ACADEMIC PLAN
2019 – 2020
C.U. B.Sc.
BOTANY (HONOURS)
SEMESTER I

Core course	**PHYCOLOGY AND MICROBIOLOGY (BOT-A-CC-1-1-TH)**	**THEORITICAL**	**Name of teachers**	**Credits 4**	**Lectures = 60**
1		**PHYCOLOGY**			
		1. General account : 1.1. Thallus organization, Structure of algal cell, 1.2. Ultrastructure of Plastids and Flagella, 1.3. Origin and evolution of sex, 1.4. Life cycle patterns, 1.5. Significant contributions of important phycologists (Fritsch, Smith, R. N. Singh, T.V. Desikachary, H.D. Kumar, M.O.P. Iyengar)	Nanda Khan (NK)		5
		2. Classification: 2.1. Diagnostic characters and examples of Cyanophyceae, Rhodophyceae, Chlorophyceae, Charophyceae and Phaeophyceae	Urmi Roy (UR)		5
		3. Cyanobacteria: 3.1. Ultrastructure of cell, 3.2. Heterocyst - structure and function, 3.3. Ecology	Mahua Bhattacharya (MB		4
		4. Bacillariophyta: 4.1. Cell structure, 4.2. Cell division, 4.3. Auxospore formation in Centrales and Pennales	Manjira Das (MD)		6
		5. Life History: 5.1. Chlamydomonas, 5.2. Oedogonium, 5.3. Chara, 5.4. Ectocarpus, 5.5. Polysiphonia, 5.6. Evolutionary significance of Prochloron	NK, UR, NK		10
		MICROBIOLOGY			
		1.Virus: 1.1. Discovery, 1.2.Plant virus- types, 1.3. Transmission and translocation of Plant virus, 1.4. TMV Physicochemical characteristics and Multiplication, 1.5. One step growth curve, 1.6. Lytic cycle (T4 phage) and Lysogenic cycle (Lambda phage), Significance of lysogeny, 1.7.Viroids and Prions.	MB and Bulbul Banerjee Biswas (BB)		10
		2.Bacteria: 2.1. Discovery, .2.2. Distinguishing features of Archaea and Bacteria, 2.3. Characteristics of some major groups: Proteobacteria (Enterobacteria), Firmicutes, Mollicutes, Actinobacteria, Spirochaetes, Chlamydiae,	BB		20

		2.4. Bacterial growth curve and generation time, 2.5.Flagella (ultrastructure) & Pilli, 2.6. Cell wall – chemical structure and differences between Gram +ve & Gram – ve bacteria, 2.7. Bacterial genome and plasmid, 2.8. Endospore - formation, structure and function, 2.9.Genetic Recombination (a) Transformation – with special emphasis on Natural and Induced competence and DNA uptake, (b) Conjugation– F- factor, F + X F − , Hfr X F − , concept of F', chromosome mobilization, (c) Transduction– Generalised and specialized.			
	PHYCOLOGY AND MICROBIOLOGY (BOT-A-CC-1-1-P)	**PRACTICAL**		**Credits 2**	
		ALGAE 1. Work out of the following algae with reproductive structure (Free hand drawing and drawing under drawing prism with magnification): Oedogonium, Chara, Ectocarpus. 2. Study of (a) Permanent slides : Gloeotrichia, Volvox, Vaucheria, Coleochaete, Polysiphonia, Centric and Pennate diatom; (b) Macroscopic specimens : Laminaria, Sargassum.	UR and NK		
		MICROBIOLOGY 1. Preparation of bacterial media – (a) Nutrient agar and nutrient broth, (b) Preparation of slants and pouring Petri-plates. 8 2. Sub-culturing of bacterial culture. 3. Gram staining from bacterial culture. 4. Microscopic examination of bacteria from natural habitat (curd) by simple staining	MB		
		FIELD WORK At least one local excursion to be conducted for study and collection of algae (only 5 from natural habitat) and another local excursion should be conducted to give an introductory idea about plant diversity (Collection not required). **CLASSROOM PERFORMANCE** 1. Laboratory Note Book of each section must be signed by the respective teacher with date during practical classes. 2. Slides (permanent) prepared during practical classes. 3. Submission (5 algae collected from natural habitat and identified latter			

Core course	**MYCOLOGY AND PHYTO-PATHOLOGY (BOT-A-CC-1-2-TH**	**THEORITICAL**	**Name of teachers**	**Credits 4**	**Lectures = 60**
2					
		1. General Account: 1.1. Hyphal forms, 1.2. Fungal spore forms and mode of liberation, 1.3. Sexual reproduction and degeneration of sex, 1.4. Parasexuality and sexual compatibility, 1.5. Life cycle patterns	Aditi Chatterjee (AC)		6
		2. Classification: 2.1. Classification of Fungi (Ainsworth, 1973) upto sub-division with diagnostic characters and examples. 2.2. General characteristics of Myxomycota, Oomycota, Zygomycota, Ascomycota, Basidiomycota, Deuteromycota	MB		6
		3. Life history: 3.1. Synchytrium, 3.2. Rhizopus, 3.3. Ascobolus, 3.4. Agaricus.	AC		10
		4.Mycorrhiza: 4.1. Types with salient features, 4.2. Role in Agriculture & Forestry	AC		4
		5. Lichen: 5.1. Types, 6.2. Reproduction, 6.3. Economic and ecological importance	AC		4
		PHYTO-PATHOLOGY			
		1.Terms and Definitions : 1.1. Disease concept, 1.2. Symptoms, 1.3. Etiology & causal complex, 1.4. Primary and secondary inocula, 1.5. Infection, 1.6. Pathogenecity and pathogenesis, 1.7. Necrotroph and Biotroph, 1.8. Koch's Postulates, 1.9. Endemic, Epidemic, Pandemic and Sporadic disease, 1.10. Disease triangle, 1.11. Disease cycle (monocyclic, polycyclic and polyetic).	MB		6
		2. Host – Parasite Interaction: 2.1. Mechanism of infection (Brief idea about Pre-penetration, Penetration and Post-penetration), 2.2. Pathotoxin (Definition,criteria and example), 2.3. Defense mechanism with special reference to Phytoalexin, 2.4. Resistance- Systemic acquired and Induced systemic.	MD		6
		3. Plant Disease Management : 3.1. Quarantine, 3.2. Chemical, 3.3. Biological, 3.4. Integrated	BB		8
		4. Symptoms , Causal organism, Disease cycle and Control measures of: 4.1. Late blight of Potato, 4.2. Brown spot of rice, 4.3. Black stem rust of wheat, 4.4. Stem rot of jute.	BB		10
	MYCOLOGY AND PHYTO-PATHOLOG	**PRACTICAL**		**Credits-2**	

	Y (BOT-A-CC-1-2-P				
		MYCOLOGY 1. Work out of the following fungi with reproductive structures (including microscopic measurement of Reproductive structures): Rhizopus (asexual), Ascobolus, Agaricus . 2. Study from permanent slides: Zygospore of Rhizopus, Conidia of Fusarium, Conidiophore of 10 Penicillium. 3. Morphological study of Fungi (fruit body of Polyporus, Cyathus), Lichens (fruticose and foliose).	BB and AC		
		PHYTO- PATHOLOGY 1. Preparation of fungal media (PDA). 2. Sterilization process. 3. Isolation of pathogen from diseased leaf. 4. Inoculation of fruit and subculturing. 5. Identification : Pathological specimens of Brown spot of rice, Bacterial blight of rice , Loose smut of wheat, Stem rot of jute, Late blight of potato; Slides of uredial, telial, pycnial & aecial stages of Puccinia gramini	BB and AC		
		FIELD WORK At least one local excursion to be conducted for study and collection of macrofungi (only 5).			
		CLASSROOM PERFORMANCE 1. Laboratory Note Book of each section must be signed by the respective teacher with date during practical classes 2. Slides (permanent) prepared during practical classes. 3. Submission (5 Macro fungi			
Core course 3	**PLANT ANATOMY-BOTTA- V**	**SEMESTER II** **Theoritical**			
		ANATOMY **1.Cell wall:** 1.1. Ultrastructure & Chemical constituents, 1.2. Plasmodesmata- ultrastructure, 1.3. Concept of Apoplast and Symplast, 1.4. Growth and Thickening of cell wall	AC and UR		8
		2. Stomata: 2.1. Types (Metcalfe and Chalk, Stebbins and Khush).	UR		4
		3. Stele: 3.1 Leaf-trace and leaf-gap, 3.2. Stelar types & evolution	MD		4
		4.Primary structure of stem and root- Monocot and Dicot. Leaf- dorsiventral and isobilateral.	UR		8
		5. Secondary growth: 5.1. Normal (intra- & extra-stelar), 5.2. Anomalous (stem of *Bignonia*, *Boerhavia*, *Tecoma*, *Dracaena* and root of *Tinospora*).	AC		12
		6. Mechanical tissues and the Principles governing their distribution in plants.	AC		8

		7. Developmental Anatomy: 7.1. Organisation of shoot apex (Tunica Corpus) and Root apex (Korper-Kappe), 7.2. Plastochrone.	UR		8
		8. Ecological Anatomy: Adaptive anatomical features of 8.1. Hydrophytes, 8.2. Xerophytes pharmacognosy.	MB		4
		9. Scope of plant anatomy: application in systematics, forensics and pharmacognosy. 4 lectures	UR		4

CORE COURSE 3	**PLANT ANATOMY - BOTPA -VI**	**PRACTICAL** 1.Workout on Plant Anatomy 2. Identification with reasons 3.Classroom performance: (Attendance, lab records, slides) 4 VIVA **PLANT ANATOMY** **1.** Microscopic studies on: Types of stomata, sclereids, raphides (*Colocasia*), cystolith (*Ficus* leaf) starch grains, aleurone grains, laticiferous ducts, oil glands. **2.** Study of anatomical details through permanent slides/ temporary stained mounts- a) Root- Monocot and dicot, b) Stem- Monocot and dicot, c) Leaf- Monocot and dicot. **3.** Study of anomalous secondary structure in stem of *Bignonia*, *Boerhaavia*, *Tecoma*, *Dracaena* and root of *Tinospora* **4.** Study of adaptive anatomical features: Hydrophytes (*Nymphaea* petiole) and Xerophytes (*Nerium* leaf).	UR&NK	

CORE COURSE 4	**ARCHAEGONIATE-BOTTA-VII**	Theoritical	Name of teachers	**Credits 4,**	**Lectures =60**
		BRYOPHYTES **1. General Account :** 1.1. General characteristics and adaptations to land habit, 1.2. Classification (Strotler and Crandle Strotler, 2009) upto class with diagnostic and examples. **2.. Life History:** Gametophyte structure and Reproduction, Development and Structure of sporophyte, Spore dispersal in 2.1. *Marchantia*, 2.2. *Anthoceros,* 2.3*. Funaria.* **3. Phylogeny:** 3.1. Unifying features of archaegoneates; transition to land habit, 3.2. Origin of Alternation of Generations (Homologous and Antithetic theory), 3.3. Evolution of Sporophytes (Progressive and Regressive concept), 3.4. Origin of Bryophytes. lectures **4. Importance :** Role of bryophytes in: 4.1. Plant succession, 4.2. Pollution Monitoring, 4.3. Economic importance of bryophytes with special reference to *Sphagnum*. **PTERIDOPHYTES** **1. General Account:** 1.1. Colonisation and rise of early land plants, 1.2. Classification of vascular plants by Gifford & Foster (1989) upto division (Rhyniophyta to Filicophyta) with diagnostic characters and examples. **2. Life History:** Sporophyte structure, Reproduction and Structure of gametophyte in 2.1. *Psilotum*, 2.2. *Selaginella*, **3.** Telome concept and its significance in the origin of different groups of Pteridophytes. **4.** Heterospory and Origin of Seed habit. **5.** Economic importance as food, medicine and Agriculture. **GYMNOSPERMS** **1.** Classification of vascular plants by Gifford & Foster (1989) upto division	MB UR AC AC BB		4 12 6 4 2

		(Progymnospermophyta to Gnetophyta) with diagnostic characters and examples. **2.** Progymnosperms : Diagnostic characters of the group, 2.2.Vegetative and reproductive features of Archeopteris, 2.3. Phylogenetic importance. **3.** Life History : Distribution in India; Vegetative and Reproductive structure of sporophyte, Development of gametophyte in : 3.1. *Cycas* , 3.2. *Pinus* and 3.3. *Gnetum*. **4.** Economic Importance with reference to Wood, Resins, Essential oils, and Drugs.	BB NK NK&AC		8 4 2 4
CORE COURSE 4	**ARCHAEGONIATE-BOTTA-VII**	**PRACTICAL**	Name of teachers	**Credits 4,**	**Lectures =60**
		BRYOPHYTES **1.** Morphological study of the plant body: Genera as mentioned in theoretical syllabus and *Riccia, Porella*. **2.** Study from permanent slides : *Riccia* (V.S. of thallus with sporophyte), *Marchantia* (L.S.through gemma cup, antheridiophore , archegoniophore) , *Anthoceros* (L.S. of sporophyte) , *Funaria* (L.S. of capsule). **PTERIDOPHYTES** **1. 1.** Morphological study of the sporophytic plant body: Genera as mentioned in the theoretical syllabus and *Lycopodium, Ophioglossum* and *Marsilea*. **2.** Workout of the reproductive structures: *Selaginella, Equisetum, Pteris*. **3.** Study from permanent slides: *Psilotum* (T.S. of synangium), *Lycopodium* (L.S. of strobilus), *Ophioglossum* (L.S. of spike), *Dryopteris* (gametophyte), *Marsilea* (L.S. of sporocarp). **GYMNOSPERMS**	BB and AC		

		1. Morphological study: syllabus), *Marsilea* (L.S. of sporocarp). **GYMNOSPERMS** **1.** Morphological study: *Cycas* (microsporophyll and megasporophyll), *Pinus* (female and male cone), *Gnetum* (female and male cone). **2.** Study from permanent slides: *Cycas* (L.S. of ovule), *Pinus* (L.S. of male and female cone), *Ginkgo* (L.S. of female strobilus), *Gnetum* (L.S. of male cone and ovule). **FIELD STUDY FIELD STUDY** Botanical excursion to familiarize the students with the natural habitats of these groups is desirable. No individual collection should be allowed. Students should submit only photographs in their field Botanical excursion to familiarize the students with the natural habitats of these groups is desirable. No individual collection should be allowed. Students should submit only photographs in their field report.	AC&B B AC&B B Nk		

SEMESTER III

Core course 5	**PALAEOBOTANY AND PALYNOLOGY -BOTA-A-CC-3-5-TH**	**Theoretical**	**Name of teachers**	**Credits 4,**	**Lectures =60**
		PALAEOBOTANY & PALYNOLOGY 1. Geological time scale with dominant plant groups through ages.	**AC**		4
		2. Plant Fossil: 2.1. Types: Body fossil (Micro- and Megafossils), Trace fossil, Chemical fossil, Index fossil, 2.2. Different modes of preservation (Schopf, 1975), 2.3. Conditions favouring fossilization, 2.4. Nomenclature and Reconstruction, 2.5. Principle of fossil dating (a brief idea), 2.6.Importance of fossil study.	**AC/BB**		12
		3. Fossil Pteridophytes: Structural features, Geological distribution and Evolutionary significance of 3.1. Rhynia, 3.2. Lepidodendron (Reconstructed), 3.3. Calamites (Reconstructed).	**BB**		10
		4. Fossil gymnosperms: Structural features and Geological distribution of reconstructed genera: 4.1. Lyginopteris, 4.2.Williamsonia, 4.3.Cordaites	**UR**		10
		5. Indian Gondwana System - Three fold division with major megafossil assemblages	**MD**		6
		6. Palynology: 6.1. Spore and Pollen, 6.2. Pollen aperture types, 6.3. NPC classification (Erdtman). 6.4. Pollen wallSporopollenin, Stratification and Ornamentation (sculpturing)..	**MD**		10
		7.. Applied Palynology: Basic concepts of: 7.1. Palaeopalynology, 7.2. Aeropalynology, 7.3. Forensic palynology, 7.4.Melissopalynology	**MD**		8

Core course 5	PALAEOBOTANY AND PALYNOLOGY -BOTA-A-CC-3-5-P	PRACTICAL PALAEOBOTANY AND PALYNOLOGY	Name of teachers	Credits 2
		- PALAEOBOTANY AND PALYNOLOGY **1. Morphological study:** Ptilophyllum and Glossopteris leaf fossils**.** **2. Study from permanent slides:** T.S. of stem of Rhynia, Lepidodendron, Calamites, Lyginopteris,Cordaites. **3. Study of Pollen types** (colpate, porate and colporate) from permanent slides**.** Slides may be prepared from specimens: Colpate (Leonurus sibiricus/ Brassica sp.), Porate (Hibiscusrosa-sinensis), Colporate (Cassia sophera/ C. tora).	**NK/UR**	
		CLASSROOM PERFORMANCE **1.** Laboratory Note Book of each section must be signed by the respective teacher with date during practical classes		

CORE COURCE- 6
REPRODUCTIVE BIOLOGY OF ANGIOSPERMS

Core course 6	REPRODUCTIVE BIOLOGY OF ANGIOSPERMS-BOT-A-CC-3-6-TH	THEORETICAL	Name of teachers	Credits 4,	Lectures =60
		MORPHOLOGY OF ANGIOSPERMS **1.** Inflorescence types with examples.	**UR**		**8**
		2. Flower, induction of flowering, flower development- genetic and molecular aspects**.**	**MD**		**14**
		3. Fruits and seeds - types with examples	**MD**		**8**
		EMBRYOLOGY 1. **Pre-fertilisation changes :** 1.1. Microsporogenesis and Microgametogenesis, 1.2. Megasporogenesis and Megagametogenesis (monosporic, bisporic and tetrasporic).	**NK**		**6**
		2. Fertilisation: 2.1. Pollen germination, 2.2. Pollen tube- growth, entry into ovule and discharge,	**NK**		**6**

		2.3. Double fertilization.			
		3.Post-fertilization changes : **3.1.** Embryogenesis in Capsella, 3.2. Development of Endosperm (3 types).	**NK**		**10**
		4. Apomixis & Polyembryony: 4.1. Apomixis- Apospory and Apogamy, 4.2.Polyembryony- different types.	**NK**		**8**

course 6	**- REPRODUCTIVE BIOLOGY OF ANGIOSPERMS(BOTA-CC-3-6-P)**	**PRACTICAL**	**Name of teachers**	**Credits 2**
		REPRODUCTIVE BIOLOGY OF ANGIOSPERMS **1.** Inflorescence types- study from fresh/ preserved specimens. 2. Flowers- study of different types from fresh/ preserved specimens. 3. Fruits- study from different types from fresh/preserved specimens. 4. Study of ovules (permanent slides/ specimens/photographs)- types (anatropous, orthotropous, amphitropous and campylotropous). 5. Field study desirable. 6. A project along supported with photographs taken during field study to be submitted giving comprehensive idea about different types of inflorescence, flowers and fruits **CLASSROOM PERFORMANCE** Same as above.	**MD/NK**	

CORE COURSE- 7
PLANT SYSTEMATICS

Core course 7	**PLANT SYSTEMATICS (BOTT-A-CC-3-7-TH)**	**THEORETICAL**	**Name of teachers**	**Lectures 60**	**Credit4**
		TAXONOMY OF ANGIOSPERMS **1. Introduction:** ***1.1.*** Components of Systematic: Nomenclature, Identification, Classification; ***1.2.*** Taxonomy and its phases - Pioneer, Consolidation, Biosystematic and Encyclopaedic; alpha- and omega- taxonomy.	**MD**	**6**	
		2. Nomenclature: Type method, Publication, Rank o f taxa, Rules of priority, Retention and rejection of names, Author	**MD**	**6**	

		Citation, Effective and valid publication, Elementary knowledge of ICN- Principles.			
		3. Systems of classification: Broad outline of Bentham & Hooker (1862-1883), Cronquist (1988), Takhatajan (1991) - system of classification with merits and demerits. Brief reference of angiosperm phylogeny group (APG III) classification. ***3.1.*** Systematics in Practice: Herbaria and Botanical Gardens - their role in teaching and research; important Herbaria and Botanical Gardens of India and world (3 each); ***3.2.*** Dichotomous keys -indented and bracketed	**MD**	**20**	
		4. Phenetics and Cladistics: Brief idea on Phenetics, Numerical taxonomy- methods and significance; Cladistics- construction of dendrogram and primary analysis; Monophyletic, polyphyletic and paraphyletic groups; Plesiomorphy and apomorphy	**MD**	**8**	
		5. Data sources in Taxonomy: Supportive evidences from: ***5.1.*** Phytochemistry, ***5.2.*** Cytology, ***5.3.*** Palynology and ***5.4.*** Molecularbiology data (Protein and Nucleic acid homology).	**MD**	**8**	
		6. Diagnostic features, Systematic position (Bentham & Hooker and Cronquist), Economicallyimportant plants (parts used and uses) of the following families: ***6.1.*** Monocotyledons: Alismataceae, Gramineae (Poaceae), Cyperaceae, Palmae (Arecaceae),Liliaceae, Musaceae, Zingiberaceae, Cannaceae, Orchidaceae. ***6.2.*** Dicotyledons: Nymphaeaceae, Magnoliaceae, Leguminosae (subfamilies), Polygonaceae ,Euphorbiaceae, Malvaceae, Umbelliferae (Apiaceae), Labiatae (Lamiaceae), Solanaceae, Scrophulariaceae, Acanthaceae, Rubiaceae, Cucurbitaceae, Compositae (Asteraceae).	**MD**	**12**	

Core course 7	**-Plant systematics (BOT-A-CC-3-7-P)**	**PRACTICAL** **- PLANT SYSTEMATICS -**	**Name of teachers**		**Credits 2**
		ANGIOSPERMS **1.** Work out, description, preparation of floral formula and floral diagram, identification up to genuswith the help of suitable literature of wild plants and systematic position according to Benthum Hooker system of classification from the following families: Malvaceae, Fabaceae (Papilionaceae),Solanaceae, Scrophulariaceae, Acanthaceae, Labiatae (Lamiaceae) , Rubiaceae. **2.** Spot identification (Binomial, Family) of common wild plants from families included in the theoretical syllabus (list to be provided).	**MD**		
		FIELD WORK At least three excursions including one excursion to Acharya Jagadish Chandra Bose Indian Botanic Garden (Shibpur, Howrah) and Central National Herbarium (CNH).			
		FIELD RECORDS 1. Field Note Book (authenticated) with field notes on the plants of the area of excursion and voucher specimen book. **2.** Herbarium specimen: Preparation of 25 angiospermic specimens (identified with author citation, voucher number and arranged following Bentham& Hooker's system of classification)to be submitted during excursion.			

SEC-A	**APPLIED PHYCOLOGY, MYCOLOGY AND MICROBIOLOGY (BOT-A-SEC-A-3-1) THEORETICAL**	**SKILL ENHANCEMENT COURSE- ELECTIVE (Credits 2, Lectures 30)**			
		APPLIED PHYCOLOGY 1. Algae as food and source of phycocolloid (Agar-agar, Algin, Carrageenan), 2. Diatomite, 3. Algal toxin, 4. Algal Biotechnology – potential of microalgae for SCP, β-carotene, Biodiesel, bioplastics fromalgar	**UR** **NK** **MD/MB**	**10**	
		APPLIED MYCOLOGY 1. Fungi as food, 2. Cheese and Ethanol- Industrial production (brief outline), 3. Fungal sources and uses of Enzyme (Cellulase), Amino acid (Tryptophan), Vitamin (Riboflavin), Antibiotic (Griseofulvin), Pharmaceuticals (Cyclosporin-A). 4. Aflatoxin	**AC**	**10**	
		APPLIED MICROBIOLOGY 1. Industrial Production of Vinegar and Streptomycin (brief outline), 2. Microbial sources and uses of Enzyme (Amylase, Protease), Amino acid (Glutamic acid, Lysine), Polysaccharides (Dextran), 3. Use of microbes as Biofertilizer and Biopesticides, 3.4. Use of microbes in mineral processing.	**BB**	**10**	
		SEMESTER IV		**, Lectures**	**(Credits**
CORE COURSE-8	**PLANT GEOGRAPHY, ECOLOGY AND EVOLUTION (BOT-A-CC-4-8-TH) THEORETICAL**	LANT GEOGRAPHY 1. Phytogeographical regions: 1.1. Phytogeographical regions of India (Chatterjee 1960); 1.2. Dominant flora of Eastern Himalaya, Western Himalaya and Sunderban Endemism: 2.1 Endemic types and Factors; 2.2. Age & Area hypothesis and Epibiotic theory; 2.3. Endemism in Indian flora . ECOLOGY 1. Preliminary idea on: 1.1. Habitat and Niche, 1.2. Ecotone and edge–effect, 1.3. Microclimate, 1.4. Ecads, ecotype 4and ecoclines, 1.5. Carrying capacity. …….4 lectures	**MD** **MB**	**8** **6**	

		2. Community ecology: 2.1. Community- Characteristics and diversity, 2.2. Ecological succession –Primary and secondary, Seral stages (with reference to Hydrosere), autogenic and allogenic succession. 3.1. Plant indicators (metallophytes); 3.2. Phytoremediation. 4. Conservation of Biodiversity: 4.1. Level of Biodiversity: genetic, species & ecosystem diversity, 4.2. Biodiversity hot spots- criteria, 21 Indian hotspots, 4.3. In- situ and ex-situ conservation, 4.4. Seed-banks, 4.5. Cryopreservation EVOLUTION 1.1 Introduction, 1.2. Theories of evolution: Natural selection, Group selection, Neutral theory of molecular evolution, 1.3. Phyletic gradualism, Punctuated equilibrium and Stasis lectures 2.1 Brief idea on: Stabilizing directional, disruptive and sexual selection; Speciation: Sympatric and allopatric speciation; Coevolution, Adaptive radiation, Reproductive isolation lectures a 3.1. Simplified phylogeny of bacteria, algae, fungi, bryophyte, pteridophyte and gymnosperm, 3.2. Phylogenetic tree.	**MB** **MB** **MB** **MB** **MD**	**4** **6** **16** **6** **4**	

	ECOLOGY AND EVOLUTION (BOT-A-CC-4-8-P)	PRACTICAL- PLANT GEOGRAPHY, 1. Field visit- at least one long excursion at different phytogeographical region of India. 2. Study of local flora and submission of a project report highlighting phytogeographical characteristics of the region. ECOLOGY 1. Study of community structure by quadrat method and determination of (i) Minimal size of the quadrat, (ii) Frequency, density and abundance of components (to be done during excursion/ field visit). 2. Comparative anatomical studies of leaves form polluted and less polluted areas. 3. Measurement of dissolved O2 by azide modification of Winkler's method. 4. Comparison of free CO2 from different sources.	**MD/MB**		Credits 2
CORE COURSE-9	BOT-A-CC-4-9-TH) ECONOMIC BOTANY	(THEORETICAL (Credits 4, Lectures 60) 1. Origin of cultivated crops: Concepts of centre of origin, their importance with reference to Vavilov's work. Examples of major plant introductions; crop domestication and loss of genetic diversity; evolution of new crops/ varieties, importance of germplasm diversity.	**NK**	.6	
		2. Cereals: Rice and wheat (origin, morphology, processing and uses). …….	**NK**	6	
		3. Legumes: Origin, morphology and uses of gram and mung bean. Importance to man and environment.	**NK**	.6	
		4. Sugar and starches: Morphology and processing of sugarcane, products and byproducts of sugarcane industry. Potato- morphology, propagation and uses. …….s	**UR**	5	
		5. Spices: Listing of important spices, their family and part used.	**UR**	.6	
		6. Beverages: Tea (morphology, processing and uses).	**UR**	.5	
		7. Oil and fats: General description, classification, extraction, their uses and health implications of mustard, soybean, coconut (Botanical name, family and uses). Essential oils-general account, extraction methods, comparison with fatty oils and their uses. …….	**AC**	10	
		8. Drug-yielding plants: Therapeutic and habit forming drugs with special reference to Cinchona, Digitalis, Papavar, Cannabis and Tobacco (morphology, processing, uses and health hazards).	**AC**	8	
		9. Timber: general account with special reference to Sal and Teak.	**MD**	4	
		10. Fibers: Cotton and Jute (Morphology, extraction and uses).	**MD**	.4	
	ECONOMIC BOTANY (BOT-A-CC-4-9-P RACTICAL-	13 ECONOMIC BOTANY 1. Cereals: Wheat (habit sketch, L.S./T.S. of grain, starch grains, micro-chemical tests); rice (habit sketch, study of paddy and grain, starch grains, micro-chemical tests)	**Nk/MD**		

		2. Legume: Soybean, ground nut (habit, fruit, seed structure, micro-chemical tests) 3. Source of sugars and starches: Sugarcane (habit sketch; cane juice- micro-chemical tests); potato (habit sketch, tuber morphology, T.S. of tuber to show localization of starch grains, W.M. of starch grains, micro-chemical tests. 4. Tea- tea leaves, tests for tannin 5. Mustard- plant specimen, seeds, tests for fat in crushed seeds 6. Habit sketch of Digitalis, Papaver and Cannabis. 7. Sal, Teak- section of young stem. 8. Jute- specimen, transverse section of stem, tests for lignin on T.S. of stem and study of fibre following maceration technique.			
CORE COURSE 10	GENETICS (BOT-A-CC-4-10-TH	**GENETICS (BOT-A-CC-4-10-TH)** **THEORETICAL**			
		Mendelian genetics and its extension	AC		
		. 2).Linkage, Crossing over and Gene Mapping: 2.1.Complete and incomplete linkage (example), linked gene does not assort independently (example), linkage group, 2.2. Crossing over, crossing over produces recombination (example), detection of crossing over (McClintock's experiment), and 2.3.Molecular mechanism of crossing over (Holliday model), 2.4. Gene mapping with three point test cross, detection of middle gene in three point test cross, calculation of recombination frequencies, 2.5. Co-efficient of coincidence and interference, mapping function, 2.6. Problems on gene mapping, 2.7. Molecular mapping – ISH, FISH (brief idea	BB		
		3.. Epistasis and Polygenic inheritance in plants	BB	4	
		4. Aneuploidy and Polyploidy: Types, examples, meiotic behaviour and importance of: 4.1. Aneuploidy, 4.2. Polyploidy, 4.3. Speciation and evolution through polyploidy	UR	8	
		5. Chromosomal aberration: Types and meiotic behaviour of: 5.1. Deletion, 5.2. Duplication, 5.3. Translocation, and 5.4. Inversion.	UR	6	
		6. Mutation : 6.1. Point mutation-Transition, Transversion and Frame shift mutation, 6.2. Molecular mechanisms (tautomerisation, alkylation, deamination, base analogue incorporation, dimerisation), 6.3. DNA repair (brief idea).	BB	8	
		7.1. One Gene–one polypeptide concept, 7.2. Split gene, 7.3. Overlapping gene, 7.4. Repetitive DNA tandem and interspersed, 7.5. Transposon (Ac-Ds system), 7.6. Homoeotic gene in plants (ABCE Quartet model of flowering	AC	12	
	- GENETICS (BOT-A-CC-4-10-P	PRACTICAL	BB		

		1. Introduction to chromosome preparation: Pre-treatment, Fixation, Staining, Squash and Smear preparation, Preparation of permanent slides. 2. Determination of mitotic index and frequency of different mitotic stages in pre-fixed root tips of Allium cepa. 3. Study of mitotic chromosome: Metaphase chromosome preparation, free hand drawing under high power objective, drawing with drawing prism under oil immersion lens, determination of 2n number, and comment on chromosome morphology of the following specimens from root tips:			
	SEC-B	USHROOM CULTURE TECHNOLOGY (BOT-A-SEC-B-4-4) THEORETICA			
		1. Introduction, nutritional and medicinal value of edible mushrooms; poisonous mushrooms, types of edible mushrooms available in India- Volvariella volvacea, Pleurotus citrinopileatus, Agaricus bisporus. 2. Cultivation technology: infrastructure: substrates (locally available), polythene bags, vessels, inoculation hook, inoculation loop, low cost stoves, sieves, culture racks, mushroom unit (thatched house), water sprayer, tray, small polythene bag. Pure culture: medium, sterilization, preparation of spawn, multiplication. Mushroom bed preparation- paddy straw, sugarcane trash, maize straw, banana leaves,. Factors affecting the mushroom bed preparation- low cost technology, composting technology in mushroom production. 3. Storage and nutrition: short term storage (Refrigeration- upto 24 hours), long term storage (canning, pickels, papads), drying, storage in salt solutions. Nutrition- proteins- amino acids, mineral elements nutrition- carbohydrates, crude fibre content- vitamins. ……. 4. Food preparation: type of foods prepared from mushroom. Research centres- National level and regional level. Cost benefit ratio- marketing in India and abroad. Export value.	**AC**	5 8 5	
CORE COURSE-11	BOT-A-CC-5-11-TH) THEORETICAL)	**SEMESTER V** **CELL AND MOLECULAR BIOLOGY** (			
		1. Origin and Evolution of Cells: 1.1. Evolution of nucleic acid (from PNA to DNA), Concept of RNA world, Ribozymes, First cell, 1.2. Origin of eukaryotic cell (endosymbiotic theory), 1.3. Small RNA- riboswitch, RNA interference, si RNA, mi RNA- brief idea, 1.4.Organellar DNA (cp- and mt- DNA).	**BB**	6 l	
		2. Nucleus and Chromosome: 2.1. Nuclear envelope, Nuclear lamina and Nuclear pore complex, 2.2. Nucleolus-ultrastructure and ribosome biogenesis, 2.3. Chromatin ultrastructure and DNA packaging in eukaryotic chromosome, 2.4. Centromere: types, structure and function.	**MD/NK**	6	
		3. Cell cycle and its regulation: 3.1. Kinetochore and spindle apparatus-structural organization and functions, 3.2.Microtubules structure, organization and function, 3.3. Mechanism of cell	**BB**	6	

		cycle control in Yeast (checkpoints and role of MPF), Apoptosis (Brief idea).			
		DNA Replication, Transcription and Translation (Prokaryotes & Eukaryotes): 1.1. Central Dogma, 1.2. Semiconservative DNA replication – mechanism, enzymes involved in DNA replication- DNA polymerase, DNA gyrase, Helicase, Ligase, primase and other accessory proteins, 1.3. Eukaryotic replication with special reference to replication licensing factor, assembly of new nucleosome, replication at the end chromosome telomere, telomerase concept, 1.4. Fidelity of DNA replication- prokaryote: nucleotide selection, proof reading, mismatch repair; eukaryote: through selection of error prone DNA polymerase, 1.5.Transcription, 1.6 RNA processing, 1.7. Aminoacylation of tRNA, 1.8. Translation.	**UR/AC/ BB**	20	
		2. Gene Regulation: 2.1 Concept of Lac-operon, 2.2. Positive and negative control.	**UR**	4	
		3. Genetic Code: 3.1Properties-evidences & exceptions, 3.2. Decipherence of codon (Binding technique	**BB**	4	
		lectures 4. Recombinant DNA Technology: 4.1. Restriction endonuclease, - types and roles, 4.2. Vector (plasmid pBR 322), 4.3. Marker gene, 4.4. Steps of cloning technique, 4.5. PCR and its application, 4.6. Genomic DNA and cDNA library.	**UR/BB**	10	
		5.Development and causes of Cancer (in general and brief), tumor suppressor gene and oncogene.	**BB**	4	
	BOT-A-CC-5-11-P)	RACTICAL- CELL BIOLOGY 1. Study of plant cell structure with the help of epidermal peal mount of Onion/Rhoeo/Crinum 2. Measurement of cell size by the technique of micrometry. 3. Counting cells per unit volume with the help of haemocytometer (Yeast/pollengrains) 4. Cytochemical staining of DNA- Pyronine-methyl green staining. 5. Estimation of DNA content through DPA staining. 6. Estimation of RNA through orcinol method. 7. Study of nucleolus through hematoxylin/ orcin staining and determination of nucleolar frequency. 8. Preparation of models/ charts: rolling circle, theta replication, semi-discontinuous replication, prokaryotic RNA polymerase and eukaryotic RNA polymerase II, assembly of spliceosome mechinary, splicing mechanism in group I and group II introns, ribozyme and alternative splicin	**BB**		
CORE COURSE-12	(BOT-A-CC-5-12-TH	THEORETICAL BIOCHEMISTRY 1. Biochemical Foundations: 1.1. Covalent and non-covalent bonds; hydrogen bond; Van der Waal's forces; 1.2. Structure and properties of water; 1.3. pH and buffer (inorganic and organic); 1.4. Handerson-Hasselbalch equation; 1.5. Isoelectric point. …….	**MB**	6 l	(Credits 4, Lectures 60)

		2. Molecules of life: 2.1. Nucleic Acids – structure of nucleosides and nucleotides ; oligo- and poly nucleotides , B & Z form of DNA, RNA- different forms; nucleotide derivatives (ATP, NADP), 2.2. Proteins – structure and classification of amino acids; primary, secondary, tertiary and quaternary structure of proteins; 2.3. Carbohydrates - structure of mono-, di- and polysaccharide; stereoisomers, enantiomers and epimers; 2.4. Lipids - structure of simple lipid and compound lipid (phospholipids and glycolipids), fatty acids- saturated and unsaturated.	**AC/UR/ MB**	4	
		3. Energy flow and enzymology: 3.1. Bioenergetics-Thermodynamic principles; free energy; energy rich bonds- phosphoryl group transfer and ATP; redox potentials and Biological redox reactions, 3.2. Enzymes – classification and nomenclature (IUBMB); Co-factors and co-enzymes; isozymes, 3.3. Mechanism of enzyme action; enzyme inhibition; 3.4. Enzyme kinetics (Michaelis- Menten equation) and simple problems.	**AC/UR**	8	
		4. Cell membrane: 4.1. Membrane chemistry, 4.2. Membrane transport (uniport, symport, antiport), mechanism of ion 28 uptake. …….6 lectures 5. Phosphorylation: ATP Synthesis- Chemiosmotic model, Oxidative and Photophosphorylation Mechanism and differences. ……lecture	**BB**	.6	
		5. Phosphorylation: ATP Synthesis- Chemiosmotic model, Oxidative and Photophosphorylation Mechanism and differenc	**UR**	6	
	BIOCHEMISTRY (BOT-A-CC-5-12-P)	PRACTICAL- 1. Detection of organic acids: citric, tartaric, oxalic and malic from laboratory samples. . Detection of carbohydrate and protein from plant samples. 3. Detection of the nature of carbohydrate – glucose, fructose , sucrose and starch from laboratory samples. 4. Detection of Ca, Mg, Fe, S from plant ash sample. Quantitative: 1. Preparation of solutions and buffers. 2. Estimation of amino-nitrogen by formol titration method (glycine) . 3. Estimation of glucose by Benedicts quantitative reagent. 4. Estimation of titratable acidity from lemon . 5. Estimation of catalase activity in plant samples and effect of substrate, enzyme concentration and pH on enzyme activity. 6. Estimation of urease activity in plant samples. 7. Colorimetric estimation of protein by Folin phenol reagent.	**UR/AC**		
	(BOT-A-DSE-A-5-1-TH) THEORETICAL	**DISCIPLINE SPECIFIC ELECTIVE COURSES** **DSE-A** **BIOSTATISTICS (Credits 4, Lectures 60)**			
		1. Biostatistics: Definition, statistical methods, basic principles, variables- measurements, functions, limitations and uses of statistics. 2. Biometry: Data, Sample, Population, Random sampling, Frequency distribution- definition only. 3. Central tendency– Arithmetic Mean, Mode and Median; Measurement of	**BB**	12 12 10	

		dispersionCoefficient of variation, Standard Deviation, Standard error of Mean. 4. Test of significance: chi- square test for goodness of fit. 5. Probability- multiplicative and additive rules of probability: application and importance. 6. Measurement of gene frequency: Hardy-Weinberg equilibrium- conditions applied for its implications (simple problems to calculate genotypic and allelic frequencies).		6 6 14	
DSE-B	PLANT BIOTECHNOLOGY (BOT-A-DSE-B-5-5-TH)	**THEORETICAL (Credits 4, Lectures 60**)			
		Plant tissue culture –Introduction			
		1.1. Basic concept and milestones, 1.2. Cellular totipotency, 1.3. Tissue culture media, 1.4. Aseptic manipulation, 1.5. Cyto-differentiation and dedifferentiation. …….10 lectures	**Nk**	10	
		2.Callus culture: 2.1. Callus induction, maintenance and application, 2.2. Suspension culture-introductory idea. …….6 lectures	**MD**	6	
		3. Plant regeneration: 3.1.Organogenesis (direct and indirect), 3.2. Somatic embryogenesis, 3.3. Significance of organogenesis and somatic embryogenesis, 3.4. Artificial seed. …….8 lectures	**AC**	8	
		4. Haploid Culture: 4.1. Anther and Pollen culture methods, 4.2. Applications. …….6 lectures	**UR**	6	
		: 5. Protoplast Culture: 5.1. Protoplast isolation and culture, 5.2. Protoplast fusion (somatic hybridization), 5.3. Significance. …….6 lectures	**MB**	6	
		6. Plant Genetic Engineering: 6.1. Brief concept of different gene transfer methods, special emphasis on Agrobacterium mediated gene transfer, Role of Reporter gene, 6.2. Achievements in crop biotechnologyenvironment and industry (suitable example)- pest resistant plants (BT cotton), herbicide resistance, disease and stress tolerance, transgenic crop with improved quality (flavr tomato, golden rice), role of transgenic in population degradation (super-bug), leaching of minerals, production of industrial enzymes, oil, edible vaccine.	**BB**	24	
CORE COURSE-13		**SEMESTER VI**			
	PLANT PHYSIOLOGY (BOT-A-CC-6-13-TH	THEORETICAL 1. Plant-water relations: 1.1 Concept of water potential, components of water potential in plant system, 1.2. Soil-plant Atmosphere continuum concept, Cavitation in xylem and embolism, 1.3. Stomatal physiology mechanism of opening and closing, Role of carbon di-	**Ac/UR**	6	

		oxide, potassium ion, abscisic acid and blue light in stomatal movement, Antitranspirants.			
		2. Mineral nutrition: essential and beneficial elements, macro- and micronutrients, methods of study and use of nutrient solutions, criteria for essentiality, mineral deficiency symptoms, roles of essential elements, chelating agents.	**AC**	6	
		3. Organic Translocation: 3.1. Phloem sap, P-protein, 3.2. Phloem loading and unloading, 3.3. Mass-flow (pressure flow) hypothesis and its critical evaluation.	**UR**	6	
		4. Plant Growth Regulators: 4.1. Physiological roles of Auxin, Gibberellin, Cytokinin, Abscisic acid, Ethylene, 4.2. Chemical nature – IAA, GA3, Kinetin, 4.3. Biosynthesis and bioassay of IAA, 4.4. Mode of action of IAA, 4.5. Brassinosteroids and Polyamines as PGRs (brief idea).	**MB/BB**	18	
		5. Photomorphogenesis: 5.1. Concept of photomorphogenesis, 5.2. Photoperiodism and plant types, 5.3. Perception of photoperiodic stimulus, 5.4. Critical day length, concept of light monitoring, 5.5. Phytochrome, cryptochrome and phototropins- chemical nature and role in photomorphogenesis, 5.6. Role of GA in flowering, 5.7. Vernalisation – role of low temperature in flowering, 5.8. Concept of biological clock and biorhythm.	**MB**	12	
		6. Seed dormancy: 6.1. Types, Causes and Methods of breaking seed dormancy, 6.2. Biochemistry of seed germination.	**MD**	6	
		7. Physiology of Senescence and Ageing	**NK**	6	
	BOT-A-CC-6-13-P) (Credits 2	PRACTICAL- PLANT PHYSIOLOGY PLANT PHYSIOLOGY 1. Determination of loss of water per stoma per hour. 2. Relationship between transpiration and evaporation. 3. Measurement of osmotic pressure of storage tissue by weighing method. 4. Measurement of osmotic pressure of Rhoeo leaf by plasmolytic method. 5. Effect of temperature on absorption of water by storage tissue and determination of Q10 . 6. Rate of imbibition of water by starchy, proteinaceous and fatty seeds and effect of seed coat. 7. To study the phenomenon of seed germination (effect of light). 8. To study the induction of amylase activity in germinating grains. 9. To study the effect of different concentrations of IAA on Avena coleopotile elongation (IAAbioassay)	**MB/AC /UR**		
CORE COURSE 14	BOT-A-CC-6-14-TH PLANT METABOLISM)	(THEORETICAL (Credits 4, Lectures 60)			
		1. Concept of metabolism: Introduction, Anabolic and catabolic metabolic pathways, regulation of metabolism, role of regulatory enzymes (allosteric, covalent modulation and isozymes) l	**BB**	4	
		2. Photosynthesis: 2.1.Chemical structure of chlorophyll a and b, absorption and action spectra, biological significance of carotenoid pigments, 2.2. Red drop and Emerson effect,	**AC**		

		Components of photosystems (light harvesting complex), photochemical reaction centres, Cyclic and noncyclic electron transport, Water splitting mechanism, 2.3. Calvin cycle – Biochemical reactions & stoichiometry, 2.4. HSK Pathway– three variants of the pathway, 2.5. Photosynthetic efficiency of C3 and C4 plants and crop 31 productivity, 2.6. Photorespiration – mechanism and significance, 2.7. Crassulacean Acid Metabolism– mechanism and ecological significance.	**UR**	16	
		3. Respiration: 3.1. EMP pathway, regulation and its anabolic role, 3.2. Conversion of Pyruvic acid to Acetyl CoA, 3.3. TCA-cycle and its amphibolic role, 3.4. Oxidative pentose phosphate pathway and its significance, 3.5. Mitochondrial electron transport system, uncouplers, 3.6. Oxidation of cytosolic NADH+H+ , 3.7. Stoichiometry of glucose oxidation (aerobic).	**UR** **AC**	12	
		4. Nitrogen Metabolism: 4.1. Assimilation of nitrate by plants, 4.2. Biochemistry of dinitrogen fixation in Rhizobium, 4.3. General principle of amino acid biosynthesis (including GS and GOGAT enzyme system).	**BB**	10	
		. 5 Lipid metabolism: 5.1. synthesis and breakdown of triglycerides, ß-oxidation, glyoxalate cycle, gluconeogenesis and its role in mobilization of the lipids during seed germinbations, α-oxidation.	**NK**	8	
		6. Mechanism of signal transduction: receptor-ligand interactions, second messenger concept, calcium-calmodilin, G protein, MAP-kinase cascade.	**AC**	10	
	PLANT METABOLISM (BOT-A-CC-6-14-P	PRACTICAL- PLANT METABOLISM 1. A basic idea of chromatography: Principle, paper chromatography and column chromatography; demonstration of column chromatography. 2. Separation of plastidial pigments by solvent and paper chromatography. 3. Estimation of total chlorophyll content from different chronologically aged leaves (young, mature and senescence) by Arnon method. 32 4. Effect of HCO3 concentration on oxygen evolution during photosynthesis in an	**AC/BB/ UR**		
DSE-A-6-3-TH)	MEDICINAL AND ETHNOBOTANY (BOT-A-DSE-A-6-3-TH)	**THEORETICAL (Credits 4, Lectures 60)** 1. **Medicinal botany**: History, scope and importance of medicinal plant, a brief idea about indigenous medicinal sciences- ayurveda, siddha and unani. Polyherbal formulations.	**NK**	14	

		2. **Pharmacognosy**- General account : 2.1 Pharmacognosy and its importance in modern medicine, 2.2 Crude drugs, 2.3 Classification of drugs- chemical and pharmacological, 2.4 Drug evaluation– organoleptic, microscopic, chemical, physical and biological, 2.5. Major pharmacological groups of plant drugs and their uses	**MD**	12	
		3. **Secondary metabolites**: 3.1 Definition of secondary metabolites and difference with primary metabolites , 3.2 Interrelationship of basic metabolic pathways with secondary metabolite biosynthesis (outlines only), 3.3 Major types–terpenoids, phenolics, flavonoids, alkaloids and their protective action against pathogenic microbes and herbivores.	**Nk**	14	
		4. **Pharmacologically active constituents:** Source plants (one example) parts used and uses of 1 Steroids (Solasodin, Diosgenin, Digitoxin), 3.2 Tannin (Catechin), 3.3 Resins (Gingerol, Curcuminoids), 3.4 Alkaloids (Quinine, Atropine. Pilocarpine, Strychnine, Reserpine, Vinblastine), 3.5. Phenols (Sennocide and Capsaicin).	**NK**	4	
		5. Ethnobotany and folk medicine: Definition, methods of study, application, Indian scenario, national interacts, Palaeo-ethnobotany, folk medicines in ethnobotany, ethnomedicine, ethnoecology, ethnic communities of India, application of natural products to certain diseases Jaudice, cardiac, infertility, diabetics, blood pressure and skin diseases.	**MD**	16	
DSE-B	Natural resource management (BOT-A-DSE-B-6-8-TH)	**THEORETICAL (Credits 4, Lectures 60)**			
		Unit 1: Natural resources Definition and types.MB		2	
		Unit 2: Sustainable utilization Concept, approaches (economic, ecological and socio-cultural).	**MD**	8	
		3: Land Utilization (agricultural, pastoral, horticultural, silvicultural); Soil degradation and management.	**MD**	8	
		4: Water Fresh water (rivers, lakes, groundwater, aquifers, watershed); Marine; Estuarine; Wetlands; Threats and management strategies.	**MB**	8	
		Unit 5: Biological Resources Biodiversity-definition and types; Significance; Threats; Management strategies; Bioprospecting; IPR; CBD; National Biodiversity Action Plan).	**BB**	12	
		Unit 6: Forests Definition, Cover and its significance (with special reference to India); Major and minor Forest products; Depletion; Management		6	
		lectures Unit 7: Energy Renewable and non-renewable sources of energy. lectures Unit 8: Contemporary practices in resource management EIA, GIS, Participatory Resource Appraisal, Ecological Footprint with emphasis on carbon footprint, Resource Accounting; Waste management.	**AC**	8	
		9: National and international efforts in resource management and conservation lectures	**MB**	4	

		SEMESTER -I GENERAL PLANT DIVERSITY I (PHYCOLOGY, MYCOLOGY, PHYTOPATHOLOGY, BRYOPHYTES AND ANATOMY) (BOT-G-CC-1-1-TH) THEORETICAL (Credits 4, Lectures 60)	**Name of teachers**	**Lectures 60**	**Cred 4**
CORE COURSE 1	**PLANT DIVERSITY I (PHYCOLOGY, MYCOLOGY, PHYTOPATHOLOGY, BRYOPHYTES AND ANATOMY) (BOT-G-CC-1-1-TH)**	THEORETICAL (Credits 4, Lectures 60)			
		2. **Phycology** 2.1. Diagnostic characters and examples of Cyanophyceae, Rhodophyceae, Chlorophyceae, Charophyceae and Phaeophyceae, 2.2 Classification: Criteria and system of Fritsch, 2.3. Life histories of Chlamydomonas, Chara and Ectocarpus, 2.4. Role of algae in the environment, agriculture, biotechnology and industry	**NK** **UR** **MB**	**14**	
		. Mycology 3.1 Diagnostic characters and examples of Oomycotina, Mastigomycotina, Zygomycotina, Ascomycotina, Basidiomycotina, Deuteromycotina (Ainsworth, 1973). 3.2 Life histories of Rhizopus and Ascobolus, 3.3. Economic importance of fungi, 3.4 Fungal symbioses: Mycorrhiza, Lichen and their importance.	**MB**		
		4. ***Phytopathology*** 4.1 Symptoms - necrotic, hypoplastic and hyperplastic, 4.2 Koch's postulates, 4.3 Biotrophs and Necrotrophs, 4.4 Disease triangle, 4.5 Pathotoxins and phytoalexins (brief BBconcept), 4.6 Symptoms, causal organism, disease cycle and control measures of plant diseases (Late blight of potato, Brown spot of Rice, Stem rot of jute).	**MB** **BB**	**12**	
		5. **Bryophytes** 5.1 Unifying features of archaegoniates and transition to land habit, 5.2 Amphibian nature of bryophytes, 5.3 Diagnostic characters and examples of Hepaticopsida, Anthocerotopsida and Bryopsida (Proskauer 1957), 5.4 Life histories of Marchantia and Funaria, 5.5 Ecological and economic importance.	**MD**	**10**	
		6. **Anatomy 6.**1 Stomata - Types (Metcalfe & Chalk), 6.2 Anatomy of root, stem and leaf of monocots and dicots, 6.3 Stelar types and evolution, 6.4 Secondary growth – normal in dicot	**Nk**	**12**	

		stem and anomaly in stem of Tecoma & Dracaena			
	PLANT DIVERSITY I (PHYCOLOGY, MYCOLOGY, PHYTOPATHOLOGY, BRYOPHYTES AND ANATOMY) (BOT-G-CC-1-1-P)	**PRACTICAL-** **(Credits 2)** 1. Work out: Microscopic preparation, drawing and labeling of Chlamydomonas, Chara, Ectocarpus, Rhizopus and Ascobolus 2. Anatomical studies (following double staining method) of: 2a. Stem- Cucurbita, sunflower and maize. 2b. Root- Colocassia, gram and orchid. 2c. Leaf- Nerium 3. Identification with reasons: 3a. Cryptogamic specimens (macroscopic/microscopic as prescribed in the theoretical syllabus. 3b. Pathological specimens (herbarium sheets) of Late blight of potato, Brown spot of rice and stem rot of jute. 4. Laboratory records: Laboratory note books (regularly signed) and slides (prepared in class) are to be submitted at the time of Practical Examination. Regular attendance in the class must be credited.	**UR/AC** **NK** **BB** **MD**		
SCORE COURSE 2	**PLANT DIVERSITY II (PTERIDOPHYTES, GYMNOSPERMS, PALAEOBOTANY, MORPHOLOGY AND II TAXONOMY) (BOT-G-CC-2-2-TH)**	**SEMESTER –II** THEORETICAL (Credits 4, Lectures 60)			
		1. Pteridophytes 1.1 Diagnostic characters and examples of Psilophyta, Lycophyta, Sphenophyta & Filicophyta (Gifford & Foster 1989). 1.2 Life histories of Selaginella and Pteris, 1.3 Economic importance. …….12 lectures	**BB**	**12**	
		2. Gymnosperms 2.1 Progymnosperms (brief idea), 2.2 Diagnostic characters and examples of Cycadophyta, Coniferophyta and Gnetophyta (Gifford & Foster 1989), 2.3 Life histories of Cycas and Pinus, 2.4 Williamsonia (reconstructed), 2.5 Economic importance of Gymnosperms. …….12 lectures	**NK**	**12**	
		3. Paleobotany & Palynology 3.1 Fossil, fossilization process and factors of fossilization, 3.2 Importance of fossil study 3.3 Geological time scale, 3.4 Palynology - Definition, spore & pollen (brief idea), Applications. …….10 lectures	**UR** **AC** **NK**	**10**	
		4. Angiosperm Morphology 4.1 Inflorescence types with examples, 4.2 Flower, 4.3 Fruits and seeds- type and examples. …….12 lectures	**MB**	**12**	

		5. Taxonomy of Angiosperms 5.1 Artificial, Natural and Phylogenetic systems of c1assificaiton with one example each, 5.2 Diagnostic features of following families- Malvaceae, Leguminosae (Fabaceae), Cucurbitaceae, 6 Rubiaceae, Compositae (Asteraceae), Solanaceae, Acanthaceae, Labiatae (Lamiaceae), Orchidaceae, Gramineae (Poaceae). …….14 lectures	**MD**	**14**	
	PLANT DIVERSITY II (PTERIDOPHYTES, GYMNOSPERMS, PALAEOBOTANY, MORPHOLOGY AND TAXONOMY) (BOT-G-CC-2-2-P	PRACTICAL-) (Credits 2)			
		1. Dissection, drawing and labelling, description of angiospermic plants and floral parts, floral formula and floral diagram, identification (family) from the following families: Leguminosae (Fabaceae), Malvaceae, Solanaceae, Labiatea (Lamiaceae), Acanthaceae. 2. Identification with reasons: Macroscopic specimens of Selaginella and Pteris, male and female strobilus of Cycas and Pinus, Anatomical slides (stellar types, transfusion tissue, sieve tube, sunken stomata, lenticels), inflorescence types. 3. Spot identification of the following Angiospermic plants (scientific names and families): Sida rhombifolia (Malvaceae), Abutilon indicum (Malvaceae), Cassia sophera (Fabaceae), Tephrosia halimtonii (Fabaceae), Crotolaria palida (Fabaceae), Coccinia grandis (Cucurbitaceae), Solanum indicum (Solanaceae), Nicotiana plumbagenifolia (Solanaceae), Leucas aspera (Lamiaceae), Leonurus sibiricus (Lamiaceae), Parthenium hysterophorus (Asteraceae), Tridax procumbense (Asteraceae), Eclipta prostrate (Asteraceae), Eragrostis tenella (Poaceae), Chrysopogon aciculantus (Poaceae), Eleusine indica (Poaceae), Vanda taesellata (Orchidaceae). 4. Laboratory records: Laboratory note books (regularly signed) and slides (prepared in class) are to e submitted at the time of Practical Examination. Regular attendance in the class must be credited.	**MD/NK**		
CORE COURSE 3	**CELL BIOLOGY, GENETICS AND MICROBIOLOGY (BOT-G-CC-3-3-TH) THEORETICAL**	**SEMESTER III** **(Credits 4, Lectures 60**)			
		Cell Biology & Genetics 1.1 Ultrastructure of nuclear envelope, nucleolus and their functions, 1.2 Molecular organisation of metaphase chromosome (Nucleosome concept).	**MD**	**7**	

		2. Chromosomal aberrations- 2.1 deletion, duplication, inversion & translocation, 2.2 Aneuploidy & Polyploidy-types, importance and role in evolution.	**AC** **MB**	**6**	
		3. Central Dogma, 3.1 Transcription and Translation.	**UR**	**10**	
		4. Genetic Code- properties.	**NK**	**4**	
		5. Linkage group and Genetic map (three-point test cross).	**BB**	**6**	
		6. Mutation – 6.1 Point mutation (tautomerisation; transition, transversion and frame shift), 6.2 Mutagen-physical and chemical.	**BB**	**8**	
		7. Brief concept of Split gene, Transposons.		**4**	
		. Microbes 2.1 Viruses- Discovery, general structure, replication (general account), DNA virus (T-phage); Lytic and lysogenic cycle, RNA virus (TMV); Economic importance; 2.2 Bacteria- discovery, general characteristics and cell structure; reproduction- vegetative, asexual and recombination (conjugation, transformation and transduction); Economic importance. lectures	**Mb** **BB**	**16**	
		RACTICAL- CELL BIOLOGY, GENETICS AND MICROBIOLOGY (BOT-G-CC-3-3-P) (Credits 2			
		1 Cell Biology: Staining (Aceto-orcein) and squash preparation of onion root tip: study of mitotic stages. Determination of mitotic index (from onion root tip). 2. Microbiology: Workout gram staining (curd/any natural source) 3. Identification with reasons: Cytological slides of different mitotic and meiotic stages. Different forms of bacteria (Coccus, Bacillus, Spiral)	**BB**		
CORE COURSE 4	**PLANT PHYSIOLOGY AND METABOLISM (BOT-G-CC-4-4-TH) THEORETICAL**	**SEMESTER IV** (Credits 4, Lectures 60) 7			
		1. Proteins 1.1 Primary, secondary and tertiary structure, 1.2 Nucleic acid- DNA structure, RNA types, 1.3 Enzyme- Classifications with examples (IUBMB), Mechanism of action.	**UR**	**8**	
		2. Transport in plants 2.1 Ascent of sap and Xylem cavitation , 2.2 Phloem transport and source-sink relation.	**AC**	**4**	
		3. Transpiration 3.1 Mechanism of stomatal movement, significance.	**Ac**	**4**	

		4. Photosynthesis 4.1 Pigments, Action spectra and Enhancement effect, 4.2 Electron transport system and Photophosphorylation, 4.3 C3 and C4 photosynthesis, CAM- Reaction and Significance.	**Nk**	**12**	
		5. Respiration 5.1 Glycolysis & Krebs cycle— Reactions and Significance, 5.2 ETS and oxidative phosphorylation.	**Ur** **AC**	**8**	
		6. Nitrogen metabolism 6.1 Biological dinitrogen fixation, 6.2 Amino acid synthesis (reductive amination and transamination).	**BB**	**6**	
		. Plant Growth regulators 7.1 Physiological roles of Auxin, Gibberellin, Cytokinin, Ethylene, ABA.	**MB**	**10**	
		8. Photoperiodism (Plant types, Role of phytochrome and GA in flowering) and Vernalization.	**MB**	**6**	
		9. Senescence (brief idea).	**MD**	**2**	
	PLANT PHYSIOLOGY AND METABOLISM (BOT-G-CC-4-4-P)	**PRACTICAL- (Credits** 2) Plant Physiology: i) Experiment on Plasmolysis. ii) Measurement of leaf area (graphical method) and determination of transpiration rate per unit 9 area by weighing method. iii) Imbibition of water by dry seeds - proteinaceous and fatty seeds . iv) Evolution of O2 during photosynthesis (using graduated tube). v) Evolution of CO2 during aerobic respiration and measurement of volume.	**AC/UR/ MB**		

	A PLANT BREEDING AND BIOMETRY (BOT-G-SEC-A-3/5-	**5th SEM GEN** **SEC –A** **PLANT BREEDING AND BIOMETRY (BOT-G-SEC-A-3/5-1) (Credits 2, Lectures30)**			
		1. Plant breeding: 1.1 Introduction and objective, 1.2 Techniques of hybridisation	**MB**	**8**	
		. 2 Mass and Pure line selection: 2.1 Procedure, 2.2 Advantages and limitations	**NK**	**2**	
		.. . 3Heterosis and hybrid seed production	**AC**	**8**	
		4. Role of mutation, polyploidy, distant hybridization and role of biotechnology in crop improvement.	**UR**	**4**	
		5. Biometry: 5.1 Measures of central tendency (Mean, Median and Mode), 5.2 Standard error and standard deviation, 5.3 Test of significance: Chi-square test for goodness of fit.	**BB**	**8**	
	PHYTOCHEMISTRY AND MEDICINAL BOTANY (BOT-G-DSE-A-5-1-TH)	**5th SEM GEN** **DSE A Group A** **THEORETICAL Credit** 4			
		, 1. Medicinal botany- History, scope and importance of medicinal plants, a broef idea about indigenous medicinal sciences- Ayurbeda, Siddha and Unani. Polyherbal formulations	**NK**	**14**	
		2. Phramacognosy- 2.1 Scope and its importance, 2.2 Primary metabolites, 2.3 Secondary metabolites- alkaloids, terpenoids, phenolics and their functions.	**MB**	**10**	
		.3 Organoleptic evaluation of crude drugs.	**MD**	**10**	
		.4 Pharmcologically active constituents: Source plants (one example), parts used and uses of: 4.1 Steroids (Diosgenin, Digitoxin), 4.2 Tannin (Catechin), 4.3 Resins (Gingerol, Curcumnoids), 4.4 Alkaloids (Strychnine, Reserpine, Vinblastine), 4.5 Phenols (Capsaicin).	**NK**	**6**	
		5. Ethnobotany and folk medicine: 5.1 Brief idea, 5.2 Applications of ethnobotany, 5.3 Application of natural product to certain diseases- Jaundice, Cardiac and Diabetics.	**MD**	**20**	
	PHYTOCHEMISTRY AND MEDICINAL BOTANY (BOT-G-DSE-A-5-1-P)	**PRACTICAL- (Credit 2)** 1. Preparations of solution and buffers 2. Acquaintance with laboratory instruments- Autoclave, Incubator, Clinical centrifuge, Analytical balance, pH meter, Colorimeter, Water bath, Distillation plant, Laminar air flow . 3. Qualitative test for proteins and carbohydrates, reducing and non reducing sugar (glucose, fructose and sucrose) 4. Tests (chemical) for tannin and alkaloid 5. Identification of medicinal plants (list to be provided) medicinal plants. Records to be	**MD/NK**		

		substantiated with photographs and description			
	MUSHROOM CULTURE TECHNOLOGY (BOT-G-SEC-D-4/6-4) (	**6th SEM GEN** **SEC B** **Credits 2** , 1. Mushroom- nutritional and medicinal value of mushrooms. Poisonous mushrooms. 2. Cultivation techniques/ technology of edible mushrooms in India: Volvarealla volvacea, Pleuretus citrinopyrineatus, Agaricus bisporus. 3. Storage- short term and long term, storage, drying. 4. Food preparation- types of foods prepared from mushroom. Cost and benefit ratio. 5. Research centres- national and regional.	**AC& MB**	**4** **12** **6** **6** **2**	
	ECONOMIC BOTANY (BOT-G-DSE-B-6-3-TH	**6th SEM GEN** DSE B THEORETICAL (Credits 4, Lectures 60) 2 3 4			
		1. Origin of cultivated plants: 1.1 Concepts of centres of origin and their importance with reference to Vavilov's work.	**NK**	**12**	
		2. Rice- origin, morphology and uses.	**NK**	**12**	
		.3 Legumes: General account with special reference to Vigna.	**MD**	**8**	
		.4 Beverages: Tea- morphology, processing and uses.	**MD**	**8**	
		5. Study of the following economically important plants (Scientific names, families, parts used and importance): 5.1 Cereals- Rice, wheat, 5.2 Pulses- Mong, gram, 5.3 Spices Ginger, cumin, 5.4 Beverages- Tea, coffee, 5.5 Medicinal plants- Cinchona, neem, Ipecac, Vasaka, 5.6 Oil yielding plants- Mustard, groundnut, coconut, 5.7 Vegetables- Potato, raddish, bottle groud, cabbage, 5.8 Fibre yielding plants- Cotton, jute, 5.9 Timber yielding plants- Teak, Sal 5.10 Fruits- Mango, apple, 5.11 Sugar yielding plant- Sugarcane.	**AC**	**16**	

	- ECONOMIC BOTANY (BOT-G-DSE-B-6-3-P) (	**PRACTICAL** **Credits 2)** 1. Study of economically important plants (rice/jute/ tea) through herbarium specimens and field study. 2. Study of cultivation practices in field and submission of report. 3. Study of local economically important plants and submission of report with photographs.	**NK&MD**	**MARKS 70**	
3rd Year		**3rd Year(General)** **PART III Full Marks-100 (Theoretical-70 & Practical-30) (Theoretical) Marks-70** Biofertilizer: 1.1 Sources 1.2 Production, 1.3 Application .	**NK**		
		. 2. Mushroom: 2.1 Food value, 2.2 Cultivation technique of Pleurotus	**NK**		
		3. Plant disease control: 3.1 Quarantine, 3.2 Biological control, 3.3 Chemical Control	**NB**		
		. 4. Plant Breeding: 4.1 Mass and Pure line selection, 4.2 Heterosis and hybrid seed production. 29	**BB**		
		5. Biometry: 5.1 Measures of Central Tendency (Mean, Mode and Median), 5.2 Goodness of fit (Chi- square test). 6. Plant tissue culture: 6.1 Callus culture and plant regeneration, 6.2 Micropropagation, 6.3 Somatic embryogenesis and Artificial seed, 6.4 Protoplast culture and applications	**BB**		
		7. Recombinant DNA Technology: 7.1 Recombinant DNA, restriction enzymes, plasmids as vector, 7.2 Gene cloning (basic steps), 7.3 Transgenic plants	**NK**		
		8. Pharmacognosy: 8.1 Scope and importance, 8.2 Secondary metabolites- alkaloids, terpenoids, phenolics and their functions, 8.3 Organoleptic evaluation of crude drugs	**NK**		
	(Practical)	. **Paper-IVB** 1 Acquaintance with laboratory instruments - Autoclave, Incubator, Clinical centrifuge, Analytical balance, pH Meter, Colorimeter, Water bath, Distillation plant. 2. Sterilization technique by autoclaving. 3. Preparation of PDA medium (slants, pouring of plates). 4. Bacteria staining by simple staining method (methylene blue/crystal violet) from curd. 5. Acquaintance with common medicinal plants and their useful parts : Terminalia arjuna, Centella asiatica, Saraca asoca, Adhatoda vasica, Andrographis paniculata, Asteracantha longifolia, Eclipta alba, Aloe barbadensis, Rauvolfia serpentina, Vitex negundo, Herpestis monieria, Holarrhena antidysenterica, Boerhaavia repens. 6. Determination of Goodness of fit of normal monohybrid ratios (3: I and I: 1) by Chi-square analysis	**NK/BB**		

		3rd Year (HONS) **PART III: THEORETICAL -200 and PRACTICAL – 200)**			
		(**THEORETICAL)** **BIOCHEMISTRY 1**. Biochemical Foundations : 1.1. Covalent and non-covalent bonds ; hydrogen bond ; Van der Waal's forces ; 1.2. Structure and properties of water ; 1.3. pH and buffer (inorganic and organic); 1.4. Handerson-Hasselbalch equation; 1.5. Isoelectric point. 2. Molecules of life : 2.1. Nucleic Acids – structure of nucleosides and nucleotides ; oligo- and poly nucleotides , B & Z form of DNA, RNA- different forms; nucleotide derivatives (ATP, NADP), 2.2. Proteins – structure and classification of amino acids; primary, secondary, tertiary and quaternary structure of proteins; 2.3. Carbohydrates - structure of mono-, di- and polysaccharide; stereoisomers, enantiomers and epimers; 2.4. Lipids - structure of simple lipid and compound lipid (phospholipids and glycolipids), fatty acids- saturated and unsaturated. 3. Energy flow and enzymology : 3.1. Bioenergetics-Thermodynamic principles; free energy; energy rich bonds- phosphoryl group transfer and ATP; redox potentials and Biological redox reactions, 3.2. Enzymes – classification and nomenclature (IUBMB); Co-factors and co-enzymes; isozymes, 3.3. Mechanism of enzyme action; enzyme inhibition; 3.4. Enzyme kinetics (MichaelisMenten equation) and simple problems. 4. Cell membrane and Biosignalling : 4.1. Membrane chemistry, 4.2. Membrane transport (uniport, symport, antiport), mechanism of ion uptake 4.3. Signal transduction pathway and second messenger concept - G-protein and Ca2+ as messenger. 5. Phosphorylation : ATP Synthesis- Chemiosmotic model, Oxidative and Photophosphorylation- Mechanism and differences.	**AC**	**35**	**28**
		PHARMACOGNOSY 1. General account : 1.1 Pharmacognosy and its importance in modern medicine , 1.2 Crude drugs, 1.3 Classification of drugs- chemical and pharmacological , 1.4 Drug evaluation – organoleptic , microscopic, chemical, physical and biological. 2. Secondary metabolites : 2.1 Definition of secondary metabolites and difference with primary metabolites , 2.2 Interrelationship of basic metabolic pathways with secondary metabolite biosynthesis (outlines only), 2.3 Major types–terpenoids, phenolics, flavonoids, alkaloids and their protective action against pathogenic microbes and herbivores. 3. Pharmacologically active constituents : Source plants (one example) parts used and uses of : 3.1 Steroids (Diosgenin, Digitoxin), 3.2 Tannin (Catechin), 3.3 Resins (Gingerol, Curcuminoids), 3.4 Alkaloids (Quinine, Strychnine, Reserpine, Vinblastine).	**MD**	**15**	**12**
		PLANT PHYSIOLOGY 50 Marks (40 Periods) 1. Plant-water relations: 1.1 Concept of water potential , components of water potential in plant system , 1.2 Soil-plant-Atmosphere continuum concept, Cavitation in xylem and embolism, 1.3 Stomatal physiology-mechanism of	**IB**	**50**	**40**

		opening and closing, Role of carbon di-oxide, potassium ion, abscisic acid and blue light in stomatal movement, Antitranspirants. 2. Organic Translocation : 2.1 Phloem sap, P-protein, 2.2 Phloem loading and unloading, 2.3 Mass-flow (pressure flow) hypothesis and its critical evaluation. 3. Photosynthesis : 3.1 Chemical structure of chlorophyll a and b , absorption and action spectra, biological significance of carotenoid pigments, 3.2 Red drop and Emerson effect, Components of photosystems (light harvesting complex), Photochemical 13 reaction centres, Cyclic and noncyclic electron transport, Water splitting mechanism, 3.3 Calvin cycle – Biochemical reactions & stoichiometry, 3.4 HSK Pathway– three variants of the pathway, 3.5. Photosynthetic efficiency of C3 and C4 plants and crop productivity, 3.6. Photorespiration – mechanism and significance, 3.7 Crassulacean acid metabolism – mechanism and ecological significance. 4. Respiration : 4.1 EMP pathway, regulation and its anabolic role , 4.2 Conversion of Pyruvic acid to Acetyl CoA, 4.3 TCA-cycle and its amphibolic role ,4.4. Oxidative pentose phosphate pathway and its significance, 4.5 ß-oxidation of fatty acids and significance, 4.6 Mitochondrial electron transport system, uncouplers, 4.7 Oxidation of cytosolic NADH+H+ 4.8 Stoichiometry of glucose oxidation (aerobic). 5. Nitrogen Metabolism : 5.1 Assimilation of nitrate by plants, 5.2 Biochemistry of dinitrogen fixation in Rhizobium, 5.3. General principle of amino acid biosynthesis (including GS and GOGAT enzyme system). 6. Plant Growth Regulators : 6.1. Physiological roles of Auxin, Gibberellin, Cytokinin, Abscisic acid, Ethylene, 6.2 Chemical nature –IAA, GA3, Kinetin, 6.3. Biosynthesis and bioassay of IAA, 6.4 Mode of action of IAA, 6.5 Brassinosteroids and Polyamines as PGRs (brief idea). 7. Photomorphogenesis : 7.1 Concept of photomorphogenesis, 7.2 Photoperiodism and plant types, 7.3 Perception of photoperiodic stimulus, 7.4 Critical day length, concept of light monitoring, 7.5 Phytochrome – chemical nature, interconversion, function in flowering, 7.6 Role of GA in flowering, 7.7 Vernalisation – role of low temperature in flowering, 7.8 Concept of biological clock and biorhythm . 8. Seed dormancy : 8.1 Types; Causes and Methods of breaking seed dormancy, 8.2 Biochemistry of seed germination. 9. Physiology of Senescence and Ageing. 10. Stress Physiology: Plant responses to: 9.1 Water stress, 9.2 Temperature stress, 9.3 Salt stress			
PAPER VI (THEORETICAL)		**CELL BIOLOGY** 1. Origin and Evolution of Cells : 1.1. Concept of RNA world, Ribozymes, First cell, 1.2. Origin of eukaryotic cell, 1.3. Organellar DNA (cp-and mt- DNA). 2. Nucleus and Chromosome : 2.1. Nuclear envelope, Nuclear lamina and Nuclear pore complex, 3.2. Nucleolus-ultrastructure and ribosome biogenesis, 3.3. Chromatin ultrastructure and DNA packaging in eukaryotic chromosome, 3.4. Karyotype concept and its parameters. 3. Cell cycle and its regulation : 3.1. Centromere, kinetochore, spindle apparatus & telomere–structural organization and functions, 3.2. Dynamics of chromosome movement in anaphase, 3.3. Mechanism of cell cycle control in Yeast (checkpoints and role of MPF), Apoptosis (Brief idea).	BB	20	16

		PLANT BREEDING & BIOMETRY 1. Plant Breeding: 14 1.1 Maintenance of germplasm, 1.2 Mass selection and Pure line selection, 1.3 Back cross method,1.4. Heterosis and hybrid seed production, 1.5. Male sterility and its use in plant breeding, 1.6 Molecular Breeding (use of DNA markers in plant breeding). 2. Biometry: 2.1 Random sampling, Feqeuency distribution, 2.2. Central tendency– Arithmetic Mean, Mode and Median, 2.3.Measurement of dispersion – Standard Deviation, Standard error of Mean, 2.4. Test of significance: 't'- test; chi- square test for goodness of fit, 2.5 Probability (Addition and Multiplication rules),2.6 Measurement of gene frequency (Hardy-Weinberg equilibrium). **PLANT BIOTECHNOLOGY** 1. Plant tissue culture –Introduction: 1.1. Cellular totipotency, 1.2. Tissue culture media, 1.3. Aseptic manipulation. 2. Callus culture : 2.1. Callus initiation, growth and maintenance, 2.2. Applications. 3. Micropropagation : 3.1. Organogenesis (direct and indirect), 3.2. Somatic embryogenesis, Artificial seed, 3.3. Significance. 4. Haploid Culture : 4.1. Anther and Pollen culture methods, 4.2. Significance . 5. Protoplast Culture : 5.1. Protoplast isolation and culture, 5.2. Protoplast fusion (somatic hybridization), 5.3. Significance. 6. Plant Genetic Engineering : 6.1. Brief concept of different gene transfer methods, special emphasis on Agrobacterium mediated gene transfer, Role of Reporter gene, 6.2. Achievements in crop biotechnology (suitable examples of transgenic plants). **GENETICS & MOLECULAR BIOLOGY** 1. Linkage, Crossing over and Gene Mapping : 1.1. Complete and incomplete linkage, linkage group, 1.2 Detection of crossing over (McClintock's experiment), 1.3 Molecular mechanism of crossing over (Holliday model), 1.4 Gene mapping (three point test cross), 1.5 Co-efficient of coincidence and interference, Mapping function, 1.6 Problems on gene mapping, 1.7 Molecular mapping – ISH, FISH (brief idea). 2. Epistasis and Polygenic inheritance in plants. 3. Aneuploidy and Polyploidy: Types, examples, meiotic behaviour and importance of: 3.1 Aneuploidy, 3.2 Polyploidy. 4. Chromosomal aberration: Types and meiotic behaviour of: 4.1 Deletion, 4.2 Duplication, 4.3 Translocation, 4.4 Inversion. 5. Mutation : 5.1 Point mutation-Transition, Transversion and Frame shift mutation, 5.2 Molecular mechanism (tautomerisation, alkylation, deamination, base analogue incorporation, dimerisation), 5.3 DNA repair (brief idea). 6. Structural organisation of Gene : 6.1 One Gene–one polypeptide concept, 6.2 Complementation test (rII locus), 6.3 Split gene, 6.4 Overlapping gene, 6.5 Repetitive DNA-tandem and interspersed, 6.6 Transposon (Ac-Ds system), 6.7 Homoeotic gene in plants (ABC model in Arabidopsis). 7. DNA Replication, Transcription and Translation (Prokaryotes & Eukaryotes): 7.1 Central Dogma, 7.2 Semiconservative replication – mechanism, 7.3 Transcription, 7.4 RNA processing, 7.5 Aminoacylation of tRNA, 7.6 Translation. 8. Gene Regulation : 8.1 Concept of Lac-operon, 8.2 Positive and negative control. 9. Genetic Code : 9.1 Properties-evidences & exceptions, 9.2	NK BB	15 50	12 40

		Decipherence of codon (Binding technique) . 10. Recombinant DNA Technology: 10.1 Enzyme (Restriction endonuclease, ligase), 10.2 Vector (plasmid pBR 322) 10.3 Marker gene, 10.4. Steps of cloning technique, 10.5 PCR and its application 10.6 Genomic DNA and cDNA library. 11. Bioinformatics : Brief concept on 11.1 Genomics, 11.2 Proteomics			
	PAPER VII	(**PR) PLANT BIOCHEMISTRY** Qualitative : 1. Detection of organic acids: citric , tartaric, oxalic and malic from laboratory samples. 2. Detection of carbohydrate and protein from plant samples. 3. Detection of the nature of carbohydrate – glucose, fructose , sucrose and starch from laboratory samples. 4. Detection of Ca, Mg, Fe, S from plant ash sample. Quantitative : 1.Estimation of amino-nitrogen by formol titration method (glycine) . 2. Estimation of glucose by Benedicts quantitative reagent. 3. Estimation of titratable acidity from lemon. 4. Estimation of catalase activity in plant samples. 5. Estimation of urease activity in plant samples. 6. Colorimetric estimation of protein by Folin phenol reagent. **PLANT PHYSIOLOGY** 1. Determination of loss of water per stoma per hour. 2. Relationship between transpiration and evaporation. 3. Rate of photosynthesis under varying HCO3 concentration in an aquatic plant using bicarbonate and to find out the optimum and toxic concentration . 4. Separation of plastidial pigments. 5. Measurement of oxygen uptake by respiring tissue (per g/hr.) 6. Determination of the RQ of germinating seeds. 7. Measurement of osmotic pressure of storage tissue by weighing method. 8. Measurement of osmotic pressure of Rhoeo leaf by plasmolytic method. 9. Effect of temperature on absorption of water by storage tissue and determination of Q10. 10. Comparison of imbibitions of water by starchy, proteinaceous and fatty seeds. **ANATOMY** 1. Microscopic studies on: Types of stomata, sclereids, raphides (Colocasia), cystolith (Ficus leaf) starch grains, aleurone grains, laticiferous ducts, oil glands. 2. Study of anomalous secondary structure in stem of Bignonia, Boerhaavia, Tecoma, Dracaena and root of Tinospora 3. Study of adaptive anatomical features : Hydrophytes (Nymphaea – petiole) and Xerophytes (Nerium – leaf). **PHARMACOGNOSY** 1. Chemical tests for (a) Tannin (Camellia sinensis / Terminalia chebula), (b) Alkaloid (Catharanthus roseus) . 2. Powder microscopy – Zingiber and Holarrhena . 3. Histochemical tests of (a) Curcumin (Curcuma longa) , (b) Starch in non-lignified vessel (Zingiber), (c) Alkaloid (stem of Catharanthus and bark of Holarrhena).	AC IB NK		

			MD		
	PAPER VIII	**(PRACTICAL) : 100 MARKS**			
		CELL BIOLOGY AND GENETICS 1. Introduction to chromosome preparation: Pre-treatment, Fixation, Staining, Squash and Smear preparation, Preparation of permanent slides. 2. Determination of mitotic index and frequency of different mitotic stages in pre-fixed root tips of Allium cepa. 3. Study of mitotic chromosome : Metaphase chromosome preparation , free hand drawing under high power objective, drawing with drawing prism under oil immersion lens, determination of 2n number, comment on chromosome morphology of the following specimens from root tips: Allium cepa , Aloe vera , Lens esculenta. 4. Study of meiotic chromosome: Smear preparation of meiotic cells, identification of different stages and free hand drawing of the following specimens from flower buds: Allium cepa and Setcreasea sp. 5.Identification from permanent slides : Meiosis – (i) normal stages (ii) abnormal stages – laggard, anaphase bridge, ring chromosome (Rhoeo discolor); Mitosis –(i) normal stages, (ii) abnormal stages- early separation, late separation, multipolarity , sticky bridge, fragmentation, (ii) pollen mitosis. **BIOMETRY** 1. Determination of goodness of fit in normal and modified mono-and dihybrid ratios (3:1, 1:1, 9:7, 13:3, 15:1, 9:3:3:1, 1:1:1:1) by Chi-square analysis and comment on the nature of inheritance . 2. Univeriate analysis of statistical data : Statistical tables , mean , mode , median , standard deviation and standard error (using seedling population / leaflet size). MICROBIOLOGY 1. Preparation of bacterial media – (a) Nutrient agar and nutrient broth, (b) Preparation of slants and pouring Petriplates. 2. Sub-culturing of bacterial culture. 3. Gram staining from bacterial culture. 4. Microscopic examination of bacteria from natural habitat(curd) by simple staining. **PLANT PATHOLOGY** 1. Preparation of fungal media (PDA). 2. Sterilization process. 3. Isolation	BB		

		of pathogen from diseased leaf. 4. Inoculation of fruit and subculturing. 5.Identification : Pathological specimens of Brown spot of rice, Bacterial blight of rice ,Loose smut of wheat, Stem rot of jute, Late blight of potato; Slides of uredial, telial, pycnial & aecial stages of Puccinia graminis.	SR		