

Akkamahadevi Women's University, Vijayapura

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

CORE SUBJECT: BOTANY – [Post Graduate]

Course code	Course name	Credits				Marks										Remarks
						C1			C2			C3			Total	
		L	T	P	Total	L	T	P	L	T	P	L	T	P		
Semester I																
HCT-1.1	Phycology, Mycology, Bacteriology and Virology	04			04	15			15			70			100	
HCT-1.2	Bryophytes and Pteridophytes	04			04	15			15			70			100	
HCT-1.3	Gymnosperms and Palaeobotany	04			04	15			15			70			100	
SCT-1.1*	Plant Pathology Phytogeography and Evolution Biostatistics and Bioinformatics *(One of the above SOFT CORE subjects shall be selected by the candidate/ as per the decision of the Departmental Council one SC may be offered)	04			04	15			15			70			100	
HCP-1.1	Phycology, Mycology, Bacteriology and Virology			02	02			07			07			36	50	
HCP-1.2	Bryophytes and Pteridophytes			02	02			07			07			36	50	
HCP-1.3	Gymnosperms and Palaeobotany			02	02			07			07			36	50	
SCP-1.1*	*Based on Soft Core Paper offered			02	02			07			07			36	50	
O.E -1.1	Offered by Department of Women’s Studies	04			04	15			15			70			100	
	Total	20		08	28	75		28	75		28	350		144	700	
Semester II																
HCT-2.1	Ecology and Environmental Biology	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-2.1*	Methods in Plant Science Plant Genetic Engineering Nutraceuticals *(One of the above SOFT CORE subjects shall be selected by the candidate/ as per the decision of the Departmental Council one SC may be offered)	04			04	15			15			70			100	
HCP-2.1	Ecology and Environmental Biology			02	02			07			07			36	50	
HCP-2.2	Cell and Molecular Biology			02	02			07			07			36	50	
HCP-2.3	Genetics and Evolution			02	02			07			07			36	50	
SCP-2.1*	*Based on Soft Core paper offered			02	02			07			07			36	50	
OE-2.1	Offered by Department of Women's studies	04			04	15			15			70			100	
	Total	20		08	28	75		28	75		28	350		144	700	
Semester III																
HCT-3.1	Systematic Botany of Angiosperms	04			04	15			15			70			100	
HCP-3.2	Botanical Tour and Herbarium preparation 1. The candidate shall undertake compulsorily field work outside the campus area/ District, a minimum of 3 to 4 days to understand floristic diversity of Angiosperms and to collect specimens from various agro-climatic conditions for the preparation of the Herbarium. 2. The University shall encourage the Department by providing required funds to undertake field studies by the students, since it is hard core subject required for the completion of the M.Sc. Botany programme.			02	02										50	
HCT-3.3	Reproductive Biology of Angiosperms and Plant Anatomy	04			04	15			15			70			100	
SCT-3.1*	Economic Botany	04			04	15			15			70			100	

	Medicinal Plants and Phytochemistry Biodiversity and Conservation *(One of the above SOFT CORE subjects shall be selected by the candidate/ as per the decision of the Departmental Council one SC may be offered)														
HCP-3.1	Systematic Botany of Angiosperms			02	02			07			07			36	50
HCP-3.3	Reproductive Biology of Angiosperms and Plant Anatomy			02	02			07			07			36	50
SCP- 3.1*	*Based on Soft Core paper offered			02	02			07			07			36	50
OE-3.1*	Plant Propagation Techniques Plant Diversity and Human Welfare *(One of the above OPEN ELECTIVE subjects shall be selected by the candidate/ as per the decision of the Departmental Council one OE may be offered)	04			04	15			15			70			100
	Total	16		06	24	75		21	75		21	350		108	600
Semester IV															
HCT-4.1	Plant Physiology	04			04	15			15			70			100
HCPW-4.2	Project work*			06	06										150
SCT-4.1*	Plant Breeding and Propagation Plant Biotechnology Ethnobotany and IPR *(One of the above SOFT CORE subjects shall be selected by the candidate/ as per the decision of the Departmental Council one SC may be offered)	04			04	15			15			70			100
HCP-4.1	Plant Physiology			02	02			07			07			36	50
O.E-4.1*	Medicinal Botany Aesthetic Botany *(One of the above OPEN ELECTIVE subjects	04			04	15			15			70			100

	shall be selected by the candidate/ as per the decision of the Departmental Council one OE may be offered)															
	Total	12		08	20	45		07	45		07	210		36	500	
	Programme total														2500	

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 work shall be evaluated for 150 marks (100 marks for dissertation, 25 marks for presentation of the work using power point slides and 25 marks for viva-voce examination by inviting external examiner along with internal examiner).

Board of Studies Members

- | | |
|-----------------------------------------------------------------------|------------|
| 1. Dr. Aziz Makandar, Dean, Faculty of Science and Technology | - Chairman |
| 2. Dr. Babu R. L., Co-ordinator, Dept. of Botany | - Convener |
| 3. Dr. G. Krishnakumar, Dept. of Applied Botany, Mangalore University | - Member |
| 4. Dr. K.N. Amruthesh, Dept. of Botany, University of Mysore | - Member |
| 5. Dr. H.R. Raveesha, Dept. of Botany, Bangalore University | - Member |
| 6. Dr. B. Lingannaiah, Dept. of Botany, Davanagere University | - Member |
| 7. Dr. G. Ravishankar, Dept. of Biotechnology, DSCE, Bangalore | - Member |

Sd/-

Chairman/ Co-ordinator
Board of Studies (BOS) in Botany
Dept. of Botany, Akkamahadevi Women's University
Vijayapura – 586 108, Karnataka

Scheme of Teaching, Examination and Credit points of M.Sc. Botany Programme w.e.f. 2018-19

Semester	Paper No. and Title	Teaching Hrs/week	Internal Assessment	Exam Hrs	Exam Marks	Credits
I	HCT-1.1: Phycology, Mycology, Bacteriology and Virology	04	30	03	70	04
	HCT-1.2: Bryophytes and Pteridophytes	04	30	03	70	04
	HCT-1.3: Gymnosperms and Palaeobotany	04	30	03	70	04
	SCT-1.1: Plant Pathology	04	30	03	70	04
	SCT-1.1: Phytogeography and Evolution					
	SCT-1.1: Biostatistics and Bioinformatics					
	HCP-1.1: Phycology, Mycology, Bacteriology and Virology	04	14	04	36	02
	HCP-1.2: Bryophytes and Pteridophytes	04	14	04	36	02
	HCP-1.3: Gymnosperms and Palaeobotany	04	14	04	36	02
	SCP- 1.1: Based on Soft Core Paper offered	04	14	04	36	02
	OE-1.1: Offered by Department of Women's Studies	04	30	03	70	04
II	HCT-2.1: Ecology and Environmental Biology	04	30	03	70	04
	HCT-2.2: Cell and Molecular Biology	04	30	03	70	04
	HCT-2.3: Genetics and Evolution	04	30	03	70	04
	SCT-2.1: Methods in Plant Science	04	30	03	70	04
	SCT-2.1: Plant Genetic Engineering					
	SCT-2.1: Nutraceuticals					
	HCP-2.1: Ecology and Environmental Biology	04	14	04	36	02
	HCP-2.2: Cell and Molecular Biology	04	14	04	36	02
	HCP-2.3: Genetics and Evolution	04	14	04	36	02
	SCP-2.1: Based on Soft Core Paper offered	04	14	04	36	02
	OET-2.1: Offered by Department of Women's Studies	04	30	03	70	04
III	HCT-3.1: Systematic Botany of Angiosperms	04	30	03	70	04
	HCP-3.2: Botanical Tour and Herbarium preparation	04	14	--	36	02
	HCT-3.3: Reproductive Biology of Angiosperms and Plant Anatomy	04	30	03	70	04
	SCT-3.1: Economic Botany	04	30	03	70	04
	SCT-3.1: Medicinal Plants and Phytochemistry					
	SCT-3.1: Biodiversity and Conservation					
	HCP-3.1: Systematic Botany of Angiosperms	04	14	04	36	02
	HCP-3.3: Reproductive Biology of Angiosperms and Plant Anatomy	04	14	04	36	02
	SCP-3.1: Based on Soft Core Paper offered	04	14	04	36	02
	OET-3.1: Plant Propagation Techniques	04	30	03	70	04
	OET-3.1: Plant Diversity and Human Welfare					
IV	HCT-4.1: Plant Physiology	04	30	03	70	04
	HCPW-4.2: Project Work	06	50	--	70	06
	SCT-4.4: Plant Breeding	04	30	03	70	04
	SCT-4.4: Plant Biotechnology					
	SCT-4.4: Ethnobotany and IPR					
	HCP-4.1: Plant Physiology	04	14	04	36	02
	OET-4.1: Medicinal Botany	04	30	03	70	04
	OET-4.1: Aesthetic Botany					
Total Marks (I to IV Semester) = 2100 + 400 (OET)						

**HCT: Hard Core Theory; SCT: Soft Core Theory; HCP: Hard Core Practical
SCP: Soft Core Practical; HCPW: Project Work and Dissertation, OET: Open Elective Theory**

Akkamahadevi Women's University, Vijayapur
M. Sc. Botany, Choice Based Credit System (CBCS) Syllabus,
CORE SUBJECT: Botany – [Post Graduate]

Semester I	Hrs/week	Credits
HCT-1.1: Phycology, Mycology, Bacteriology and Virology	04	04
HCT-1.2: Bryophytes and Pteridophytes	04	04
HCT-1.3: Gymnosperms and Palaeobotany	04	04
SCT-1.1: Plant Pathology	04	04
SCT-1.1: Phytogeography and Evolution		
SCT-1.1: Biostatistics and Bioinformatics		
HCP-1.1: Phycology, Mycology, Bacteriology and Virology	04	02
HCP-1.2: Bryophytes and Pteridophytes	04	02
HCP-1.3: Gymnosperms and Palaeobotany	04	02
SCP- 1.1: Based on Soft Core Paper offered	04	02
OE-1.1: Offered by Department of Women's Studies	04	04
		Sub. Total:28
Semester II		
HCT-2.1: Ecology and Environmental Biology	04	04
HCT-2.2: Cell and Molecular Biology	04	04
HCT-2.3: Genetics and Evolution	04	04
SCT-2.1: Methods in Plant Science	04	04
SCT-2.1: Plant Genetic Engineering		
SCT-2.1: Nutraceuticals		
HCP-2.1: Ecology and Environmental Biology	04	02
HCP-2.2: Cell and Molecular Biology	04	02
HCP-2.3: Genetics and Evolution	04	02
SCP-2.1: Based on Soft Core Paper offered	04	02
OET-2.1: Offered by Department of Women's Studies	04	04
		Sub. Total:28
Semester III		
HCT-3.1: Systematic Botany of Angiosperms	04	04
HCP-3.2: Botanical Tour and Herbarium preparation	04	02
HCT-3.3: Reproductive Biology of Angiosperms and Plant Anatomy	04	04
SCT-3.1: Economic Botany	04	04
SCT-3.1: Medicinal Plants and Phytochemistry		
SCT-3.1: Biodiversity and Conservation		
HCP-3.1: Systematic Botany of Angiosperms	04	02
HCP-3.3: Reproductive Biology of Angiosperms and Plant Anatomy	04	02
SCP-3.1: Based on Soft Core Paper offered	04	02
OET-3.1: Plant Propagation Techniques	04	04
OET-3.1: Plant Diversity and Human Welfare		
		Sub. Total:24
Semester IV		
HCT-4.1: Plant Physiology	04	04
HCPW-4.2: Project Work	06	06
SCT-4.4: Plant Breeding	04	04
SCT-4.4: Plant Biotechnology		
SCT-4.4: Ethnobotany and IPR		
HCP-4.1: Plant Physiology	04	02
OET-4.1: Medicinal Botany	04	04
OET-4.1: Aesthetic Botany		
		Sub. Total:20

Total Credits: 64+06 (Theory + Project) +30 (Practical + Field study or Study tour) = 100 credits

Note:

1. There shall be 30 marks as internal assessment (IA) for each theory paper and 14 marks as IA for each practical paper
2. There shall be 70 marks for each theory paper and 36 marks for each practical final examination at the end of each semester.
3. The project work carries 150 marks (Dissertation-100, Presentation -25 and Viva voce- 25).

Open Elective Papers for other Department students:

Semester- I	Hrs/Week	Credits
OET 1.1 – Offered by the Department of Women’s Studies	04	04
Semester- II		
OET 2.1 – Offered by the Department of Women’s Studies	04	04
Semester-III		
OET-3.1- Plant Propagation Techniques Plant Diversity and Human Welfare	04	04
Semester-IV		
OET-4.1- Medicinal Botany Aesthetic Botany	04	04

OET Total Credits: 16

Note:

1. There shall be 30 marks as internal assessment (IA) for each theory paper
2. There shall be 70 marks for each theory paper

DEPARTMENT OF BOTANY

Akkamahadevi Women's University, Vijayapura



Syllabus

For

P.G. Studies in

BOTANY

Choice Based Credit System

2018-19 onwards



AKKAMAHADEVI WOMEN'S UNIVERSITY, VIJAYAPURA
(Formerly: KARNATAKA STATE WOMEN'S UNIVERSITY)

Proceedings of the B.O.S Meeting held on 27th May 2018 at Dept. of Botany, AWU, Vijayapura

Agenda

1. Framing the syllabus as per the CBCS Pattern of all the core subject of M.Sc. Botany I to IV semester for its introduction from the academic year 2018-2019.
2. Preparation of Panel of Examiners
3. Preparation of Question Paper for theory and Practical examination as per CBCS Pattern

Resolution

1. The BOS Chairman formally welcomed all the members. The members framed the syllabus as per the CBCS Pattern. The syllabus was framed as per other programmes in science faculty to have uniformity in terms of credits and marks.
2. Prepared Panel of Examiners and approved for the year 2018-19.
3. Prepared the question paper pattern as per CBCS Pattern for theory and practical examinations and approved.

Member Present:

Dr. Aziz Makandar, Dean, Faculty of Science & Technology, AWUV

Dr. K.N. Amruthesh, Dept. of Botany, University of Mysore, Mysuru

Dr. H.R. Raveesha Dept. of Botany, Bangalore University, Bengaluru

Dean/ Chairman

Member

Member

Dr. J. R. Choudhary, Dept. of Botany, Bangalore University, Bengaluru

The committee also suggested the following:

1. Suggested to appoint teachers for each Hard/ Soft Core Subject designed as per M.Sc. CBCS Pattern for its effective implementation.
2. It is suggested to avoid by taking open elective subject by the students in the first & IV semester. In the first semester the students will be knowing the subjects offered in the campus and get familiarized with the other department about their open electives. In the IV semester, the students will be undertaking Project work on the campus or sometimes need to go outside the campus, under this circumstance, they may not get time to attend open electives, hence, it should be avoided.
3. In the III Semester, the students are required to undertake field studies in the Western Ghats to understand the floristic diversity of Angiosperms/ Plants, and collection of specimen and preparation of herbarium, which is comprising of 02 credits under hard core. Hence, University shall identify the separate Budget head to the Department for this purpose of atleast Rs. 50,000/- (Rupees Fifty thousand only) as it is compulsory.

Members absent

1. Dr. G. Krishnakumar, Dept. of Botany, Mangalore University, Mangaluru
2. Dr. B. Lingannaiah, Dept. of Botany, Davanager University, Chithradurga
3. Dr.G. Ravishankar, Dept. of Biotechnology, DSEC, Bengaluru

Akkamahadevi Women's University, Vijayapura

DEPARTMENT OF BOTANY

M.Sc. Botany Programme under Choice Based Credit System (CBCS) w.e.f. 2018-19

1.1. Duration: Two years with four semesters, each of 16 weeks duration.

1.2. Eligibility for admission: B.Sc. graduates of AWU, Vijayapura or any other recognized university with Botany as one of the main subject are eligible for admission to M.Sc. Botany course. Relaxation is for SC/ST/Cat-I students as per university norms.

1.3. Intake: 20 students for the first semester that excludes seats under enhanced fee. other rules for admission for intake of students may change from time to time as per university notification.

2. Attendance: Every student must have at least 75% attendance in each semester for eligibility to appear for semester end examination.

3. Medium of Instruction: The medium of instruction shall be English.

4. Course structure:

The student desirous for a degree M.Sc. in Botany shall complete 78 credits in Botany. Department also offers 8 credits each for elective papers in I, II, III and IV semester for students from other science subjects. Given below are the details about credits for each theory paper/practical/project work/Study tour and number of teaching hours for the four semesters along with marks allocation for students offering M. Sc. Botany or elective paper in Botany.

SEMESTER I

HCT-1.1: PHYCOLOGY, MYCOLOGY, BACTERIOLOGY AND VIROLOGY		48 Hours
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, pyrenoids, 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.	8hrs
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 Deuteromycotina. Heterothallism and Parasexuality.	8 hrs
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.	6hrs
Unit VIII	Bacteria: Ultrastructure, classification, Bergey's Manual Trust, reproduction, nutrition and economic importance.	6hrs

References:

1. Alexopoulos C. J. (1963). Introduction to Mycology.
2. Chapman V. J. and Chapman DJ (1973). The algae.
3. Biligami 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, New Delhi.

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. Pragati Prakashen meerut.

HCT-1.2: BRYOPHYTES AND PTERIDOPHYTES		48 Hours
Unit-I	Bryophytes: Introduction, distribution origin, evolution and classification, economic and ecological importance.	6hrs
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.	6hrs
Unit-V	Psilopsida: Comparative account of Psilophytales and Psilotales. Lycopside: 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 Pteridophytes.	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 PALAEOBOTANY		48 Hours
Unit-I	Gymnosperms-Introduction Distribution, General characters, Origin, Evolution and Classification of Gymnosperms.	4hrs
Unit-II	Comparative account of habit, anatomy and reproduction of Cycadales: Cycas and Zamia. Coniferales: Pinus, Araucaria, Thuja. Gnetales: Gnetum, Ephedra and Welwitschia 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.	4hrs
Unit-VI	Study of morphology, anatomy and evolutionary trends of following group of fossil plants: Psilophytales, Lepidodendrales, Calmitales, Filicales, Coenopteridales, Pteridospermales, Bennettitales, Pentoxylales, Cordiales, 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-1.1: PLANT PATHOLOGY		48 hrs
Unit-I	Introduction, scope and significance of plant pathology, significant contributions of plant pathologists. Importance of plant diseases. Methods of studying plant diseases, classification of plant diseases.	4 hrs
Unit-II	Major diseases caused by fungi, bacteria, viruses, mycoplasma, nematodes, angiosperm parasitic diseases, non-parasitic diseases on cereals, pulses, vegetables and oil crops.	8 hrs
Unit-III	Pathogenesis: penetration - indirect entry of pathogens through natural openings, wounds, root hairs, buds, direct penetration. Role of toxins in pathogenesis- Introduction, microscopic system, bioassay, Host-relation toxins, non-host selective toxins, control of toxin biosynthesis	8 hrs
Unit-IV	Mode of transmission of pathogens by seeds air, soil, water, vectors, contagious, animals. Effect of environmental factors on disease	6 hrs

	development disease epidemiology and forecasting.	
Unit-V	Detection and diagnosis of plant pathogenesis- Introduction host range and symptomatology, morphology of the causal organism, selective media, biochemical markers-substrate metabolism, fatty acid profiles (FAME analysis), protein analysis, serological techniques, nucleic acid techniques, choice of diagnostic techniques.	8 hrs
Unit-VI	Management of plant diseases by conventional methods: cultural, chemical and biological.	4 hrs
Unit-VII	Mycoparasitism of soil borne plant pathogens- biotrophic and necrotrophic parasitism, techniques for studying mycoparasitism in natural system, ecological factors affecting parasitism, distribution of mycoparasites, mycoparasites in biological control. Predatory and parasitic fungi - predatory hyphomycetes, and hymenomycetes.	10 hrs

References:

1. Singh, R.S. 1973. Plant Disease. Oxford and IBH Pub. Co., New Delhi.
2. Agrios, G.N. 1994. Plant Pathology. 2nd Edn. Academic Press New York.
3. Johnston, A. and Both, C. 1983. Plant Pathologists Pocket Book. 2nd Edn. Commonwealth Mycological Institute, Oxford and IBH Pub. Co., Calcutta.
4. Rangaswamy, G. and Mahadevan, A. 2002. Diseases of Crop Plants in India. Prentice Hall of India Pvt.Ltd., New Delhi.
5. Mehrotra, R.S. 1983. Plant Pathology. Tata McGraw Hill Pub. Co., Ltd., New Delhi.
6. Vidhyasekaran, P. 2004. Encyclopedia of Plant Pathology. Viva Books Pvt. Ltd., New Delhi.

SCT-1.1: PHYTOGEOGRAPHY AND EVOLUTION		48 hrs
Unit-I	Phytogeographical regions of the World. India: Western Himalaya, Eastern Himalaya, Indus plane, Gangetic sub-mountain zone, Temperate zone, Alpine zone. General characters of flora of India. Native taxa, naturalization of exotic taxa.	8hrs
Unit-II	Floristics: Floristic study of the world and India. Continental drift: A general account, tectonic movements, disjunct distribution, dispersal, migration and endemics.	4hrs
Unit-III	Plant Distribution: Continuous, discontinuous, Centre of origin endemic, bathymetric distribution, Centre of origin of crop plants. Evolution and Plant Migration, Dispersal, isolation, migration and barriers, vicarious species, relict species, isofloras, polytopy, centers of origin of crop plants.	12hrs
Unit-IV	Darwin and origin of species, models of speciation- Allopatric speciation, Sympatric speciation, Statispatric speciation. Isolating mechanism and rate of speciation. Genetic variation-inbreeding depression, protein polymorphism, variation in nucleotide sequences.	12hrs

	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.
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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 deviation, Standard error, Coefficient of variation.	6 hrs
Unit-IV	Probability and Probability distribution: Binomial, passion and normal distribution. Testing of Hypothesis: Null hypothesis,	8hrs

	alternative hypothesis, z test, t test and chi-square test.	
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

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HCP-1.1: PHYCOLOGY, MYCOLOGY, BACTERIOLOGY AND VIROLOGY

Phycology

Cynophyta: *Microcystis* ,
Spirulina, *Scytonema* and *Oscillatoria*
Chlorophyta : *Chlymydomonas*, *Volvox*, *Pediastrum*, *Scenedesmus*, *Hydrodictyon*
Diatoms : *Pinnate* and *Centric* – *Synendra*, *Pinnuria*, *Navicula* & *Cyclotella*
Xanthophyta : *Botrydium*
Phaeophyta : *Dictyota* and *Ectocarpus*
Rhodophyta: *Polysiphonia* and *Gracillaria*
Economic important product : *Agar-Agar*, *Spirulina* tablets

Mycology

Phycomycetes : *Mucor*, *Phytophthora*, *Saprolegnia*
Ascomycetes : *Saccharomyces*, *Xylaria*, *Aspergillus*, *Peziza*
Basidiomycetes : *Polyporus*, *Lycoperdon*, *Ustilago*, *Agaricus*
Duetoromycetes : *Alternaria* , *Cercospora*, *Cladosporium*

Bacteriology and Virology

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-1.2: 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*
Selaginella, *Isoetes*, *Equisetum*
Ophiglossum and *Botrychium*
Angiopteris, *Pteris* & *Hymenophyllum*
Marselia, *Salvinia* and *Azolla*

HCP-1.3: GYMNOSPERMS AND PALEOBOTANY

Gymnosperms : Study of vegetative habit, Anatomy and reproductive structure of the following

Cycas and *zomia*
Pinus, *Taxus* and *Thuja*

	<i>Gnetum, Ephedra, Welwitschia</i> <i>Ginkgo</i>
Paleobotany: Study of fossil forms using moulds, charts, photography and slides	
	<i>Lepidodendron</i> <i>Calamites</i> <i>Leginopteris</i> Geological Time scale using chart

SCP-1.1: PLANT PATHOLOGY

1. Classification of plant disease
Fungal: (Powdery mildew of cluster bean, leaf blight of paddy, leaf spot of chilli, frog-eye spot, leaf spot of tobacco)
Bacterial: (Citrus canker)
Viral: (Mosaic, leaf curl, pepper wilt, bunchy top of banana, katte disease of cardamom)
Mycoplasma: (little leaf of brinjal, grassy shoot of sugar cane)
Nematode: (root of brinjal/tomato)
Angiospermic parasites: (loranthus, viscum, cuscuta)
2. Pure culture – identification of fungi based on conidia and mycelial morphology.
3. Spore release by wash-off method
4. Disease assessment
5. Anthracnose disease in French bean/ Cluster bean
6. Downy mildew of pearl millet
7. Leaf rust of coffee
8. Disease of crop plants - Fungal, mycoplasmal, bacterial, nematodal, viral, angiospermic parasitic diseases (other than above mentioned disease)

SCP-1.1: PHYTOGEOGRAPHY AND EVOLUTION

1. Floristic regions of India.
2. Evolutionary concepts
3. Drawing maps of continental drift
4. Listing plants of AMWU campus
5. Listing of wild edible plants and
6. Listing of medicinal plants and their uses in Vijayapur area.
7. Studying species distribution and its measurements.
8. Examples of exotic / invasive species

SCP-1.1: BIOSTATISTICS AND BIOINFORMATICS

Biostatistics

Measures of central tendency
Measures of Dispersion
Correlation and Regression

Bioinformatics

Biological Databases

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

HCT-2.1 ECOLOGY AND ENVIRONMENTAL BIOLOGY		48 hrs
Unit-I	Scope of ecology in environmental management. Climatic factors: interaction of ecological factors- light-temp, precipitation, humidity, wind and atmospheric gases; Fire factor; Edaphic factors-composition of soil- formation of soil, soil profile, soil classification, soil components and properties, soil erosion and conservation.	8hrs
Unit-II	Ecosystem – Structure and function; Energy flow, food chain, tropic levels. Ecological pyramids, charting of ecology; pathway and measurement rate; primary and secondary metabolic activities.	6hrs
Unit-III	Biogeochemical cycles : hydrological, gaseous (Carbon and Nitrogen) & sedimentary cycles, nutrient budget with reference to nitrogen, and carbon sequestration, climate change protocol, global warming issues. Ecological succession: models, trends and causes; time factor and stability.	8hrs
Unit-IV	Population ecology: attributes, density and distribution, natality, mortality, age distribution, population growth, growth rate composition, Hardy Weinberg law.	8hrs
Unit-V	Major ecosystems of the world: pond, river, marine, deserts, tundra and forest, productivity of different ecosystems: grassland, forest, shola, savanna, thar, Chillka lake, Western and east Himalaya, Western Ghats. Ganga action plan.	4hrs
Unit-VI	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 health	6hrs
Unit VII	Remote sensing and GIS: Basic and fundamental concepts of remote sensing.	4hrs
Unit VIII	Environmental Impact Assessment: Introduction, process and methods of impact analysis. International biological program, UNESCO, MAB. UNEP.	4hrs

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HCT-2.2 CELL AND MOLECULAR BIOLOGY		48 hrs
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.	6hrs
Unit-III	Mechanism of cell division: Cell cycle regulatory enzymes and proteins, chiasma formation, mechanism of recombination, synaptonemal complex.	4hrs
Unit-IV	Chromosomal Aberrations: types and evolutionary significance. Numerical changes in chromosomes – euploidy, haploidy, polyploidy, aneuploidy and evolutionary significance.	6hrs
Unit-V	Mutagenesis – physical and chemical mutagens, molecular basis of mutation, DNA repair mechanism. Transposable elements, transposon tagging of genes, genetic and evolutionary significance.	4hrs

Unit-VI	DNA replication, transcription (RNA synthesis and processing), DNA and RNA polymerases, genetic code, translation.	8hrs
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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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

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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 – chromatographic techniques, ion exchange, gel filtration affinity chromatography, high performance liquid chromatography. Electrophoresis techniques – agarose, polyacrylamide	10hrs

	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

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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, Lambda 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, <i>Agrobacterium</i> mediated gene transfer, The Ti-plasmid, The process of T-DNA transfer and integration, Practical applications of <i>Agrobacterium</i> -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 <i>Bacillus thuringiensis</i> 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. Carbohydrates and lipids, Molecular farming of proteins, Economic consideration of molecular farming.	4hrs
Unit-VIII	Future prospects for GM crops: The current state of transgenic crops, Concerns about GM crops, the regulations of GM crops and products.	4hrs

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SCT-2.1: NUTRACEUTICALS		48 hrs
Unit-I	Nutraceuticals as science: Importance of nutraceuticals 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; nutraceuticals on the market.	12hrs
Unit-II	Plant and animal based nutraceuticals: Antioxidants, saponins, vitamins, minerals, carotenoids, amino acids, gum and resins, chitin, chitosan, glucosamine, chondroitin, cod liver oil; Algal nutraceuticals (Spirulina, Sea weeds); Bacterial nutraceuticals, Probiotics (yoghurt), Prebiotics and Synbiotics; fermented foods in health care. Lipid, carbohydrate and protein based nutraceuticals; dietary fibers, source and health benefits. Recommended Daily Allowances.	12hrs
Unit-III	Nutraceuticals in health and disease: In preventive and protective medicine, in cancer treatment, cholesterol and obesity control. Nutraceuticals from home garden (Aloe, Honey, Turmeric, Saffron, Ginseng, Neem, fruits, spices, herbs, Bramhi, Tulasi, Bitter guard, 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.	12hrs
Unit-IV	Legal control of food safety and standards: National and international regulation of food and nutraceutical 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.	12hrs

References

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12. World Health Organization. 2007. Community based management of severe acute malnutrition. The World Food Programme, the United Nations System Standing Committee on Nutrition and the United Nations Children's Fund. Official Websites of Food Safety and Standards Authority of India and Codex Alimentarius Commission.

HCP-2.1 ECOLOGY AND ENVIRONMENTAL BIOLOGY

1. Analysis of water samples of lotic and lentic with reference to.
 - a. Carbon dioxide
 - b. Dissolved oxygen
 - c. Total hardness
 - d. Phosphate
 - e. Sulphate
 - f. Nitrates
2. Effect of SO₂ and Cl₂ gasses on plants.
3. Water holding capacity of different soil samples
4. Determination of organic content, carbonates, exchangeable bases and oxidizable organic content of soils
5. Study of vegetation by quadrat and transect method
6. Ecological instruments-Animometer, Lux meter, Rain gauge, Max and min thermometer
7. Visit to meteorological station
8. Morphological and anatomical adaptation in hydrophytes, xerophytes (succulents and non-

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 of 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, Real Time 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

differentiation in tobacco. Transformation of *Agrobacterium* by triparental mating and by electroporation, *Agrobacterium*-mediated transformation of tobacco, detection of GUS and GFP in transgenic plants. Acclimatization of transgenic plants and maintenance in greenhouse.

SCP-2.1: NUTRACEUTICALS

1. Extraction and estimation of total sugars from food products (dairy product, fruit juices, bread).
2. Estimation of crude fat contents of foods by Soxhlet's method (Butter, Margarine, edible oil).
3. Estimation of total Nitrogen of foods by Kjeldahl and Micro Kjeldahl methods.
4. To study nutritional composition (Proteins, carbohydrates, lipids, vitamin C and presence of secondary metabolites) of the following: Bee honey, Mushrooms, dairy products, Beans, Spinach, Carrot, Apple, Amla, Pineapple, Papaya, Lentil and Soya.
5. Extraction and estimation of oil or crude fat content in oil seeds.
6. Estimation of total phenols and chlorogenic acid (Phenolic compound) in plant material.
7. Qualitative test for tannins, phenolics and alkaloids using TLC.
8. Extraction and quantification of alkaloids.

SEMESTER III

HCT-3.1 SYSTEMATIC BOTANY OF ANGIOSPERMS		48 hrs
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.	8hrs
Unit-II	The species concept, Taxonomic hierarchy, species, genus, family and other categories. Material basis of systematics; correlation, weighting, variations of characters and isolation	4hrs
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-Takhtajan, Cornquist A brief note on APG III system of classification	6hrs
Unit-IV	Taxonomy 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, Nymphaeaceae, Papaveraceae, Urticaceae, 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, Zingiberaceae, Liliaceae, Dioscoreaceae, and Orchidaceae.	4hrs

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HCT-3.3 REPRODUCTIVE BIOLOGY AND PLANT ANATOMY		48 hrs
Unit-I	Embryology: Introduction, History and scope of Embryology	2hrs
Unit-II	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 tetrasporic embryo sac development (No type studies of tetrasporic embryo sac). Female gametophyte: Organization of mature Embryo sac, Ultra structure of Egg apparatus, Nutrition of Embryo sac.	10hrs
Unit-III	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-IV	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.	6hrs
Unit-V	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	10hrs

	tube elements and functions.	
Unit-VI	Primary and secondary growth: Anamolous primary structures with special reference to <i>Nyctanthus</i> , <i>Achyranthus</i> . Anamolus secondary growth with reference to <i>Boerrhavia</i> , <i>Bignonia</i> , <i>Leptadinia</i> , <i>Piper</i> , <i>Tinospora</i> , <i>Thunbergia coccinea</i> .	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:

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2. Cutler, D. F. (1978) Applied Plant Anatomy, Longman, New York.
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17. Shivanna K. R. and Sawhney V. K. (eds) 1997. Pollen Biotechnology for crop production and improvement. Cambridge University, Cambridge.

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, Karyagum	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

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6. Peter B. Kaufman *et al.*, 1999. Natural Products from Plants
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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,	10hrs

	Characteristics, preliminary chemical analysis, qualitative and quantitative analysis of raw drug using Colorimetry, Spectrophotometry, Chromatography (<i>Senna, Datura, Cinchona, Ginger, Nuxvomica, Withania, Rauwolfia, Emblica</i>)	
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. (<i>Dioscorea, Isabgol, Senna, Liquiorice, Rauwolfia, Costus, Withania, Citronella, Vetiver, Artemisia, Acorus, Vanilla</i>)	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:

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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.
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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- pharmacognostic 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 Essential oils.

SCP-3.1: BIODIVERSITY AND CONSERVATION

1. Field survey of important plants of the region.
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

References

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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, Agrobiodiversity 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 importance. Wood and its uses.	12hrs

References:

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

SEMESTER IV

HCT-4.1 PLANT PHYSIOLOGY		48 hrs
Unit-I	Water relations: solutions, colloids, molarity, buffer molar solutions, pH, emulsion and gels. Permeability, theories of cell permeability and biosignaling, diffusion, osmosis, membranes, osmotic pressure, turgor pressure, wall pressure, relation between OP, DPD and TP, concept of water potential, plasmolysis, significance of osmosis and imbibitions.	5hrs
Unit-II	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	5hrs
Unit-III	Mineral nutrition: macro and micronutrients and their role and deficiency symptoms, absorption of mineral salts, nature of membranes general mechanism of solute absorption	4hrs
Unit-IV	Photosynthesis: structure of chloroplast and photosynthetic pigments, action spectrum, concept of two photosystems, red drop and Emerson enhancement effect, photophosphorylation, Calvin cycle, C ₄ and CAM pathways, photorespiration and factors affecting on photosynthesis	8hrs
Unit-V	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	6hrs
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, photoperiodism, phytochrome, vernalization and 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

References

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HCP-4.1 PLANT 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.

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, Apomixis	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

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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, Mycorrhiza, Actinorrhiza 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.Strategies for engineering stress tolerance. Transgenic plants;	10hrs

	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.	
Unit-VI	Post-harvest technology: RNAi and antisense RNA technology for extending shelf life of fruits and flowers (ACC synthase gene and polygalacturonase); delay of softening and ripening of fleshy fruits (tomato, banana, watermelons). Post-harvest protection of cereals, millets and pulses.	8hrs

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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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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	10hrs

	ethnobotany, ethnomedicine, ethnoecology, ethnic communities of India. Application of natural products to certain diseases- Jaundice, cardiac, infertility, diabetics, Blood pressure and skin diseases.	
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References

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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 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	14hrs

	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.	
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Akkamahadevi Women's University. Vijayapura

M.Sc. Degree Examination, Nov/ Dec 2018

Subject: Botany (CBCS)

Theory Model Question Paper

Time: 3 Hrs

Max. Marks: 70

Instructions to the candidates: Answer all the questions; Draw diagrams wherever necessary

Part-A

Q-1 Answer the following questions

1X1 = 10

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.
- 8.
- 9.
- 10.

Part-B

Answer the following any five questions

12X5 = 60

Q-2

- a)
- b)

Q-3

- a)
- b)

Q-4

- a)
- b)

Q-5

- a)
- b)

Q-6

- a)
- b)

Q-7

- a)
- b)

Q-8

- a)
- b)

Akkamahadevi Women's University. Vijayapura

M.Sc. Degree Examination, Nov/ Dec 2018

Subject: Botany (CBCS)

Practical Model Question Paper

Time: 3 hrs

Max. Marks: 36

Q. I Major Question	10 marks
Q. II Minor Question	06 marks
Q. III Comment on	5X2=10 marks
Q. IV Viva-voce	05 marks
Q. V Journal /Record	05 marks