.H.: Global Biodiversity Assessment Part I
4. M.S. Prashanth : Environmental Studies.
5. M.C. Dash : Fundamental of Ecology.
6. D.K. Asthana ,MeeraAsthana : Environment :- Problems & Solutions.
7. D.K.Belsare : Introduction to Biodiversity.
8. SurendraSingh : Geomorphology and Remote Sensing in EnvironmentalManagement.
9. N.DasGupta : Environmental Accounting.
10. ErachBharucha : Textbook of Environmental Studies.
11. M.L. Narasaiah : Biodiversity & Sustainable Development.
12. M.L.Narasaiah : Education & Biodiversity.
13. R.L. Panigrahy, LingarajPatro : Biodiversity Conservation and Sustainable Development.

HCP-3.5 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-3.6 Plant Anatomy and Embryology.
1. Preparation of permanent slides of free hand /paraffin Sections 2. Wood anatomy study based on T.S., T.L.S. and R.L.S. 3. Dermal tissue system 4. Endosperm/ Embryo dissection 5. Observation of slides of Microsporogenesis and megasporogenesis. 6. Pollen germination and viability.

HCP-3.7: 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-3.8: ECONOMIC BOTANY AND CONSERVATION OF BIODIVERSITY
1. Field survey for collection of economically important plants of the region. 2. Study of locally available economic products of plant origin. 3. Estimation of Carbohydrates in Cereals. 4. Estimation of Proteins in Pulses. 5. In situ and ex situ Conservation methods. 6. A visit to Botanic Gardens, Zoologic Park, Biosphere Reserves, National Parks and Sanctuaries.

<table>
<tr><th colspan="2">SCT-3.9 Plant Propagation Techniques</th><th>52hrs</th></tr>
<tr><td colspan="2">Course objectives:
To introduce the botanical concepts that underlie the propagation of plants and to acquaint the students with the methods and technologies that are used in the propagation industry.
To make students think critically about plant propagation to solve problems and communicate and explain the scientific basis for the different techniques and their individual use and application.
Possible outcomes:
The course will make the learners knowing about various techniques of propagating plants by seeds, rooting cuttings, grafting, budding, layering, and micropropagation (tissue culture). Students will be able to select the appropriate methods of asexual and sexual propagation based upon biological characteristics of the crops and manipulate the propagation environment to promote the successful propagation of plants.
Programmespecific outcomes:
Plan the propagation of different plant species from seeds, using different seed propagation methods.
Plan the propagation of different types of plants from cuttings, using different cutting propagation methods.
Determine the management practices of significance to the commercial viability of a propagation nursery.</td><td></td></tr>
<tr><td>Unit-I</td><td>Plant propagation- History, scope and importance. Propagation structures with reference to greenhouse equipment and media.</td><td>3hrs</td></tr>
<tr><td>Unit-II</td><td>Seed propagation; Germination, type of seed dormancy and breaking, techniques of seed production and handling principles.</td><td>8hrs</td></tr>
<tr><td>Unit-III</td><td>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</td><td>14hrs</td></tr>
<tr><td>Unit-IV</td><td>Micropropagation – Techniques and applications in forestry and</td><td>5hrs</td></tr>
</table>

	horticulture.	
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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SEMESTER IV

<table>
<tr><th colspan="2">HCT-4.1 PLANT PHYSIOLOGY</th><th>52 hrs</th></tr>
<tr><td colspan="2">Course objectives:
The course would deal with the study of plant physiology especially the water transport, absorption, mineral nutrition, photosynthesis, respiration and phytohormones.
Explains physiological responses produced by plants against environmental stresses.
Possible outcomes:
The students will be able to understand how plants acquire and use the energy and material resources required to complete their life cycle. Students will understand the phenomena of carbohydrate synthesis in plants and use of the carbon to generate energy to maintain plant functions; and control of plant functions through growth regulators. Students will understand the physiological changes occurred during different stress conditions such as water deficit, salinity and heat stresses.
Programmespecific outcomes:
The Students will learn about absorption,translocation and utilization of water and other minerals.
Comprehend the changes during growthprocess (germination to abscission).
Understand the energy flow and variousmetabolic cycles with their integration.
Get an overall perception about variousphysiological processes occurring in plants.</td><td></td></tr>
<tr><td>Unit-I</td><td>Water relations: solutions, colloids, molarity, buffer molar solutions, pH, emulsion and gels. Permeability, theories of cell permeability and biosignaling, diffusion, osmosis, membranes, osmotic pressure, turgur pressure, wall pressure, relation between OP, DPD and TP, concept of water potential, plasmolysis, significance of osmosis and imbibitions.</td><td>6hrs</td></tr>
<tr><td>Unit-II</td><td>Active and passive water absorption, mechanism of ascent of sap: root pressure theory and mechanism of cohesion tension theory, water potential gradient
Transpiration: types, mechanism, theories of opening and closing of stomata, factors affecting rate of transpiration, anti-transpirants and guttation</td><td>6hrs</td></tr>
<tr><td>Unit-III</td><td>Unit 4. Mineral nutrition: macro and micronutrients and their role</td><td>4hrs</td></tr>
</table>

	and deficiency symptoms, absorption of mineral salts, nature of membranes general mechanism of solute absorption	
Unit-IV	**Unit 5.** Photosynthesis: structure of chloroplast and photosynthetic pigments, action spectrum, concept of two photosystems, red drop and emerson enhancement effect, photophosphorylation, celvin cycle, C_4 and CAM pathways, photorespiration and factors affectiong on photosynthesis	**10hrs**
Unit-V	**Unit 6.** Respiration: aerobic, anaerobic and fermentation glycolysis, krebs cycle, electron transport system, redox potential, oxidative phosphorylation, pentose phosphate pathway. Respiratory quotient (RQ) and factors affecting on respiration	**6 hrs**
Unit-VI	Nitrogen fixation, importance of nitrate reductase its regulation and ammonium assimilation. Proteins- structure and synthesis, lipid metabolism.	**4hrs**
Unit-VII	Enzymes- classification, properties and nomenclature (IUBMB), co factors, co-enzymes, isozymes, mechanism of enzyme action, enzyme inhibition enzyme kinetics.	**6hrs**
Unit-VIII	Growth: photomorphogenesis, photoperiodismphytochrome, vernilizationand concept of biological clock. Seed dormancy- causes and methods of breaking dormancy. Stress physiology- concept and plant responses to water, salt and temperature stresses, physiological action of Auxins, Gibberellins, Cytokinins, ABA, ethylene and growth inhibitors.	**10hrs**

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<table>
<tr><th colspan="2">HCT-4.2 PLANT BREEDING</th><th>52 hrs</th></tr>
<tr><td colspan="2">Course objectives:
To realize the significance of plant breeding techniques in improving the plant productivity and strain improvement.
To describe sources and types of genetic variation and explain their importance for plant improvement.
To enlighten students on practical problems of plant breeding and the ways and means of solving the problems.
Possible outcomes:
The course will give a scientific approach to plant breeding techniques and their significances. Students will acquire basic knowledge of conventional and non-conventional methods of plant breeding. By knowing the elementary principles in plant breeding students will understand the importance and value of producing disease and insect resistant plants. They will also be familiar with methods used to change the traits of a plant to create the desired genotype/phenotype.
Programmespecific outcomes:
Students will understand the concepts of plant breeding involving the principles, selection procedure and achievements in plant breeding. So they will be enabled to implement their knowledge on plant breeding techniques in their agriculture fields for the improvement of crops.
Students will understand the variousprocesses in crop improvement program.
By knowing the elementary principles in plant breeding students will understand the importance and value of producing disease and insect resistant plants.</td><td></td></tr>
<tr><td>Unit-I</td><td>Introduction:Objectives of plant breeding, important achievements and future prospects, Genetic variability and its role in plant breeding, Domestication and centers of origin of cultivated plants.</td><td>6 hrs</td></tr>
<tr><td>Unit-II</td><td>Systems of reproduction in plants: Reproductive system; sexual and asexual
Pollination; cross and Self-pollination control mechanism, Incompatibility, male sterility and their types, Apomixsis</td><td>10 hrs</td></tr>
<tr><td>Unit-III</td><td>Hybridization:Methods of hybridization and its role.Inter-varietal, inter specific and inter generic crosses.Heterosis and inbreeding depression.</td><td>8 hrs</td></tr>
<tr><td>Unit-IV</td><td>Breeding for resistance: abiotic stresses (drought and salinity), biotic stresses (disease and insects).</td><td>10hrs</td></tr>
<tr><td>Unit-V</td><td>Mutation breeding:Mutations (Spontaneous and induced), Chemical</td><td>9 hrs</td></tr>
</table>

	and physical mutagens.Methods of mutation breeding, Limitations and achievements of mutation breeding.	
Unit-VI	Molecular breeding : Molecular marker system, RFLP, RAPD, AFLP, SSR and SNPs.Methods and importance of marker assisted breeding	**9 hrs**

References

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SCT-4.3 PLANT BIOTECHNOLOGY		52 hrs
Course objectives: • To train the students in the aspects of innovative applications and techniques in tissue culture to conserve endemic, endangered plants and improve the quality of the economically important plants. • To learn the recent advances in genetic engineering and production of transgenic plants **Possible outcomes:** Systematic training given in the different branches of applied biotechnology will enhance the confidence in students to take up entrepreneurial ventures in developing bio tagged products, and provide services in national and multinational industries dealing with bio utility and bio resource management. **Programmespecific outcomes:** • The students will understand the basicconcepts of genome organization in plantsand molecular markers. • Have a clear knowledge of plant tissueculture techniques • Have a basic understanding of the plantgenetic transformation methods. • Be fully aware of the basics and applications of plant biotechnology.		
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.	**10hrs**
Unit-III	Metabolic engineering of plants: Plant cell culture for the production of useful chemicals and secondary metabolites (Hairy root culture, Biotransformation, Elicitation) - pigments, flavanoids, alkaloids;	**10hrs**

	mechanism and manipulation of shikimate pathway. Commercial production of enzymes, biodegradable plastics, therapeutic proteins, edible vaccines and antibiotics using transgenic technology.	
Unit-IV	Plant Development: Plant growth regulators- auxin, gibberlins, cytokinins, abscicic acid, 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, Ethical issues associated with GM crops and GM food; labelling of GM plants and products. Importance of integrated pest management.	**10hrs**
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**

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HCP-4.4PLANT PHYSIOLOGY
1. Study of permeability of membranes using different concentration of organic solvents 2. Determination of osmotic potential of cell sap by plasmolytic methods 3. Separation of chloroplast pigments by solvents methods 4. Determination rate of photosynthesis using different wavelengths 5. Determination of RQ of carbohydrates, fats and proteins 6. Detection of carbohydrates, fats, oils, alkaloids, enzyme activity in plant tissue 7. Study of plant movements 8. Physiological action of plant hormones 9. Study of inorganic elements in plant tissues/ash 10. Experiments on stress physiology.

HCP-4.5 PLANT BREEDING
1. Visiting a plant breeding station to familiarize with breeding programmes. 2. Hybridization techniques, selfing and crossing techniques. 3. Technique of emasculation; Techniques in selfing and hybridization 4. Different types of layering (Simple layering, tip layering, serpentine layering, Air layering, mound layering). 5. Grafting – Whip (or splice), side and bark grafting. 6. Budding − T-budding, Inverted T-budding and chip budding. 7. Pollen viability; germination test and TTC test. 8. PCR – Technique with known primers.

SCP-4.6 PLANT BIOTECHNOLOGY
1. Isolation of plasmids DNA from 2. Preparation of tissue culture media and organ culture (shoot tips, leaf) 3. Anther culture and haploid production 4. Isolation, culture and fusion of protoplast 5. Production of synthetic seeds from explants 6. Extraction and quantification of leg haemoglobin from root nodules (Rhizobum) of leguminous plant 7. Agro bacteria culture and transformation of explants

KARNATAKA STATE WOMEN'S UNIVERSITY,

Jnanashakti Campus, Torvi

Vijayapur

Department of P.G. Studies and Research in BOTANY

CORE SUBJECT: BOTANY

SYLLABUS on

CHOICE-BASED CREDIT SYSTEM (CBCS)

2016

Karnataka state Women's university. Vijayapur

The BOS Meeting held on 17.10.2016 at the Dept .of Botany,KSWU.Vijayapur

Meeting agenda:

1. Faming the CBCS format Syllabus for botany Course
2. Preparation of panel of examiners
3. Preparation of question pattern for theory and practical

Proceeding of the BOS Meeting.

1.TheBos member discussed the above agendas and prepared the syllabus and approved
2. Prepared the panel of examiners and approved
3. Prepared the Question paper pattern for theory and practical and approved

Members Present:

Prof. K.N. Amruthesh Chairman

Prof.B.LingannaiahMember

Prof.Krishnakumar.J Member

Prof..Ravishankar.G. Member

Prof.S .V.Halse Member Convener

Karnataka state Women's university. Vijayapur

M .Sc. Degree Examination (Botany)

Practical Question Paper

Time: 3 hrs **Max.Marks: 40**

Q. I		**10 marks**
Q. II		**10 marks**
Q. III		**10 marks**
Q. IV	**Viva**	**05 marks**
Q. V	**Journal**	**05 marks**

Karnataka state Women's university. Vijayapur

M .Sc. Degree Examination (Botany)

Theory Question Paper

Time:3 Hrs **Max.Marks: 80**

I. Answer any five of the followings **2X5 = 10**

1.

2.

3.

4.

5.

6.

7.

II. Write in brief any six of the followings **5X6 = 30**

1.

2.

3.

4.

5.

6.

7.

III. Write in detail any four of the followings **10X4 = 40**

1.

2.

3.

4.

5.

6.