DEPARTMENT OF BOTANY

TEACHING PLAN FOR HONOURS COURSE (UNDER CBCS SYSTEM)

Academic Session 2018-2019

SEMESTER I- Honours

CORE COURSE 1 (THEORITICAL)

PHYCOLOGY AND MICROBIOLOGY (BOT-A-CC-1-1-TH)

TOPIC	SUB-TOPIC	TEACHER	TEACHING METHOD	CLASS HOUR
PHYCOLOGY	General account: Thallus organization, Structure of algal cell, Ultrastructure of Plastids and Flagella, Origin and evolution of sex, Life cycle patterns, Significant contributions of important phycologists (Fritsch, Smith, R. N. Singh, T.V. Desikachary, H.D. Kumar, M.O.P. Iyengar)	RP	Class lecture, power point presentation, interactive discussion	3 hr
	Classification: Criteria and basis of Fritsch's classification, Classification by Lee (2008) upto phylum with examples, Salient features of Cyanobacteria, Rhodophyta, Chlorophyta ,	RP	Class lecture, power point presentation,	3 hr

	Charophyta, Bacillariophyta, Xanthophyta, Phaeophyta, Heterokantophyta.		interactive discussion	
	Cyanobacteria: Ultrastructure of cell, Heterocyst - structure and function, Ecology	RP	Class lecture, power point presentation, interactive discussion	2 hr
	Bacillariophyta: Cell structure, Cell division, Auxospore formation in Centrales and Pennales	RP	Class lecture, power point presentation, interactive discussion	3 hr
	Life History: *Chlamydomonas, Oedogonium, Chara, Ectocarpus, Polysiphonia*, Evolutionary significance of Prochloron	RP	Class lecture, power point presentation, interactive discussion	10 hr
MICROBIOLOGY	Virus: Discovery, Plant virus- types, Transmission and translocation of Plant virus, TMV- Physicochemical characteristics and Multiplication, One step growth curve, Lytic cycle (T4 phage) and	MM	Class lecture, power point presentation,	3 hr

	Lysogenic cycle (Lambda phage), Significance of lysogeny, Viroids and Prions		interactive discussion	
	Bacteria: Discovery, Distinguishing features of Archaea and Bacteria, Characteristics of some major groups: Proteobacteria (Enterobacteria), Firmicutes, Mollicutes, Actinobacteria, Spirochaetes, Chlamydiae, Bacterial growth curve and generation time, Flagella (ultrastructure) & Pilli, Cell wall – chemical structure and differences between Gram +ve & Gram – ve bacteria, Bacterial genome and plasmid, Endospore - formation, structure and function, 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	MM	Class lecture, power point presentation, interactive discussion	6 hr

CORE COURSE 1 (PRACTICAL)

PHYCOLOGY AND MICROBIOLOGY (BOT-A-CC-1-1-P)

TOPIC	SUBTOPIC	TEACHER	TEACHING METHOD	CLASS HOUR
ALGAE	Work out: (Free hand drawing and drawing under drawing prism with magnification): Oedogonium, Chara, Ectocarpus	RP	Demonstration, interaction, work out	6 hr
	Study of Permanent slides: *Gloeotrichia, Volvox, Vaucheria, Coleochaete, Polysiphonia*, Centric and Pennate diatom	RP	Demonstration	2 hr
	Study of Macroscopic specimens: *Laminaria, Sargassum*	RP	Demonstration	1 hr
MICROBIOLOGY	Preparation of bacterial media: Nutrient agar and nutrient broth, Preparation of slants and pouring Petri-plates	MM	Demonstration	3 hr
	Sub-culturing of bacterial culture	MM	Demonstration, experimental work	2 hr
	Gram staining from bacterial culture	MM	Demonstration, experimental work	3 hr

	Microscopic examination of bacteria from natural habitat (curd) by simple staining	MM	Demonstration, experimental work	3 hr
	Field work: for study and collection of algae (from natural habitat) conducted to give an introductory idea about plant diversity	MM, RP	Field visit	4 hr

CORE COURSE 2 (Theory)

MYCOLOGY AND PHYTO-PATHOLOGY (BOT-A-CC-1-2-TH)

TOPIC	SUB-TOPIC	TEACHER	TEACHING METHOD	CLASS HOUR
MYCOLOGY	General Account: Hyphal forms, Fungal spore forms and mode of liberation, Sexual reproduction and degeneration of sex, Parasexuality and sexual compatibility, Life cycle patterns	RP	Class lecture, power point presentation, interactive discussion	4 hr
	Classification: Classification of Fungi (Ainsworth, 1973) upto sub-division with diagnostic characters and examples. General characteristics of Myxomycota, Oomycota, Zygomycota, Ascomycota, Basidiomycota, Deuteromycota	RP	Class lecture, power point presentation, interactive discussion	2 hr

	Life history: Synchytrium, Rhizopus, Ascobolus, Agaricus	RP	Class lecture, power point presentation, interactive discussion	6 hr
	Mycorrhiza: Types with salient features, Role in Agriculture & Forestry	RP	Class lecture, power point presentation, interactive discussion	2 hr
	Lichen: Types, Reproduction, Economic and ecological importance	RP	Class lecture, power point presentation, interactive discussion	2 hr
PHYTO-PATHOLOGY	Terms and Definitions: Disease concept, Symptoms, Etiology & causal complex, Primary and secondary inocula, Infection, Pathogenecity and pathogenesis, Necrotroph and Biotroph, Koch's Postulates, Endemic, Epidemic, Pandemic and Sporadic disease,	DS	Class lecture, power point presentation, interactive discussion	2 hr

	Disease triangle, Disease cycle (monocyclic, polycyclic and polyetic)			
	Host – Parasite Interaction: Mechanism of infection (Brief idea about Pre-penetration, Penetration and Post-penetration), Pathotoxin (Definition,criteria and example), Defense mechanism with special reference to Phytoalexin, Resistance- Systemic acquired and Induced systemic.	DS	Class lecture, power point presentation, interactive discussion	4 hr
	Plant Disease Management: Quarantine, Chemical, Biological, Integrated	DS	Class lecture, power point presentation, interactive discussion	3 hr
	Symptoms, Causal organism, Disease cycle and Control measures: Late blight of Potato, Brown spot of rice, Black stem rust of wheat, Stem rot of jute.	DS	Class lecture, power point presentation, interactive discussion	6 hr

CORE COURSE 2 (PRACTICAL)

TOPIC	SUB-TOPIC	TEACHER	TEACHING METHOD	CLASS HOUR
MYCOLOGY	Work out: microscopic measurement of Reproductive structures): *Rhizopus* (asexual), *Ascobolus*, *Agaricus*	RP	Demonstration, work out	4 hr
	Study from permanent slides: Zygospore of Rhizopus, Conidia of Fusarium, Conidiophore of Penicillium	RP	Demonstration	1 hr
	Morphological study of Fungi: fruit body of Polyporus, Cyathus), Lichens (fruticose and foliose	RP	Demonstration	1 hr
PHYTO-PATHOLOGY	Preparation of fungal media (PDA)	DS	Demonstration, experimental work	2 hr
	Sterilization process.	DS	Demonstration, experimental work	2 hr
	Isolation of pathogen from diseased leaf.	DS	Demonstration, experimental work	1 hr
	Inoculation of fruit and subculturing.	DS	Demonstration, experimental work	2 hr

	Identification : Pathological specimens- 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	DS	Demonstration, interactive discussion	3 hr
FIELD WORK	Study and collection of macrofungi	MM, DS	Field visit, demonstration	4 hr

SEMESTER- II (Theory)

CORE COURSE 3

PLANT ANATOMY (BOT-A-CC-2-3-TH)

TOPIC	SUBTOPIC	TEACHER	TEACHING METHOD	CLASS HOUR
ANATOMY	Cell wall: Ultrastructure & Chemical constituents, Plasmodesmata- ultrastructure, Concept of Apoplast and Symplast, Growth and Thickening of cell wall	MM	Class lecture, power point presentation, interactive discussion	3 hr
	Stomata: Types (Metcalfe and Chalk, Stebbins and Khush)	MM	Class lecture, power point	1 hr

			presentation, interactive discussion	
	Stele: Leaf-trace and leaf-gap, Stelar types & evolution	MM	Class lecture, power point presentation, interactive discussion	2 hr
	Primary structure of stem and root: - Monocot and Dicot. Leaf- dorsiventral and isobilateral	MM	Class lecture, power point presentation, interactive discussion	6 hr
	Secondary growth: Normal (intra- & extra-stelar), Anomalous (stem of *Bignonia, Boerhavia, Tecoma, Dracaena* and root of *Tinospora*)	MM	Class lecture, power point presentation, interactive discussion	5 hr
	Mechanical tissues and the Principles governing their distribution in plants	MM	Class lecture, power point presentation,	2 hr

			interactive discussion	
	Developmental Anatomy: Organisation of shoot apex (Tunica–Corpus) and Root apex (Korper-Kappe), Plastochrone	MM	Class lecture, power point presentation, interactive discussion	2 hr
	Ecological Anatomy: Adaptive anatomical features of Hydrophytes, Xerophytes	MM	Class lecture, power point presentation, interactive discussion	2 hr
	Scope of plant anatomy: application in systematics, forensics and pharmacognosy	MM	Class lecture, power point presentation, interactive discussion	3 hr

SEMESTER- II (PRACTICAL)

CORE COURSE 3

PLANT ANATOMY (BOT-A-CC-2-3-P)

TOPIC	SUB-TOPIC	TEACHER	TEACHING METHOD	CLASS HOUR
Microscopic studies	Microscopic studies on: Types of stomata, sclereids, raphides (Colocasia), cystolith (Ficus leaf) starch grains, aleurone grains, laticiferous ducts, oil glands	MM	Demonstration, experimental work	3
Study of anatomical details from slides	Root: Monocot and dicot, b) Stem- Monocot and dicot, c) Leaf- Monocot and dicot	MM	Demonstration, experimental work	6
Study of anomalous secondary structure	*Bignonia, Boerhaavia, Tecoma, Dracaena and root of Tinospora*	MM	Demonstration, experimental work	5
Study of adaptive anatomical features	Hydrophytes (Nymphaea – petiole) and Xerophytes (Nerium – leaf)	MM	Demonstration, experimental work	1

CORE COURSE 4 (THEORITICAL)

ARCHAEGONIATE (BOT-A-CC-2-4-TH)

TOPIC	SUB-TOPIC	TEACHER	TEACHING METHOD	CLASS HOUR
BRYOPHYTES	General Account: General characteristics and adaptations to land habit, Classification (Strotler and Crandle Strotler, 2009) up to class with diagnostic characters and examples	RP	Class lecture, power point presentation, interactive discussion	4 hr
	Life History: Gametophyte structure and Reproduction, Development and Structure of sporophyte, Spore dispersal in: Marchantia, Anthoceros, Funaria.	RP	Class lecture, power point presentation, interactive discussion	4 hr
	Phylogeny: Unifying features of archaegoniates; transition to land habit, Origin of Alternation of Generations (Homologous and Antithetic theory), Evolution of Sporophytes (Progressive and Regressive concept), Origin of Bryophytes	RP	Class lecture, power point presentation, interactive discussion	4 hr
	Importance: Role of bryophytes in: Plant succession, Pollution Monitoring, Economic importance of bryophytes with special reference to Sphagnum	RP	Class lecture, power point presentation,	2 hr

			interactive discussion	
PTERIDOPHYTES	General Account: Colonisation and rise of early land plants, Classification of vascular plants by Gifford & Foster (1989) upto division (Rhyniophyta to Filicophyta) with diagnostic characters and examples	DS	Class lecture, power point presentation, interactive discussion	2 hr
	Life History: Sporophyte structure, Reproduction and Structure of gametophyte in Psilotum, Selaginella, Equisetum, Pteris.	DS	Class lecture, power point presentation, interactive discussion	8 hr
	Telome concept and its significance in the origin of different groups of Pteridophytes	DS	Class lecture, power point presentation, interactive discussion	2 hr
	Heterospory and Origin of Seed habit	DS	Class lecture, power point presentation,	2 hr

			interactive discussion	
	Economic importance as food, medicine and Agriculture	DS	Class lecture, power point presentation, interactive discussion	1 hr
GYMNOSPERMS	Classification: Classification of vascular plants by Gifford & Foster (1989) upto division (Progymnospermophyta to Gnetophyta) with diagnostic characters and examples	RP	Class lecture, power point presentation, interactive discussion	3 hr
	Progymnosperms: Diagnostic characters of the group, Vegetative and reproductive features of Archeopteris, Phylogenetic importance	RP	Class lecture, power point presentation, interactive discussion	2 hr
	Life History: Distribution in India; Vegetative and Reproductive structure of sporophyte, Development of gametophyte in : Cycas , Pinus and Gnetum	RP	Class lecture, power point presentation,	2 hr

			interactive discussion	
	Economic Importance with reference to Wood, Resins, Essential oils, and Drugs	RP	Class lecture, power point presentation, interactive discussion	2 hr

CORE COURSE 4 (PRACTICAL)

ARCHAEGONIATE (BOT-A-CC-2-4-P)

TOPIC	SUB-TOPIC	TEACHER	TEACHING METHOD	CLASS HOUR
BRYOPHYTES	Morphological study: *Riccia, Porella*	DS	Demonstration, interactive discussion	1
	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)	DS	Demonstration, interactive discussion	3

PTERIDOPHYTES	Morphological study of the sporophytic plant body: Lycopodium, Ophioglossum and Marsilea	DS	Demonstration, interactive discussion	1
	Workout of the reproductive structures: Selaginella, Equisetum, Pteris	DS	Demonstration, interactive discussion, work out	6
	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).	DS	Demonstration, interactive discussion	2
GYMNOSPERMS	Morphological study: Cycas (microsporophyll and megasporophyll), Pinus (female and male cone), Gnetum (female and male cone)	DS	Demonstration, interactive discussion	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)	DS	Demonstration, interactive discussion	2
FIELD STUDY	Botanical excursion to familiarize the students with the natural habitats of Bryophyte, Pteridophyta and gymnosperms	DS, MM	Field visit, demonstration	4

TEACHING PLAN

Academic Session 2019-2020

SEMESTER I- Honours

CORE COURSE 1 (THEORITICAL)

PHYCOLOGY AND MICROBIOLOGY (BOT-A-CC-1-1-TH)

TOPIC	SUB-TOPIC	TEACHER	TEACHING METHOD	CLASS HOUR
PHYCOLOGY	General account: Thallus organization, Structure of algal cell, Ultrastructure of Plastids and Flagella, Origin and evolution of sex, Life cycle patterns, Significant contributions of important phycologists (Fritsch, Smith, R. N. Singh, T.V. Desikachary, H.D. Kumar, M.O.P. Iyengar)	RP	Class lecture, power point presentation, interactive discussion	3 hr
	Classification: Criteria and basis of Fritsch's classification, Classification by Lee (2008) upto phylum with examples, Salient features of Cyanobacteria, Rhodophyta, Chlorophyta ,	RP	Class lecture, power point presentation, interactive discussion	3 hr

	Charophyta, Bacillariophyta, Xanthophyta, Phaeophyta, Heterokantophyta.			
	Cyanobacteria: Ultrastructure of cell, Heterocyst - structure and function, Ecology	RP	Class lecture, power point presentation, interactive discussion	2 hr
	Bacillariophyta: Cell structure, Cell division, Auxospore formation in Centrales and Pennales	RP	Class lecture, power point presentation, interactive discussion	3 hr
	Life History: *Chlamydomonas, Oedogonium, Chara, Ectocarpus, Polysiphonia*, Evolutionary significance of Prochloron	RP	Class lecture, power point presentation, interactive discussion	10 hr
MICROBIOLOGY	Virus: Discovery, Plant virus- types, Transmission and translocation of Plant virus, TMV- Physicochemical characteristics and Multiplication, One step growth curve, Lytic cycle (T4 phage) and	MM	Class lecture, power point presentation,	3 hr

	Lysogenic cycle (Lambda phage), Significance of lysogeny, Viroids and Prions		interactive discussion	
	Bacteria: Discovery, Distinguishing features of Archaea and Bacteria, Characteristics of some major groups: Proteobacteria (Enterobacteria), Firmicutes, Mollicutes, Actinobacteria, Spirochaetes, Chlamydiae, Bacterial growth curve and generation time, Flagella (ultrastructure) & Pilli, Cell wall – chemical structure and differences between Gram +ve & Gram – ve bacteria, Bacterial genome and plasmid, Endospore - formation, structure and function, 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	MM	Class lecture, power point presentation, interactive discussion	6 hr

CORE COURSE 1 (PRACTICAL)

PHYCOLOGY AND MICROBIOLOGY (BOT-A-CC-1-1-P)

TOPIC	SUBTOPIC	TEACHER	TEACHING METHOD	CLASS HOUR
ALGAE	Work out: (Free hand drawing and drawing under drawing prism with magnification): Oedogonium, Chara, Ectocarpus	RP	Demonstration, interaction, work out	6 hr
	Study of Permanent slides: *Gloeotrichia, Volvox, Vaucheria, Coleochaete, Polysiphonia*, Centric and Pennate diatom	RP	Demonstration	2 hr
	Study of Macroscopic specimens: *Laminaria, Sargassum*	RP	Demonstration	1 hr
MICROBIOLOGY	Preparation of bacterial media: Nutrient agar and nutrient broth, Preparation of slants and pouring Petri-plates	MM	Demonstration	3 hr
	Sub-culturing of bacterial culture	MM	Demonstration, experimental work	2 hr
	Gram staining from bacterial culture	MM	Demonstration, experimental work	3 hr

	Microscopic examination of bacteria from natural habitat (curd) by simple staining	MM	Demonstration, experimental work	3 hr
	Field work: for study and collection of algae (from natural habitat) conducted to give an introductory idea about plant diversity	MM, RP	Field visit	4 hr

CORE COURSE 2 (Theory)

MYCOLOGY AND PHYTO-PATHOLOGY (BOT-A-CC-1-2-TH)

TOPIC	SUB-TOPIC	TEACHER	TEACHING METHOD	CLASS HOUR
MYCOLOGY	General Account: Hyphal forms, Fungal spore forms and mode of liberation, Sexual reproduction and degeneration of sex, Parasexuality and sexual compatibility, Life cycle patterns	RP	Class lecture, power point presentation, interactive discussion	4 hr
	Classification: Classification of Fungi (Ainsworth, 1973) upto sub-division with diagnostic characters and examples. General characteristics of Myxomycota, Oomycota, Zygomycota, Ascomycota, Basidiomycota, Deuteromycota	RP	Class lecture, power point presentation, interactive discussion	2 hr

	Life history: Synchytrium, Rhizopus, Ascobolus, Agaricus	RP	Class lecture, power point presentation, interactive discussion	6 hr
	Mycorrhiza: Types with salient features, Role in Agriculture & Forestry	RP	Class lecture, power point presentation, interactive discussion	2 hr
	Lichen: Types, Reproduction, Economic and ecological importance	RP	Class lecture, power point presentation, interactive discussion	2 hr
PHYTO-PATHOLOGY	Terms and Definitions: Disease concept, Symptoms, Etiology & causal complex, Primary and secondary inocula, Infection, Pathogenecity and pathogenesis, Necrotroph and Biotroph, Koch's Postulates, Endemic, Epidemic, Pandemic and Sporadic disease,	DS	Class lecture, power point presentation, interactive discussion	2 hr

	Disease triangle, Disease cycle (monocyclic, polycyclic and polyetic)			
	Host – Parasite Interaction: Mechanism of infection (Brief idea about Pre-penetration, Penetration and Post-penetration), Pathotoxin (Definition,criteria and example), Defense mechanism with special reference to Phytoalexin, Resistance- Systemic acquired and Induced systemic.	DS	Class lecture, power point presentation, interactive discussion	4 hr
	Plant Disease Management: Quarantine, Chemical, Biological, Integrated	DS	Class lecture, power point presentation, interactive discussion	3 hr
	Symptoms, Causal organism, Disease cycle and Control measures: Late blight of Potato, Brown spot of rice, Black stem rust of wheat, Stem rot of jute.	DS	Class lecture, power point presentation, interactive discussion	6 hr

CORE COURSE 2 (PRACTICAL)

TOPIC	SUB-TOPIC	TEACHER	TEACHING METHOD	CLASS HOUR
MYCOLOGY	Work out: microscopic measurement of Reproductive structures): *Rhizopus* (asexual), *Ascobolus*, *Agaricus*	RP	Demonstration, work out	4 hr
	Study from permanent slides: Zygospore of Rhizopus, Conidia of Fusarium, Conidiophore of Penicillium	RP	Demonstration	1 hr
	Morphological study of Fungi: fruit body of Polyporus, Cyathus), Lichens (fruticose and foliose	RP	Demonstration	1 hr
PHYTO-PATHOLOGY	Preparation of fungal media (PDA)	DS	Demonstration, experimental work	2 hr
	Sterilization process.	DS	Demonstration, experimental work	2 hr
	Isolation of pathogen from diseased leaf.	DS	Demonstration, experimental work	1 hr
	Inoculation of fruit and subculturing.	DS	Demonstration, experimental work	2 hr

	Identification : Pathological specimens- 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	DS	Demonstration, interactive discussion	3 hr
FIELD WORK	Study and collection of macrofungi	MM, DS	Field visit, demonstration	4 hr

SEMESTER- II (Theory)

CORE COURSE 3

PLANT ANATOMY (BOT-A-CC-2-3-TH)

TOPIC	SUBTOPIC	TEACHER	TEACHING METHOD	CLASS HOUR
ANATOMY	Cell wall: Ultrastructure & Chemical constituents, Plasmodesmata- ultrastructure, Concept of Apoplast and Symplast, Growth and Thickening of cell wall	MM	Class lecture, power point presentation, interactive discussion	3 hr
	Stomata: Types (Metcalfe and Chalk, Stebbins and Khush)	MM	Class lecture, power point	1 hr

			presentation, interactive discussion	
	Stele: Leaf-trace and leaf-gap, Stelar types & evolution	MM	Class lecture, power point presentation, interactive discussion	2 hr
	Primary structure of stem and root: - Monocot and Dicot. Leaf- dorsiventral and isobilateral	MM	Class lecture, power point presentation, interactive discussion	6 hr
	Secondary growth: Normal (intra- & extra-stelar), Anomalous (stem of *Bignonia, Boerhavia, Tecoma, Dracaena* and root of *Tinospora*)	MM	Class lecture, power point presentation, interactive discussion	5 hr
	Mechanical tissues and the Principles governing their distribution in plants	MM	Class lecture, power point presentation,	2 hr

			interactive discussion	
	Developmental Anatomy: Organisation of shoot apex (Tunica–Corpus) and Root apex (Korper-Kappe), Plastochrone	MM	Class lecture, power point presentation, interactive discussion	2 hr
	Ecological Anatomy: Adaptive anatomical features of Hydrophytes, Xerophytes	MM	Class lecture, power point presentation, interactive discussion	2 hr
	Scope of plant anatomy: application in systematics, forensics and pharmacognosy	MM	Class lecture, power point presentation, interactive discussion	3 hr

SEMESTER- II (PRACTICAL)

CORE COURSE 3

PLANT ANATOMY (BOT-A-CC-2-3-P)

TOPIC	SUB-TOPIC	TEACHER	TEACHING METHOD	CLASS HOUR
Microscopic studies	Microscopic studies on: Types of stomata, sclereids, raphides (Colocasia), cystolith (Ficus leaf) starch grains, aleurone grains, laticiferous ducts, oil glands	MM	Demonstration, experimental work	3
Study of anatomical details from slides	Root: Monocot and dicot, b) Stem- Monocot and dicot, c) Leaf- Monocot and dicot	MM	Demonstration, experimental work	6
Study of anomalous secondary structure	*Bignonia, Boerhaavia, Tecoma, Dracaena and root of Tinospora*	MM	Demonstration, experimental work	5
Study of adaptive anatomical features	Hydrophytes (Nymphaea – petiole) and Xerophytes (Nerium – leaf)	MM	Demonstration, experimental work	1

CORE COURSE 4 (THEORITICAL)

ARCHAEGONIATE (BOT-A-CC-2-4-TH)

TOPIC	SUB-TOPIC	TEACHER	TEACHING METHOD	CLASS HOUR
BRYOPHYTES	General Account: General characteristics and adaptations to land habit, Classification (Strotler and Crandle Strotler, 2009) up to class with diagnostic characters and examples	RP	Class lecture, power point presentation, interactive discussion	4 hr
	Life History: Gametophyte structure and Reproduction, Development and Structure of sporophyte, Spore dispersal in: Marchantia, Anthoceros, Funaria.	RP	Class lecture, power point presentation, interactive discussion	4 hr
	Phylogeny: Unifying features of archaegoniates; transition to land habit, Origin of Alternation of Generations (Homologous and Antithetic theory), Evolution of Sporophytes (Progressive and Regressive concept), Origin of Bryophytes	RP	Class lecture, power point presentation, interactive discussion	4 hr

	Importance: Role of bryophytes in: Plant succession, Pollution Monitoring, Economic importance of bryophytes with special reference to Sphagnum	RP	Class lecture, power point presentation, interactive discussion	2 hr
PTERIDOPHYTES	General Account: Colonisation and rise of early land plants, Classification of vascular plants by Gifford & Foster (1989) upto division (Rhyniophyta to Filicophyta) with diagnostic characters and examples	DS	Class lecture, power point presentation, interactive discussion	2 hr
	Life History: Sporophyte structure, Reproduction and Structure of gametophyte in Psilotum, Selaginella, Equisetum, Pteris.	DS	Class lecture, power point presentation, interactive discussion	8 hr
	Telome concept and its significance in the origin of different groups of Pteridophytes	DS	Class lecture, power point presentation, interactive discussion	2 hr

	Heterospory and Origin of Seed habit	DS	Class lecture, power point presentation, interactive discussion	2 hr
	Economic importance as food, medicine and Agriculture	DS	Class lecture, power point presentation, interactive discussion	1 hr
GYMNOSPERMS	Classification: Classification of vascular plants by Gifford & Foster (1989) upto division (Progymnospermophyta to Gnetophyta) with diagnostic characters and examples	RP	Class lecture, power point presentation, interactive discussion	3 hr
	Progymnosperms: Diagnostic characters of the group, Vegetative and reproductive features of Archeopteris, Phylogenetic importance	RP	Class lecture, power point presentation, interactive discussion	2 hr

	Life History: Distribution in India; Vegetative and Reproductive structure of sporophyte, Development of gametophyte in : Cycas , Pinus and Gnetum	RP	Class lecture, power point presentation, interactive discussion	2 hr
	Economic Importance with reference to Wood, Resins, Essential oils, and Drugs	RP	Class lecture, power point presentation, interactive discussion	2 hr

CORE COURSE 4 (PRACTICAL)

ARCHAEGONIATE (BOT-A-CC-2-4-P)

TOPIC	SUB-TOPIC	TEACHER	TEACHING METHOD	CLASS HOUR
BRYOPHYTES	Morphological study: *Riccia, Porella*	DS	Demonstration, interactive discussion	1

	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)	DS	Demonstration, interactive discussion	3
PTERIDOPHYTES	Morphological study of the sporophytic plant body: Lycopodium, Ophioglossum and Marsilea	DS	Demonstration, interactive discussion	1
	Workout of the reproductive structures: Selaginella, Equisetum, Pteris	DS	Demonstration, interactive discussion, work out	6
	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).	DS	Demonstration, interactive discussion	2
GYMNOSPERMS	Morphological study: Cycas (microsporophyll and megasporophyll), Pinus (female and male cone), Gnetum (female and male cone)	DS	Demonstration, interactive discussion	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)	DS	Demonstration, interactive discussion	2
FIELD STUDY	Botanical excursion to familiarize the students with the natural habitats of Bryophyte, Pteridophyta and gymnosperms	DS, MM	Field visit, demonstration	4

SEMESTER- III

CORE COURSE-5 (THEORETICAL)

PALAEOBOTANY AND PALYNOLOGY (BOT-A-CC-3-5-TH)

TOPIC	SUB-TOPIC	TEACHER	TEACHING METHOD	CLASS HOUR
PALAEOBOTANY & PALYNOLOGY	Geological time scale with dominant plant groups through ages	MM	Online teaching through Google meet, ppt, interactive discussion	4 hr

	Plant Fossil: Types: Body fossil (Micro- and Megafossils), Trace fossil, Chemical fossil, Index fossil, Different modes of preservation (Schopf, 1975), Conditions favouring fossilization, Nomenclature and Reconstruction, Principle of fossil dating (a brief idea), Importance of fossil study	MM	Online teaching through Google meet, ppt, interactive discussion	5 hr
	Fossil Pteridophytes: Structural features, Geological distribution and Evolutionary significance of Rhynia, Lepidodendron (Reconstructed), Calamites (Reconstructed)	MM	Online teaching through Google meet, ppt, interactive discussion	6 hr
	Fossil gymnosperms: Structural features and Geological distribution of reconstructed genera: Lyginopteris, Williamsonia, Cordaites	MM	Online teaching through Google meet, ppt, interactive discussion	4 hr
	Indian Gondwana System: Three fold division with major megafossil assemblages	MM	Online teaching through Google meet, ppt,	2 hr

			interactive discussion	
	Palynology: Spore and Pollen, Pollen aperture types, NPC classification (Erdtman) Pollen wall Sporopollenin, Stratification and Ornamentation (sculpturing)	MM	Online teaching through Google meet, ppt, interactive discussion	3 hr
	Applied Palynology: Basic concepts of: Palaeopalynology, Aeropalynology, Forensic palynology, Melissopalynology	MM	Online teaching through Google meet, ppt, interactive discussion	4 hr

CORE COURSE-5 (PRACTICAL)

PALAEOBOTANY AND PALYNOLOGY (BOT-A-CC-3-5-P)

CC-5	TOPIC	TEACHER	TEACHING METHOD	CLASS HOUR
PALAEOBOTANY AND PALYNOLOGY	Morphological study: Ptilophyllum and Glossopteris leaf fossils	MM	Demonstration, interactive discussion	1

	Study from permanent slides: T.S. of stem of *Rhynia, Lepidodendron, Calamites, Lyginopteris, Cordaites*	MM	Demonstration, interactive discussion	3
	Study of Pollen types: (colpate from *Leonurus sibiricus*/ Brassica sp., porate from Hibiscus rosa-sinensis and colporate from *Cassia sophera*/ *C. tora*)	DS	Demonstration, interactive discussion, work out	2

CORE COURCE- 6 (THEORETICAL)

REPRODUCTIVE BIOLOGY OF ANGIOSPERMS (BOT-A-CC-3-6-TH)

TOPIC	SUB-TOPIC	TEACHER	TEACHING METHOD	CLASS HOUR
MORPHOLOGY OF ANGIOSPERMS	Inflorescence types with examples	DS	Online teaching through Google meet, ppt, interactive discussion	3 hr
	Flower, induction of flowering, flower development- genetic and molecular aspects	DS	Online teaching through Google meet, ppt,	4 hr

			interactive discussion	
	Fruits and seeds types with examples	DS	Online teaching through Google meet, ppt, interactive discussion	4 hr
EMBRYOLOGY	Pre-fertilisation changes: Microsporogenesis and Microgametogenesis, Megasporogenesis and Megagametogenesis (monosporic, bisporic and tetrasporic)	DS	Online teaching through Google meet, ppt, interactive discussion	6 hr
	Fertilisation: Pollen germination, Pollen tube-growth, entry into ovule and discharge, Double fertilization	DS	Online teaching through Google meet, ppt, interactive discussion	3 hr
	Post-fertilization changes: Embryogenesis in Capsella, Development of Endosperm (3 types)	DS	Online teaching through Google meet, ppt,	2 hr

			interactive discussion	
	Apomixis & Polyembryony: Apomixis- Apospory and Apogamy, Polyembryony- different types	DS	Online teaching through Google meet, ppt, interactive discussion	1 hr

CORE COURCE- 6 (PRACTICAL)

REPRODUCTIVE BIOLOGY OF ANGIOSPERMS (BOT-A-CC-3-6-P)

TOPIC	SUB-TOPIC	TEACHER	TEACHING METHOD	CLASS HOUR
REPRODUCTIVE BIOLOGY OF ANGIOSPERMS	Inflorescence types- study from fresh/ preserved specimens	DS	Demonstration, interactive discussion	2 hr
	Flowers- study of different types from fresh/ preserved specimens	DS	Demonstration, interactive discussion	2 hr

	Fruits- study from different types from fresh/preserved specimens	DS	Demonstration, interactive discussion	2 hr
	Study of ovules (permanent slides/ specimens/photographs)- types (anatropous, orthotropous, amphitropous and campylotropous)	DS	Demonstration, interactive discussion	1 hr
	Field work to give a comprehensive idea about different types of inflorescence, flowers and fruits	DS, MM	Demonstration	4 hr

CORE COURSE- 7 (THEORETICAL)

PLANT SYSTEMATICS (BOT-A-CC-3-7-TH)

TOPIC	SUB-TOPIC	TEACHER	TEACHING METHOD	CLASS HOUR
TAXONOMY OF ANGIOSPERMS	Introduction: Components of Systematic: Nomenclature, Identification, Classification; Taxonomy and its phases - Pioneer, Consolidation, Biosystematic and Encyclopaedic; alpha- and omega- taxonomy	DS	Online teaching through Google meet, ppt, interactive discussion	3 hr
	Nomenclature: Type method, Publication, Rank of taxa, Rules of priority, Retention and rejection of	DS	Online teaching through Google	3 hr

	names, Author Citation, Effective and valid publication, Elementary knowledge of ICN-Principles		meet, ppt, interactive discussion	
	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. Systematics in Practice: Herbaria and Botanical Gardens – their role in teaching and research; important Herbaria and Botanical Gardens of India and world (3 each); Dichotomous keys – indented and bracketed	DS	Online teaching through Google meet, ppt, interactive discussion	8 hr
	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	RP	Online teaching through Google meet, ppt, interactive discussion	2 hr
	Data sources in Taxonomy: Supportive evidences from: Phytochemistry, Cytology, Palynology and	RP	Online teaching through Google meet, ppt,	6 hr

	Molecular biology data (Protein and Nucleic acid homology)		interactive discussion	
	Diagnostic features, Systematic position (Bentham & Hooker and Cronquist), Economically important plants (parts used and uses): Monocotyledons- Alismataceae, Gramineae (Poaceae), Cyperaceae, Palmae (Arecaceae), Liliaceae, Musaceae, Zingiberaceae, Cannaceae, Orchidaceae	RP	Online teaching through Google meet, ppt, interactive discussion	6 hr
	Diagnostic features, Systematic position (Bentham & Hooker and Cronquist), Economically important plants (parts used and uses): Dicotyledons- Nymphaeaceae, Magnoliaceae, Leguminosae (subfamilies), Polygonaceae, Euphorbiaceae, Malvaceae, Umbelliferae (Apiaceae), Labiatae (Lamiaceae), Solanaceae, Scrophulariaceae, Acanthaceae, Rubiaceae, Cucurbitaceae, Compositae (Asteraceae).	DS	Online teaching through Google meet, ppt, interactive discussion	6 hr

CORE COURSE- 7 (PRACTICAL)

PLANT SYSTEMATICS (BOT-A-CC-3-7-P)

TOPIC	SUB-TOPIC	TEACHER	TEACHING METHOD	CLASS HOUR
ANGIOSPERMS	Work out, description, preparation of floral formula and floral diagram, identification up to genus with 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.	DS	Demonstration, interactive discussion	10 hr
	Spot identification: (Binomial, Family) of common wild plants	DS	Demonstration, interactive discussion	3 hr
FIELD WORK	Three excursions and Herbarium specimen preparations: Acharya Jagadish Chandra Bose Indian Botanic Garden (Shibpur, Howrah) and Central National Herbarium (CNH)	DS, MM	demonstration	4 hr

SKILL ENHANCEMENT COURSE- ELECTIVE (SEC) SEC-A

BIOFERTILIZERS (BOT-A-SEC-A-3-2) (THEORETICAL)

TOPIC	SUB-TOPIC	TEACHER	TEACHING METHOD	CLASS HOUR
GENERAL ACCOUNT ABOUT THE MICROBES USED AS BIOFERTILIZERS, RHIZOBIUM	Isolation, identification, mass multiplication, carrier based inoculants, actinorrhizal symbiosis.	MM	Online teaching through Google meet, ppt, interactive discussion	3 hr
AZOSPIRILLUM	Isolation and mass multiplication- carrier based inoculants, associative effect of different microorganisms.	MM	Online teaching through Google meet, ppt, interactive discussion	3 hr
AZOTOBACTER	Classification, characteristics- crop response to Azetobacter inoculants, maintenance and mass multiplication.	MM	Online teaching through Google meet, ppt,	3 hr

			interactive discussion	
CYANOBACTERIA (BLUE GREEN ALGAE)	Azolla and Anabaena azollae association, nitrogen fixation. Factors affecting growth, blue green algae and Azolla in rice cultivation.	RP	Online teaching through Google meet, ppt, interactive discussion	3 hr
MYCORRHIZAL ASSOCIATION	Types of mycorrhizal association, phosphorus nutrition, growth and yield- colonisation of VAM – isolation and inoculum production of VAM and its influence on growth and yield of crop plants.	RP	Online teaching through Google meet, ppt, interactive discussion	3 hr
ORGANIC FARMING	Green manuring and organic fertilizers, recycling of biodegradable municipal, agricultural and industrial wastes- biocompost making methods, types and methods of vermicomposting- field application.	RP	Online teaching through Google meet, ppt, interactive discussion	3 hr

SEMESTER IV

CORE COURSE-8 (THEORETICAL)

PLANT GEOGRAPHY, ECOLOGY AND EVOLUTION (BOT-A-CC-4-8-TH)

TOPIC	SUB-TOPIC	TEACHER	TEACHING METHOD	CLASS HOUR
PLANT GEOGRAPHY	Phytogeographical regions: Phytogeographical regions of India (Chatterjee 1960); Dominant flora of Eastern Himalaya, Western Himalaya and Sundarban.	DS	Online teaching through Google meet, ppt, interactive discussion	2 hr
	Endemism: Endemic types and Factors; Age & Area hypothesis and Epibiotic theory; Endemism in Indian flora	DS	Online teaching through Google meet, ppt, interactive discussion	4 hr
ECOLOGY	Preliminary idea on: Habitat and Niche, Ecotone and edge–effect, Microclimate, Ecads, ecotype and ecoclines, Carrying capacity.	DS	Online teaching through Google meet, ppt, interactive discussion	2 hr

	Community ecology: Community- Characteristics and diversity, Ecological succession –Primary and secondary, Seral stages (with reference to Hydrosere), autogenic and allogenic succession.	DS	Online teaching through Google meet, ppt, interactive discussion	2 hr
	Plant indicators (metallophytes); Phytoremediation	DS	Online teaching through Google meet, ppt, interactive discussion	2 hr
	Conservation of Biodiversity: Level of Biodiversity: genetic, species & ecosystem diversity, Biodiversity hot spots- criteria, Indian hotspots, In- situ and ex-situ conservation, Seed-banks, Cryopreservation	DS	Online teaching through Google meet, ppt, interactive discussion	4 hr
EVOLUTION	Introduction: Theories of evolution: Natural selection, Group selection, Neutral theory of molecular evolution, Phyletic gradualism, Punctuated equilibrium and Stasis	DS	Online teaching through Google meet, ppt, interactive discussion	2 hr

	Brief idea on: Stabilizing directional, disruptive and sexual selection; Speciation: Sympatric and allopatric speciation; Coevolution, Adaptive radiation, Reproductive isolation	DS	Online teaching through Google meet, ppt, interactive discussion	3 hr
	Simplified phylogeny of bacteria, algae, fungi, bryophyte, pteridophyte and gymnosperm, Phylogenetic tree	DS	Online teaching through Google meet, ppt, interactive discussion	3 hr

CORE COURSE-8 (PRACTICAL)

PLANT GEOGRAPHY, ECOLOGY AND EVOLUTION (BOT-A-CC-4-8-P)

TOPIC	SUB-TOPIC	TEACHER	TEACHING METHOD	CLASS HOUR
PLANT GEOGRAPHY	Field work: long excursion at different phytogeographical region of India, Study of local flora	DS	Demonstration, interactive discussion	4 hr

ECOLOGY	Study of community structure by quadrat method and determination of (i) Minimal size of the quadrat, (ii) Frequency, density and abundance of components	DS	Demonstration, interactive discussion	2 hr
	Comparative anatomical studies of leaves form polluted and less polluted areas	DS	Demonstration, interactive discussion	1 hr
	Measurement of dissolved O_2 by azide modification of Winkler's method	DS	Demonstration, interactive discussion	2 hr
	Comparison of free CO_2 from different sources	DS	Demonstration, interactive discussion	2 hr

CORE COURSE- 9 (THEORETICAL)

ECONOMIC BOTANY (BOT-A-CC-4-9-TH)

CC-2	TOPIC	TEACHER	TEACHING METHOD	CLASS HOUR
ECONOMIC BOTANY	Origin of cultivated crops: Concepts of centre of origin, their importance with reference to Vavilov's	RP	Online teaching through Google	3 hr

	work. Examples of major plant introductions; crop domestication and loss of genetic diversity; evolution of new crops/ varieties, importance of germplasm diversity.		meet, ppt, interactive discussion	
	Cereals: Rice and wheat (origin, morphology, processing and uses).	RP	Online teaching through Google meet, ppt, interactive discussion	2 hr
	Legumes: Origin, morphology and uses of gram and mung bean. Importance to man and environment.	RP	Online teaching through Google meet, ppt, interactive discussion	2 hr
	Sugar and starches: Morphology and processing of sugarcane, products and byproducts of sugarcane industry. Potato- morphology, propagation and uses.	RP	Online teaching through Google meet, ppt, interactive discussion	3 hr
	Spices: Listing of important spices, their family and part used.	RP	Online teaching through Google	1 hr

			meet, ppt, interactive discussion	
	Beverages: Tea (morphology, processing and uses).	DS	Online teaching through Google meet, ppt, interactive discussion	2 hr
	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.	DS	Online teaching through Google meet, ppt, interactive discussion	3 hr
	Drug-yielding plants: Therapeutic and habit forming drugs with special reference to Cinchona, Digitalis, Papavar, Cannabis and Tobacco (morphology, processing, uses and health hazards).	DS	Online teaching through Google meet, ppt, interactive discussion	2 hr
	Timber: general account with special reference to Sal and Teak.	DS	Class lecture, power point presentation,	2 hr

			interactive discussion	
	Fibers: Cotton and Jute (Morphology, extraction and uses).	DS	Online teaching through Google meet, ppt, interactive discussion	2 hr

CORE COURSE- 9 (PRACTICAL)

ECONOMIC BOTANY (BOT-A-CC-4-9-P)

TOPIC	SUB-TOPIC	TEACHER	TEACHING METHOD	CLASS HOUR
ECONOMIC BOTANY	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)	DS	Demonstration, interactive discussion	3 hr
	Legume: Soybean, ground nut (habit, fruit, seed structure, micro-chemical tests)	DS	Demonstration, interactive discussion	2 hr

	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.	DS	Demonstration, interactive discussion	3 hr
	Tea- tea leaves, tests for tannin:	DS	Demonstration, interactive discussion	2 hr
	Mustard- plant specimen, seeds, tests for fat in crushed seeds	DS	Demonstration, interactive discussion	2 hr
	Habit- Digitalis, Papaver and Cannabis	DS	Demonstration, interactive discussion	1 hr
	Sal, Teak- section of young stem	DS	Demonstration, interactive discussion	2 hr
	Jute- specimen, transverse section of stem, tests for lignin on T.S. of stem and study of fibre following maceration technique	DS	Demonstration, interactive discussion	2 hr

CORE COURSE 10 (THEORETICAL)

GENETICS (BOT-A-CC-4-10-TH)

CC-2	TOPIC	TEACHER	TEACHING METHOD	CLASS HOUR
GENETICS	Introduction: Mendelian genetics and its extension	MM	Online teaching through Google meet, ppt, interactive discussion	2 hr
	Linkage, Crossing over and Gene Mapping: Complete and incomplete linkage (example), linked gene does not assort independently (example), linkage group, Crossing over, crossing over produces recombination (example), detection of crossing over (McClintock's experiment), and Molecular mechanism of crossing over (Holliday model), Gene mapping with three point test cross, detection of middle gene in three point test cross, calculation of recombination frequencies, Co-efficient of coincidence and interference, mapping	MM	Online teaching through Google meet, ppt, interactive discussion	5 hr

	function, Problems on gene mapping, Molecular mapping – ISH, FISH (brief idea).			
	Epistasis and Polygenic inheritance in plants	MM	Online teaching through Google meet, ppt, interactive discussion	2 hr
	Aneuploidy and Polyploidy: Types, examples, meiotic behaviour and importance of: Aneuploidy,. Polyploidy, Speciation and evolution through polyploidy.	MM	Online teaching through Google meet, ppt, interactive discussion	4 hr
	Chromosomal aberration: Types and meiotic behaviour of: Deletion, Duplication, Translocation and. Inversion.	MM	Online teaching through Google meet, ppt, interactive discussion	5 hr
	Mutation: Point mutation-Transition, Transversion and Frame shift mutation, Molecular mechanisms (tautomerisation, alkylation, deamination, base	MM	Online teaching through Google meet, ppt,	6 hr

	analogue incorporation, dimerisation), DNA repair (brief idea).		interactive discussion	
	Structural organisation of Gene: One Gene–one polypeptide concept, Split gene, Overlapping gene, Repetitive DNAtandem and interspersed, Transposon (Ac-Ds system), Homoeotic gene in plants (ABCE Quartet model of flowering).	MM	Online teaching through Google meet, ppt, interactive discussion	8 hr

CORE COURSE 10 (PRACTICAL)

GENETICS (BOT-A-CC-4-10-TH)

TOPIC	SUB-TOPIC	TEACHER	TEACHING METHOD	CLASS HOUR
GENETICS	Introduction to chromosome preparation: Pre-treatment, Fixation, Staining, Squash and Smear preparation, Preparation of permanent slides.	MM	Demonstration, interactive discussion	3 hr
	Determination of mitotic index and frequency of different mitotic stages in pre-fixed root tips of Allium cepa.	MM	Demonstration, interactive discussion	4 hr

	Study of mitotic chromosome: 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: Allium cepa, Aloe vera, Lens esculenta.	MM	Demonstration, interactive discussion	3 hr
	Study of chromosomal aberrations developed due to exposure to any two pollutants/ pesticides Etc	MM	Demonstration, interactive discussion	2 hr
	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.	MM	Demonstration, interactive discussion	3 hr
	Identification from permanent slides : Meiosis – (i) normal stages (ii) abnormal stages – laggard, anaphase bridge, ring chromosome (Rhoeo discolor); Mitosis – (i) normal stages, (ii) abnormal stagesearly separation, late separation, multipolarity, sticky bridge, laggard, fragmentation, (ii) pollen mitosis.	MM	Demonstration, interactive discussion	3 hr

SKILL ENHANCEMENT COURSE- ELECTIVE (SEC) SEC-B

MUSHROOM CULTURE TECHNOLOGY (BOT-A-SEC-B-4-4) THEORETICAL

TOPIC	SUB-TOPIC	TEACHER	TEACHING METHOD	CLASS HOUR
INTRODUCTION	Nutritional and medicinal value of edible mushrooms; poisonous mushrooms, types of edible mushrooms available in India- Volvariella volvacea, Pleurotus citrinopileatus, Agaricus bisporus.	MM	Online teaching through Google meet, ppt, interactive discussion	2 hr
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.	MM	Online teaching through Google meet, ppt, interactive discussion	3 hr

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	RP	Online teaching through Google meet, ppt, interactive discussion	3 hr
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.	RP	Class lecture, power point presentation, interactive discussion	3 hr

Academic Session 2020-21

SEMESTER I- Honours

CORE COURSE 1 (THEORITICAL)

PHYCOLOGY AND MICROBIOLOGY (BOT-A-CC-1-1-TH)

TOPIC	SUB-TOPIC	TEACHER	TEACHING METHOD	CLASS HOUR
PHYCOLOGY	General account: Thallus organization, Structure of algal cell, Ultrastructure of Plastids and Flagella,	RP	Online teaching	3 hr

	Origin and evolution of sex, Life cycle patterns, Significant contributions of important phycologists (Fritsch, Smith, R. N. Singh, T.V. Desikachary, H.D. Kumar, M.O.P. Iyengar)		through Google meet, ppt, interactive discussion	
	Classification: Criteria and basis of Fritsch's classification, Classification by Lee (2008) upto phylum with examples, Salient features of Cyanobacteria, Rhodophyta, Chlorophyta , Charophyta, Bacillariophyta, Xanthophyta, Phaeophyta, Heterokantophyta.	RP	Online teaching through Google meet, ppt, interactive discussion	3 hr
	Cyanobacteria: Ultrastructure of cell, Heterocyst - structure and function, Ecology	RP	Online teaching through Google meet, ppt, interactive discussion	2 hr
	Bacillariophyta: Cell structure, Cell division, Auxospore formation in Centrales and Pennales	RP	Online teaching through Google meet, ppt,	3 hr

			interactive discussion	
	Life History: *Chlamydomonas, Oedogonium, Chara, Ectocarpus, Polysiphonia*, Evolutionary significance of Prochloron	RP	Online teaching through Google meet, ppt, interactive discussion	10 hr
MICROBIOLOGY	Virus: Discovery, Plant virus- types, Transmission and translocation of Plant virus, TMV- Physicochemical characteristics and Multiplication, One step growth curve, Lytic cycle (T4 phage) and Lysogenic cycle (Lambda phage), Significance of lysogeny, Viroids and Prions	MM	Online teaching through Google meet, ppt, interactive discussion	3 hr
	Bacteria: Discovery, Distinguishing features of Archaea and Bacteria, Characteristics of some major groups: Proteobacteria (Enterobacteria), Firmicutes, Mollicutes, Actinobacteria, Spirochaetes, Chlamydiae, Bacterial growth curve and generation time, Flagella (ultrastructure) & Pilli, Cell wall – chemical structure and differences between Gram	MM	Online teaching through Google meet, ppt, interactive discussion	6 hr

	+ve & Gram – ve bacteria, Bacterial genome and plasmid, Endospore - formation, structure and function, 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			

CORE COURSE 1 (PRACTICAL)

PHYCOLOGY AND MICROBIOLOGY (BOT-A-CC-1-1-P)

TOPIC	SUBTOPIC	TEACHER	TEACHING METHOD	CLASS HOUR
ALGAE	Work out: (Free hand drawing and drawing under drawing prism with magnification): Oedogonium, Chara, Ectocarpus	RP	Demonstration, interaction, work out	6 hr
	Study of Permanent slides: *Gloeotrichia, Volvox, Vaucheria, Coleochaete, Polysiphonia*, Centric and Pennate diatom	RP	Demonstration	2 hr

	Study of Macroscopic specimens: *Laminaria, Sargassum*	RP	Demonstration	1 hr
MICROBIOLOGY	Preparation of bacterial media: Nutrient agar and nutrient broth, Preparation of slants and pouring Petri-plates	MM	Demonstration	3 hr
	Sub-culturing of bacterial culture	MM	Demonstration, experimental work	2 hr
	Gram staining from bacterial culture	MM	Demonstration, experimental work	3 hr
	Microscopic examination of bacteria from natural habitat (curd) by simple staining	MM	Demonstration, experimental work	3 hr
	Field work: for study and collection of algae (from natural habitat) conducted to give an introductory idea about plant diversity	MM, RP	Field visit	4 hr

CORE COURSE 2 (Theory)

MYCOLOGY AND PHYTO-PATHOLOGY (BOT-A-CC-1-2-TH)

TOPIC	SUB-TOPIC	TEACHER	TEACHING METHOD	CLASS HOUR

MYCOLOGY	General Account: Hyphal forms, Fungal spore forms and mode of liberation, Sexual reproduction and degeneration of sex, Parasexuality and sexual compatibility, Life cycle patterns	RP	Online teaching through Google meet, ppt, interactive discussion	4 hr
	Classification: Classification of Fungi (Ainsworth, 1973) upto sub-division with diagnostic characters and examples. General characteristics of Myxomycota, Oomycota, Zygomycota, Ascomycota, Basidiomycota, Deuteromycota	RP	Online teaching through Google meet, ppt, interactive discussion	2 hr
	Life history: Synchytrium, Rhizopus, Ascobolus, Agaricus	RP	Online teaching through Google meet, ppt, interactive discussion	6 hr
	Mycorrhiza: Types with salient features, Role in Agriculture & Forestry	RP	Online teaching through Google meet, ppt, interactive discussion	2 hr

	Lichen: Types, Reproduction, Economic and ecological importance	RP	Online teaching through Google meet, ppt, interactive discussion	2 hr
PHYTO-PATHOLOGY	Terms and Definitions: Disease concept, Symptoms, Etiology & causal complex, Primary and secondary inocula, Infection, Pathogenecity and pathogenesis, Necrotroph and Biotroph, Koch's Postulates, Endemic, Epidemic, Pandemic and Sporadic disease, Disease triangle, Disease cycle (monocyclic, polycyclic and polyetic)	DS	Online teaching through Google meet, ppt, interactive discussion	2 hr
	Host – Parasite Interaction: Mechanism of infection (Brief idea about Pre-penetration, Penetration and Post-penetration), Pathotoxin (Definition,criteria and example), Defense mechanism with special reference to Phytoalexin, Resistance- Systemic acquired and Induced systemic.	DS	Online teaching through Google meet, ppt, interactive discussion	4 hr
	Plant Disease Management: Quarantine, Chemical, Biological, Integrated	DS	Online teaching through Google meet, ppt,	3 hr

			interactive discussion	
	Symptoms, Causal organism, Disease cycle and Control measures: Late blight of Potato, Brown spot of rice, Black stem rust of wheat, Stem rot of jute.	DS	Online teaching through Google meet, ppt, interactive discussion	6 hr

CORE COURSE 2 (PRACTICAL)

TOPIC	SUB-TOPIC	TEACHER	TEACHING METHOD	CLASS HOUR
MYCOLOGY	Work out: microscopic measurement of Reproductive structures): *Rhizopus* (asexual), *Ascobolus*, *Agaricus*	RP	Demonstration, work out	4 hr
	Study from permanent slides: Zygospore of Rhizopus, Conidia of Fusarium, Conidiophore of Penicillium	RP	Demonstration	1 hr
	Morphological study of Fungi: fruit body of Polyporus, Cyathus), Lichens (fruticose and foliose	RP	Demonstration	1 hr

PHYTO-PATHOLOGY	Preparation of fungal media (PDA)	DS	Demonstration, experimental work	2 hr
	Sterilization process.	DS	Demonstration, experimental work	2 hr
	Isolation of pathogen from diseased leaf.	DS	Demonstration, experimental work	1 hr
	Inoculation of fruit and subculturing.	DS	Demonstration, experimental work	2 hr
	Identification : Pathological specimens- 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	DS	Demonstration, interactive discussion	3 hr
FIELD WORK	Study and collection of macrofungi	MM, DS	Field visit, demonstration	4 hr

SEMESTER- II (Theory)

CORE COURSE 3

PLANT ANATOMY (BOT-A-CC-2-3-TH)

TOPIC	SUBTOPIC	TEACHER	TEACHING METHOD	CLASS HOUR
ANATOMY	Cell wall: Ultrastructure & Chemical constituents, Plasmodesmata- ultrastructure, Concept of Apoplast and Symplast, Growth and Thickening of cell wall	MM	Class lecture, power point presentation, interactive discussion	3 hr
	Stomata: Types (Metcalfe and Chalk, Stebbins and Khush)	MM	Class lecture, power point presentation, interactive discussion	1 hr
	Stele: Leaf-trace and leaf-gap, Stelar types & evolution	MM	Class lecture, power point presentation, interactive discussion	2 hr

	Primary structure of stem and root: - Monocot and Dicot. Leaf- dorsiventral and isobilateral	MM	Class lecture, power point presentation, interactive discussion	6 hr
	Secondary growth: Normal (intra- & extra-stelar), Anomalous (stem of *Bignonia*, *Boerhavia*, *Tecoma*, *Dracaena* and root of *Tinospora*)	MM	Class lecture, power point presentation, interactive discussion	5 hr
	Mechanical tissues and the Principles governing their distribution in plants	MM	Class lecture, power point presentation, interactive discussion	2 hr
	Developmental Anatomy: Organisation of shoot apex (Tunica–Corpus) and Root apex (Korper-Kappe), Plastochrone	MM	Class lecture, power point presentation, interactive discussion	2 hr

	Ecological Anatomy: Adaptive anatomical features of Hydrophytes, Xerophytes	MM	Class lecture, power point presentation, interactive discussion	2 hr
	Scope of plant anatomy: application in systematics, forensics and pharmacognosy	MM	Class lecture, power point presentation, interactive discussion	3 hr

SEMESTER- II (PRACTICAL)

CORE COURSE 3

PLANT ANATOMY (BOT-A-CC-2-3-P)

TOPIC	SUB-TOPIC	TEACHER	TEACHING METHOD	CLASS HOUR
Microscopic studies	Microscopic studies on: Types of stomata, sclereids, raphides (Colocasia), cystolith (Ficus leaf) starch grains, aleurone grains, laticiferous ducts, oil glands	MM	Demonstration, experimental work	3 hr

Study of anatomical details from slides	Root: Monocot and dicot, b) Stem- Monocot and dicot, c) Leaf- Monocot and dicot	MM	Demonstration, experimental work	6 hr
Study of anomalous secondary structure	*Bignonia, Boerhaavia, Tecoma, Dracaena and root of Tinospora*	MM	Demonstration, experimental work	5 hr
Study of adaptive anatomical features	Hydrophytes (Nymphaea – petiole) and Xerophytes (Nerium – leaf)	MM	Demonstration, experimental work	1 hr

CORE COURSE 4 (THEORITICAL)

ARCHAEGONIATE (BOT-A-CC-2-4-TH)

TOPIC	SUB-TOPIC	TEACHER	TEACHING METHOD	CLASS HOUR
BRYOPHYTES	General Account: General characteristics and adaptations to land habit, Classification (Strotler	RP	Class lecture, power point presentation,	4 hr

	and Crandle Strotler, 2009) up to class with diagnostic characters and examples		interactive discussion	
	Life History: Gametophyte structure and Reproduction, Development and Structure of sporophyte, Spore dispersal in: Marchantia, Anthoceros, Funaria.	RP	Class lecture, power point presentation, interactive discussion	4 hr
	Phylogeny: Unifying features of archaegoniates; transition to land habit, Origin of Alternation of Generations (Homologous and Antithetic theory), Evolution of Sporophytes (Progressive and Regressive concept), Origin of Bryophytes	RP	Class lecture, power point presentation, interactive discussion	4 hr
	Importance: Role of bryophytes in: Plant succession, Pollution Monitoring, Economic importance of bryophytes with special reference to Sphagnum	RP	Class lecture, power point presentation, interactive discussion	2 hr
PTERIDOPHYTES	General Account: Colonisation and rise of early land plants, Classification of vascular plants by Gifford & Foster (1989) upto division	DS	Class lecture, power point presentation,	2 hr

	(Rhyniophyta to Filicophyta) with diagnostic characters and examples		interactive discussion	
	Life History: Sporophyte structure, Reproduction and Structure of gametophyte in Psilotum, Selaginella, Equisetum, Pteris.	DS	Class lecture, power point presentation, interactive discussion	8 hr
	Telome concept and its significance in the origin of different groups of Pteridophytes	DS	Class lecture, power point presentation, interactive discussion	2 hr
	Heterospory and Origin of Seed habit	DS	Class lecture, power point presentation, interactive discussion	2 hr
	Economic importance as food, medicine and Agriculture	DS	Class lecture, power point presentation,	1 hr

			interactive discussion	
GYMNOSPERMS	Classification: Classification of vascular plants by Gifford & Foster (1989) upto division (Progymnospermophyta to Gnetophyta) with diagnostic characters and examples	RP	Class lecture, power point presentation, interactive discussion	3 hr
	Progymnosperms: Diagnostic characters of the group, Vegetative and reproductive features of Archeopteris, Phylogenetic importance	RP	Class lecture, power point presentation, interactive discussion	2 hr
	Life History: Distribution in India; Vegetative and Reproductive structure of sporophyte, Development of gametophyte in : Cycas , Pinus and Gnetum	RP	Class lecture, power point presentation, interactive discussion	2 hr
	Economic Importance with reference to Wood, Resins, Essential oils, and Drugs	RP	Class lecture, power point presentation,	2 hr

			interactive discussion	

CORE COURSE 4 (PRACTICAL)

ARCHAEGONIATE (BOT-A-CC-2-4-P)

TOPIC	SUB-TOPIC	TEACHER	TEACHING METHOD	CLASS HOUR
BRYOPHYTES	Morphological study: *Riccia*, *Porella*	DS	Demonstration, interactive discussion	1 hr
	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)	DS	Demonstration, interactive discussion	3 hr
PTERIDOPHYTES	Morphological study of the sporophytic plant body: Lycopodium, Ophioglossum and Marsilea	DS	Demonstration, interactive discussion	1 hr
	Workout of the reproductive structures: Selaginella, Equisetum, Pteris	DS	Demonstration, interactive	6 hr

			discussion, work out	
	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).	DS	Demonstration, interactive discussion	2 hr
GYMNOSPERMS	Morphological study: Cycas (microsporophyll and megasporophyll), Pinus (female and male cone), Gnetum (female and male cone)	DS	Demonstration, interactive discussion	2 hr
	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)	DS	Demonstration, interactive discussion	2 hr
FIELD STUDY	Botanical excursion to familiarize the students with the natural habitats of Bryophyte, Pteridophyta and gymnosperms	DS, MM	Field visit, demonstration	4 hr

CORE COURSE-5 (THEORETICAL)

PALAEOBOTANY AND PALYNOLOGY (BOT-A-CC-3-5-TH)

TOPIC	SUB-TOPIC	TEACHER	TEACHING METHOD	CLASS HOUR
PALAEOBOTANY & PALYNOLOGY	Geological time scale with dominant plant groups through ages	MM	Online teaching through Google meet, ppt, interactive discussion	4 hr
	Plant Fossil: Types: Body fossil (Micro- and Megafossils), Trace fossil, Chemical fossil, Index fossil, Different modes of preservation (Schopf, 1975), Conditions favouring fossilization, Nomenclature and Reconstruction, Principle of fossil dating (a brief idea), Importance of fossil study	MM	Online teaching through Google meet, ppt, interactive discussion	5 hr
	Fossil Pteridophytes: Structural features, Geological distribution and Evolutionary significance of Rhynia, Lepidodendron (Reconstructed), Calamites (Reconstructed)	MM	Online teaching through Google meet, ppt,	6 hr

			interactive discussion	
	Fossil gymnosperms: Structural features and Geological distribution of reconstructed genera: Lyginopteris, Williamsonia, Cordaites	MM	Online teaching through Google meet, ppt, interactive discussion	4 hr
	Indian Gondwana System: Three fold division with major megafossil assemblages	MM	Online teaching through Google meet, ppt, interactive discussion	2 hr
	Palynology: Spore and Pollen, Pollen aperture types, NPC classification (Erdtman) Pollen wall Sporopollenin, Stratification and Ornamentation (sculpturing)	MM	Online teaching through Google meet, ppt, interactive discussion	3 hr
	Applied Palynology: Basic concepts of: Palaeopalynology, Aeropalynology, Forensic palynology, Melissopalynology	MM	Online teaching through Google meet, ppt,	4 hr

			interactive discussion	

CORE COURSE-5 (PRACTICAL)

PALAEOBOTANY AND PALYNOLOGY (BOT-A-CC-3-5-P)

CC-5	TOPIC	TEACHER	TEACHING METHOD	CLASS HOUR
PALAEOBOTANY AND PALYNOLOGY	Morphological study: Ptilophyllum and Glossopteris leaf fossils	MM	Demonstration, interactive discussion	1 hr
	Study from permanent slides: T.S. of stem of *Rhynia, Lepidodendron, Calamites, Lyginopteris, Cordaites*	MM	Demonstration, interactive discussion	3 hr
	Study of Pollen types: (colpate from *Leonurus sibiricus*/ Brassica sp., porate from Hibiscus rosa-sinensis and colporate from *Cassia sophera*/ *C. tora*)	DS	Demonstration, interactive discussion, work out	2 hr

CORE COURCE- 6 (THEORETICAL)

REPRODUCTIVE BIOLOGY OF ANGIOSPERMS (BOT-A-CC-3-6-TH)

TOPIC	SUB-TOPIC	TEACHER	TEACHING METHOD	CLASS HOUR
MORPHOLOGY OF ANGIOSPERMS	Inflorescence types with examples	DS	Online teaching through Google meet, ppt, interactive discussion	3 hr
	Flower, induction of flowering, flower development- genetic and molecular aspects	DS	Online teaching through Google meet, ppt, interactive discussion	4 hr
	Fruits and seeds types with examples	DS	Online teaching through Google meet, ppt, interactive discussion	4 hr
EMBRYOLOGY	Pre-fertilisation changes: Microsporogenesis and Microgametogenesis, Megasporogenesis and	DS	Online teaching through Google	6 hr

	Megagametogenesis (monosporic, bisporic and tetrasporic)		meet, ppt, interactive discussion	
	Fertilisation: Pollen germination, Pollen tube-growth, entry into ovule and discharge, Double fertilization	DS	Online teaching through Google meet, ppt, interactive discussion	3 hr
	Post-fertilization changes: Embryogenesis in Capsella, Development of Endosperm (3 types)	DS	Online teaching through Google meet, ppt, interactive discussion	2 hr
	Apomixis & Polyembryony: Apomixis- Apospory and Apogamy, Polyembryony- different types	DS	Online teaching through Google meet, ppt, interactive discussion	1 hr

CORE COURCE- 6 (PRACTICAL)

REPRODUCTIVE BIOLOGY OF ANGIOSPERMS (BOT-A-CC-3-6-P)

TOPIC	SUB-TOPIC	TEACHER	TEACHING METHOD	CLASS HOUR
REPRODUCTIVE BIOLOGY OF ANGIOSPERMS	Inflorescence types- study from fresh/ preserved specimens	DS	Demonstration, interactive discussion	2 hr
	Flowers- study of different types from fresh/ preserved specimens	DS	Demonstration, interactive discussion	2 hr
	Fruits- study from different types from fresh/preserved specimens	DS	Demonstration, interactive discussion	2 hr
	Study of ovules (permanent slides/ specimens/photographs)- types (anatropous, orthotropous, amphitropous and campylotropous)	DS	Demonstration, interactive discussion	1 hr
	Field work to give a comprehensive idea about different types of inflorescence, flowers and fruits	DS, MM	Demonstration	4 hr

CORE COURSE- 7 (THEORETICAL)

PLANT SYSTEMATICS (BOT-A-CC-3-7-TH)

TOPIC	SUB-TOPIC	TEACHER	TEACHING METHOD	CLASS HOUR
TAXONOMY OF ANGIOSPERMS	Introduction: Components of Systematic: Nomenclature, Identification, Classification; Taxonomy and its phases - Pioneer, Consolidation, Biosystematic and Encyclopaedic; alpha- and omega- taxonomy	DS	Online teaching through Google meet, ppt, interactive discussion	3 hr
	Nomenclature: Type method, Publication, Rank of taxa, Rules of priority, Retention and rejection of names, Author Citation, Effective and valid publication, Elementary knowledge of ICN-Principles	DS	Online teaching through Google meet, ppt, interactive discussion	3 hr
	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. Systematics in Practice: Herbaria and Botanical Gardens – their role in teaching and research;	DS	Online teaching through Google meet, ppt, interactive discussion	8 hr

	important Herbaria and Botanical Gardens of India and world (3 each); Dichotomous keys – indented and bracketed			
	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	RP	Online teaching through Google meet, ppt, interactive discussion	2 hr
	Data sources in Taxonomy: Supportive evidences from: Phytochemistry, Cytology, Palynology and Molecular biology data (Protein and Nucleic acid homology)	RP	Online teaching through Google meet, ppt, interactive discussion	6 hr
	Diagnostic features, Systematic position (Bentham & Hooker and Cronquist), Economically important plants (parts used and uses): Monocotyledons- Alismataceae, Gramineae (Poaceae), Cyperaceae, Palmae (Arecaceae), Liliaceae, Musaceae, Zingiberaceae, Cannaceae, Orchidaceae	RP	Online teaching through Google meet, ppt, interactive discussion	6 hr

	Diagnostic features, Systematic position (Bentham & Hooker and Cronquist), Economically important plants (parts used and uses): Dicotyledons- Nymphaeaceae, Magnoliaceae, Leguminosae (subfamilies), Polygonaceae, Euphorbiaceae, Malvaceae, Umbelliferae (Apiaceae), Labiatae (Lamiaceae), Solanaceae, Scrophulariaceae, Acanthaceae, Rubiaceae, Cucurbitaceae, Compositae (Asteraceae).	DS	Online teaching through Google meet, ppt, interactive discussion	6 hr

CORE COURSE- 7 (PRACTICAL)

PLANT SYSTEMATICS (BOT-A-CC-3-7-P)

TOPIC	SUB-TOPIC	TEACHER	TEACHING METHOD	CLASS HOUR
ANGIOSPERMS	Work out, description, preparation of floral formula and floral diagram, identification up to genus with the help of suitable literature of wild plants and systematic position according to Benthum Hooker system of classification from the following families:	DS	Demonstration, interactive discussion	10 hr

	Malvaceae, Fabaceae (Papilionaceae), Solanaceae, Scrophulariaceae, Acanthaceae, Labiatae (Lamiaceae), Rubiaceae.			
	Spot identification: (Binomial, Family) of common wild plants	DS	Demonstration, interactive discussion	3 hr
FIELD WORK	Three excursions and Herbarium specimen preparations: Acharya Jagadish Chandra Bose Indian Botanic Garden (Shibpur, Howrah) and Central National Herbarium (CNH)	DS, MM	demonstration	4 hr

SKILL ENHANCEMENT COURSE- ELECTIVE (SEC) SEC-A

BIOFERTILIZERS (BOT-A-SEC-A-3-2) (THEORETICAL)

TOPIC	SUB-TOPIC	TEACHER	TEACHING METHOD	CLASS HOUR
GENERAL ACCOUNT ABOUT THE MICROBES	Isolation, identification, mass multiplication, carrier based inoculants, actinorrhizal symbiosis.	MM	Online teaching through Google meet, ppt,	3 hr

USED AS BIOFERTILIZERS, RHIZOBIUM			interactive discussion	
AZOSPIRILLUM	Isolation and mass multiplication- carrier based inoculants, associative effect of different microorganisms.	MM	Online teaching through Google meet, ppt, interactive discussion	3 hr
AZOTOBACTER	Classification, characteristics- crop response to Azetobacter inoculants, maintenance and mass multiplication.	MM	Online teaching through Google meet, ppt, interactive discussion	3 hr
CYANOBACTERIA (BLUE GREEN ALGAE)	Azolla and Anabaena azollae association, nitrogen fixation. Factors affecting growth, blue green algae and Azolla in rice cultivation.	RP	Online teaching through Google meet, ppt, interactive discussion	3 hr
MYCORRHIZAL ASSOCIATION	Types of mycorrhizal association, phosphorus nutrition, growth and yield- colonisation of VAM –	RP	Online teaching through Google meet, ppt,	3 hr

	isolation and inoculum production of VAM and its influence on growth and yield of crop plants.		interactive discussion	
ORGANIC FARMING	Green manuring and organic fertilizers, recycling of biodegradable municipal, agricultural and industrial wastes- biocompost making methods, types and methods of vermicomposting- field application.	RP	Online teaching through Google meet, ppt, interactive discussion	3 hr

SEMESTER IV

CORE COURSE-8 (THEORETICAL)

PLANT GEOGRAPHY, ECOLOGY AND EVOLUTION (BOT-A-CC-4-8-TH)

TOPIC	SUB-TOPIC	TEACHER	TEACHING METHOD	CLASS HOUR
PLANT GEOGRAPHY	Phytogeographical regions: Phytogeographical regions of India (Chatterjee 1960); Dominant flora of Eastern Himalaya, Western Himalaya and Sundarban.	DS	Online teaching through Google meet, ppt, interactive discussion	2 hr

	Endemism: Endemic types and Factors; Age & Area hypothesis and Epibiotic theory; Endemism in Indian flora	DS	Online teaching through Google meet, ppt, interactive discussion	4 hr
ECOLOGY	Preliminary idea on: Habitat and Niche, Ecotone and edge–effect, Microclimate, Ecads, ecotype and ecoclines, Carrying capacity.	DS	Online teaching through Google meet, ppt, interactive discussion	2 hr
	Community ecology: Community- Characteristics and diversity, Ecological succession –Primary and secondary, Seral stages (with reference to Hydrosere), autogenic and allogenic succession.	DS	Online teaching through Google meet, ppt, interactive discussion	2 hr
	Plant indicators (metallophytes); Phytoremediation	DS	Online teaching through Google meet, ppt, interactive discussion	2 hr

	Conservation of Biodiversity: Level of Biodiversity: genetic, species & ecosystem diversity, Biodiversity hot spots- criteria, Indian hotspots, In- situ and ex-situ conservation, Seed-banks, Cryopreservation	DS	Online teaching through Google meet, ppt, interactive discussion	4 hr
EVOLUTION	Introduction: Theories of evolution: Natural selection, Group selection, Neutral theory of molecular evolution, Phyletic gradualism, Punctuated equilibrium and Stasis	DS	Online teaching through Google meet, ppt, interactive discussion	2 hr
	Brief idea on: Stabilizing directional, disruptive and sexual selection; Speciation: Sympatric and allopatric speciation; Coevolution, Adaptive radiation, Reproductive isolation	DS	Online teaching through Google meet, ppt, interactive discussion	3 hr
	Simplified phylogeny of bacteria, algae, fungi, bryophyte, pteridophyte and gymnosperm, Phylogenetic tree	DS	Online teaching through Google meet, ppt, interactive discussion	3 hr

CORE COURSE-8 (PRACTICAL)

PLANT GEOGRAPHY, ECOLOGY AND EVOLUTION (BOT-A-CC-4-8-P)

TOPIC	SUB-TOPIC	TEACHER	TEACHING METHOD	CLASS HOUR
PLANT GEOGRAPHY	Field work: long excursion at different phytogeographical region of India, Study of local flora	DS	Demonstration, interactive discussion	4 hr
ECOLOGY	Study of community structure by quadrat method and determination of (i) Minimal size of the quadrat, (ii) Frequency, density and abundance of components	DS	Demonstration, interactive discussion	2 hr
	Comparative anatomical studies of leaves form polluted and less polluted areas	DS	Demonstration, interactive discussion	1 hr
	Measurement of dissolved O_2 by azide modification of Winkler's method	DS	Demonstration, interactive discussion	2 hr
	Comparison of free CO_2 from different sources	DS	Demonstration, interactive discussion	2 hr

CORE COURSE- 9 (THEORETICAL)

ECONOMIC BOTANY (BOT-A-CC-4-9-TH)

CC-2	TOPIC	TEACHER	TEACHING METHOD	CLASS HOUR
ECONOMIC BOTANY	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.	RP	Online teaching through Google meet, ppt, interactive discussion	3 hr
	Cereals: Rice and wheat (origin, morphology, processing and uses).	RP	Online teaching through Google meet, ppt, interactive discussion	2 hr
	Legumes: Origin, morphology and uses of gram and mung bean. Importance to man and environment.	RP	Online teaching through Google meet, ppt,	2 hr

			interactive discussion	
	Sugar and starches: Morphology and processing of sugarcane, products and byproducts of sugarcane industry. Potato- morphology, propagation and uses.	RP	Online teaching through Google meet, ppt, interactive discussion	3 hr
	Spices: Listing of important spices, their family and part used.	RP	Online teaching through Google meet, ppt, interactive discussion	1 hr
	Beverages: Tea (morphology, processing and uses).	DS	Online teaching through Google meet, ppt, interactive discussion	2 hr
	Oil and fats: General description, classification, extraction, their uses and health implications of mustard, soybean, coconut (Botanical name, family	DS	Online teaching through Google meet, ppt,	3 hr

	and uses). Essential oils- general account, extraction methods, comparison with fatty oils and their uses.		interactive discussion	
	Drug-yielding plants: Therapeutic and habit forming drugs with special reference to Cinchona, Digitalis, Papavar, Cannabis and Tobacco (morphology, processing, uses and health hazards).	DS	Online teaching through Google meet, ppt, interactive discussion	2 hr
	Timber: general account with special reference to Sal and Teak.	DS	Class lecture, power point presentation, interactive discussion	2 hr
	Fibers: Cotton and Jute (Morphology, extraction and uses).	DS	Online teaching through Google meet, ppt, interactive discussion	2 hr

CORE COURSE- 9 (PRACTICAL)

ECONOMIC BOTANY (BOT-A-CC-4-9-P)

TOPIC	SUB-TOPIC	TEACHER	TEACHING METHOD	CLASS HOUR
ECONOMIC BOTANY	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)	DS	Demonstration, interactive discussion	3 hr
	Legume: Soybean, ground nut (habit, fruit, seed structure, micro-chemical tests)	DS	Demonstration, interactive discussion	2 hr
	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.	DS	Demonstration, interactive discussion	3 hr
	Tea- tea leaves, tests for tannin:	DS	Demonstration, interactive discussion	2 hr

	Mustard- plant specimen, seeds, tests for fat in crushed seeds	DS	Demonstration, interactive discussion	2 hr
	Habit- Digitalis, Papaver and Cannabis	DS	Demonstration, interactive discussion	1 hr
	Sal, Teak- section of young stem	DS	Demonstration, interactive discussion	2 hr
	Jute- specimen, transverse section of stem, tests for lignin on T.S. of stem and study of fibre following maceration technique	DS	Demonstration, interactive discussion	2 hr

CORE COURSE 10 (THEORETICAL)

GENETICS (BOT-A-CC-4-10-TH)

CC-2	TOPIC	TEACHER	TEACHING METHOD	CLASS HOUR
GENETICS	Introduction: Mendelian genetics and its extension	MM	Online teaching through Google	2 hr

			meet, ppt, interactive discussion	
	Linkage, Crossing over and Gene Mapping: Complete and incomplete linkage (example), linked gene does not assort independently (example), linkage group, Crossing over, crossing over produces recombination (example), detection of crossing over (McClintock's experiment), and Molecular mechanism of crossing over (Holliday model), Gene mapping with three point test cross, detection of middle gene in three point test cross, calculation of recombination frequencies, Co-efficient of coincidence and interference, mapping function, Problems on gene mapping, Molecular mapping – ISH, FISH (brief idea).	MM	Online teaching through Google meet, ppt, interactive discussion	5 hr
	Epistasis and Polygenic inheritance in plants	MM	Online teaching through Google meet, ppt, interactive discussion	2 hr

	Aneuploidy and Polyploidy: Types, examples, meiotic behaviour and importance of: Aneuploidy,. Polyploidy, Speciation and evolution through polyploidy.	MM	Online teaching through Google meet, ppt, interactive discussion	4 hr
	Chromosomal aberration: Types and meiotic behaviour of: Deletion, Duplication, Translocation and. Inversion.	MM	Online teaching through Google meet, ppt, interactive discussion	5 hr
	Mutation: Point mutation-Transition, Transversion and Frame shift mutation, Molecular mechanisms (tautomerisation, alkylation, deamination, base analogue incorporation, dimerisation), DNA repair (brief idea).	MM	Online teaching through Google meet, ppt, interactive discussion	6 hr
	Structural organisation of Gene: One Gene–one polypeptide concept, Split gene, Overlapping gene, Repetitive DNAtandem and interspersed, Transposon (Ac-Ds system), Homoeotic gene in plants (ABCE Quartet model of flowering).	MM	Online teaching through Google meet, ppt, interactive discussion	8 hr

CORE COURSE 10 (PRACTICAL)

GENETICS (BOT-A-CC-4-10-TH)

TOPIC	SUB-TOPIC	TEACHER	TEACHING METHOD	CLASS HOUR
GENETICS	Introduction to chromosome preparation: Pre-treatment, Fixation, Staining, Squash and Smear preparation, Preparation of permanent slides.	MM	Demonstration, interactive discussion	3 hr
	Determination of mitotic index and frequency of different mitotic stages in pre-fixed root tips of Allium cepa.	MM	Demonstration, interactive discussion	4 hr
	Study of mitotic chromosome: 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: Allium cepa, Aloe vera, Lens esculenta.	MM	Demonstration, interactive discussion	3 hr

	Study of chromosomal aberrations developed due to exposure to any two pollutants/ pesticides etc	MM	Demonstration, interactive discussion	2 hr
	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.	MM	Demonstration, interactive discussion	3 hr
	Identification from permanent slides : Meiosis – (i) normal stages (ii) abnormal stages – laggard, anaphase bridge, ring chromosome (Rhoeo discolor); Mitosis – (i) normal stages, (ii) abnormal stagesearly separation, late separation, multipolarity, sticky bridge, laggard, fragmentation, (ii) pollen mitosis.	MM	Demonstration, interactive discussion	3 hr

SKILL ENHANCEMENT COURSE- ELECTIVE (SEC) SEC-B

MUSHROOM CULTURE TECHNOLOGY (BOT-A-SEC-B-4-4) THEORETICAL

TOPIC	SUB-TOPIC	TEACHER	TEACHING METHOD	CLASS HOUR
INTRODUCTION	Nutritional and medicinal value of edible mushrooms; poisonous mushrooms, types of edible	MM	Online teaching through Google	2 hr

	mushrooms available in India- Volvariella volvacea, Pleurotus citrinopileatus, Agaricus bisporus.		meet, ppt, interactive discussion	
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.	MM	Online teaching through Google meet, ppt, interactive discussion	3 hr
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	RP	Online teaching through Google meet, ppt, interactive discussion	3 hr
FOOD PREPARATION	Type of foods prepared from mushroom. Research centres- National level and regional level. Cost	RP	Class lecture, power point	3 hr

	benefit ratio- marketing in India and abroad. Export value.		presentation, interactive discussion	

SEMESTER V

CORE COURSE- 11 (THEORETICAL)

CELL AND MOLECULAR BIOLOGY (BOT-A-CC-5-11-TH)

TOPIC	SUB-TOPIC	TEACHER	TEACHING METHOD	CLASS HOUR
CELL BIOLOGY	Origin and Evolution of Cells: 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, Organellar DNA (cp- and mt- DNA).	RP	Online teaching through Google meet, ppt, interactive discussion	6 hr
	Nucleus and Chromosome: Nuclear envelope, Nuclear lamina and Nuclear pore complex, 2.2. Nucleolus- ultrastructure and ribosome biogenesis, 2.3. Chromatin ultrastructure and DNA packaging in	MM	Online teaching through Google meet, ppt,	4 hr

	eukaryotic chromosome, 2.4. Centromere: types, structure and function.		interactive discussion	
	Cell cycle and its regulation: Kinetochore and spindle apparatus-structural organization and functions, Microtubulesstructure, organization and function, Mechanism of cell cycle control in Yeast (checkpoints and role of MPF), Apoptosis (Brief idea).	MM	Online teaching through Google meet, ppt, interactive discussion	4 hr
MOLECULAR BIOLOGY	DNA Replication, Transcription and Translation (Prokaryotes & Eukaryotes): Central Dogma, Semiconservative DNA replication – mechanism, enzymes involved in DNA replication- DNA polymerase, DNA gyrase, Helicase, Ligase, primase and other accessory proteins, Eukaryotic replication with special reference to replication licensing factor, assembly of new nucleosome, replication at the end chromosome telomere, telomerase concept, Fidelity of DNA replication- prokaryote: nucleotide selection, proof reading, mismatch repair; eukaryote: through selection of error prone DNA polymerase, Transcription, RNA processing, Aminoacylation of tRNA, Translation.	MM	Online teaching through Google meet, ppt, interactive discussion	12 hr

	Gene Regulation: Concept of Lac-operon, Positive and negative control.	MM	Online teaching through Google meet, ppt, interactive discussion	4 hr
	Genetic Code: Properties-evidences & exceptions, Decipherence of codon (Binding technique).	MM	Online teaching through Google meet, ppt, interactive discussion	3 hr
	Recombinant DNA Technology: Restriction endonuclease, - types and roles, Vector (plasmid pBR 322), Marker gene, Steps of cloning technique, PCR and its application, Genomic DNA and cDNA library.	MM	Online teaching through Google meet, ppt, interactive discussion	6 hr
	Development and causes of Cancer, tumor suppressor gene and oncogene	MM	Online teaching through Google meet, ppt, interactive discussion	2 hr

CORE COURSE- 11 (PRACTICAL)

CELL AND MOLECULAR BIOLOGY (BOT-A-CC-5-11-P)

TOPIC	SUB-TOPIC	TEACHER	TEACHING METHOD	CLASS HOUR
CELL BIOLOGY	Study of plant cell structure with the help of epidermal peal mount of Onion/Rhoeo/Crinum	MM	Demonstration, interactive discussion	3 hr
	Measurement of cell size by the technique of micrometry	MM	Demonstration, interactive discussion	2 hr
	Counting cells per unit volume with the help of haemocytometer (Yeast/ pollengrains)	MM	Demonstration, interactive discussion	2 hr
	Cytochemical staining of DNA- Pyronine-methyl green staining	MM	Demonstration, interactive discussion	4 hr
	Estimation of DNA content through DPA staining.	MM	Demonstration, interactive discussion	3 hr

	Estimation of RNA through orcinol method.	MM	Demonstration, interactive discussion	3 hr
	Study of nucleolus through hematoxylin/ orcin staining and determination of nucleolar frequency	MM	Demonstration, interactive discussion	3 hr
	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 splicing.	MM	Demonstration, interactive discussion	4 hr

CORE COURSE- 12 (THEORETICAL)

BIOCHEMISTRY (BOT-A-CC-5-12-TH)

CC-2	TOPIC	TEACHER	TEACHING METHOD	CLASS HOUR
BIOCHEMISTRY	Biochemical Foundations: Covalent and non-covalent bonds; hydrogen bond; Van der Waal's forces; 1.2. Structure and properties of water; 1.3.	RP	Online teaching through Google meet, ppt,	4 hr

	pH and buffer (inorganic and organic); 1.4. Handerson-Hasselbalch equation; 1.5. Isoelectric point.		interactive discussion	
	Molecules of life: Nucleic Acids – structure of nucleosides and nucleotides ; oligo- and poly nucleotides , B & Z form of DNA, RNA- different forms; nucleotide derivatives (ATP, NADP), Proteins – structure and classification of amino acids; primary, secondary, tertiary and quaternary structure of proteins; Carbohydrates - structure of mono-, di- and polysaccharide; stereoisomers, enantiomers and epimers; Lipids - structure of simple lipid and compound lipid (phospholipids and glycolipids), fatty acids- saturated and unsaturated.	DS	Online teaching through Google meet, ppt, interactive discussion	4 hr
	Energy flow and enzymology: Bioenergetics- Thermodynamic principles; free energy; energy rich bonds- phosphoryl group transfer and ATP; redox potentials and Biological redox reactions, Enzymes – classification and nomenclature (IUBMB); Co-factors and co-enzymes; isozymes,	DS	Online teaching through Google meet, ppt, interactive discussion	4 hr

	Mechanism of enzyme action; enzyme inhibition; Enzyme kinetics (Michaelis- Menten equation) and simple problems.			
	Cell membrane: Membrane chemistry, Membrane transport (uniport, symport, antiport), mechanism of ion uptake.	DS	Online teaching through Google meet, ppt, interactive discussion	4 hr
	Phosphorylation: ATP Synthesis- Chemiosmotic model, Oxidative and Photophosphorylation, Mechanism and differences.	DS	Online teaching through Google meet, ppt, interactive discussion	4 hr

CORE COURSE- 12 (PRACTICAL)

BIOCHEMISTRY (BOT-A-CC-5-12-P)

TOPIC	SUB-TOPIC	TEACHER	TEACHING METHOD	CLASS HOUR
PLANT BIOCHEMISTRY- Qualitative	Detection of organic acids: citric, tartaric, oxalic and malic from laboratory samples	DS	Demonstration, interactive discussion	4 hr
	Detection of carbohydrate and protein from plant samples	DS	Demonstration, interactive discussion	3 hr
	Detection of the nature of carbohydrate – glucose, fructose , sucrose and starch from laboratory Samples	DS	Demonstration, interactive discussion	5 hr
	Detection of Ca, Mg, Fe, S from plant ash sample	DS	Demonstration, interactive discussion	2 hr
PLANT BIOCHEMISTRY- Quantitative	Preparation of solutions and buffers	DS	Demonstration, interactive discussion	2 hr

	Estimation of amino-nitrogen by formol titration method (glycine)	DS	Demonstration, interactive discussion	2 hr
	Estimation of glucose by Benedicts quantitative reagent	DS	Demonstration, interactive discussion	2 hr
	Estimation of titratable acidity from lemon	DS	Demonstration, interactive discussion	2 hr
	Estimation of catalase activity in plant samples and effect of substrate, enzyme concentration and pH on enzyme activity	DS	Demonstration, interactive discussion	2 hr
	Estimation of urease activity in plant samples	DS	Demonstration, interactive discussion	2 hr
	Colorimetric estimation of protein by Folin phenol reagent	DS	Demonstration, interactive discussion	4 hr

DISCIPLINE SPECIFIC ELECTIVE COURSES DSE-A

BIOSTATISTICS (BOT-A-DSE-A-5-1-TH) THEORETICAL

TOPIC	SUB-TOPIC	TEACHER	TEACHING METHOD	CLASS HOUR
BIOSTATISTICS	Definition, statistical methods, basic principles, variables- measurements, functions, limitations and uses of statistics.	DS	Online teaching through Google meet, ppt, interactive discussion	3 hr
BIOMETRY	Data, Sample, Population, Random sampling, Frequency distribution- definition only.	DS	Online teaching through Google meet, ppt, interactive discussion	3 hr
CENTRAL TENDENCY	Arithmetic Mean, Mode and Median; Measurement of dispersion–Coefficient of variation, Standard Deviation, Standard error of Mean.	DS	Online teaching through Google meet, ppt, interactive discussion	3 hr

TEST OF SIGNIFICANCE	Chi- square test for goodness of fit.	DS	Online teaching through Google meet, ppt, interactive discussion	3 hr
PROBABILITY	Multiplicative and additive rules of probability: application and importance.	DS	Online teaching through Google meet, ppt, interactive discussion	3 hr
MEASUREMENT OF GENE FREQUENCY	Hardy-Weinberg equilibrium- conditions applied for its implications (simple problems to calculate genotypic and allelic frequencies).	DS	Online teaching through Google meet, ppt, interactive discussion	3 hr

DISCIPLINE SPECIFIC ELECTIVE COURSES DSE-A

BIOSTATISTICS (BOT-A-DSE-A-5-1-P) (PRACTICAL)

TOPIC	SUB-TOPIC	TEACHER	TEACHING METHOD	CLASS HOUR
BIOSTATISTICS	Univariate analysis of statistical data: Statistical tables, mean, mode, median, standard deviation and standard error (using seedling population / leaflet size).	DS	Demonstration, interactive discussion	3 hr
	Calculation of correlation coefficient values and finding out the probability	DS	Demonstration, interactive discussion	2 hr
	Determination of goodness of fit in Mendellian and modified mono-and dihybrid ratios (3:1, 1:1, 9:3:3:1, 1:1:1:1, 9:7, 13:3, 15:1) by Chi-square analysis and comment on the nature of inheritance	DS	Demonstration, interactive discussion	8 hr
	Calculation of ‘F’ value and finding out the probability value for the F value	DS	Demonstration, interactive discussion	1 hr

	Basic idea of computer programme for statistical analysis of correlation coefficient,‘t’ test, standard error, standard deviation.	DS	Demonstration, interactive discussion	2 hr

DISCIPLINE SPECIFIC ELECTIVE COURSES DSE-B

PLANT BIOTECHNOLOGY (BOT-A-DSE-B-5-5-TH) (THEORETICAL)

TOPIC	SUB-TOPIC	TEACHER	TEACHING METHOD	CLASS HOUR
Plant tissue culture – Introduction:	Basic concept and milestones, 1.2. Cellular totipotency, 1.3. Tissue culture media, 1.4. Aseptic manipulation, 1.5. Cyto-differentiation and dedifferentiation.	MM	Online teaching through Google meet, ppt, interactive discussion	5 hr
Callus culture	Callus induction, maintenance and application, 2.2. Suspension culture- introductory idea.	MM	Online teaching through Google meet, ppt, interactive discussion	2 hr

Plant regeneration	.Organogenesis (direct and indirect), 3.2. Somatic embryogenesis, 3.3. Significance of organogenesis and somatic embryogenesis, 3.4. Artificial seed.	MM	Online teaching through Google meet, ppt, interactive discussion	4 hr
Haploid Culture	Anther and Pollen culture methods, Applications.	MM	Online teaching through Google meet, ppt, interactive discussion	2 hr
Protoplast Culture	Protoplast isolation and culture, Protoplast fusion (somatic hybridization), Significance.	MM	Online teaching through Google meet, ppt, interactive discussion	2 hr
Plant Genetic Engineering	Brief concept of different gene transfer methods, special emphasis on Agrobacterium mediated gene transfer, Role of Reporter gene, Achievements in crop biotechnology, environment and industry (suitable example)- pest resistant plants (BT cotton), herbicide resistance, disease and stress tolerance,	MM	Online teaching through Google meet, ppt, interactive discussion	4 hr

	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.			

DISCIPLINE SPECIFIC ELECTIVE COURSES DSE-B

PLANT BIOTECHNOLOGY (BOT-A-DSE-B-5-5-P) (PRACTICAL)

TOPIC	SUB-TOPIC	TEACHER	TEACHING METHOD	CLASS HOUR
PLANT BIOTECHNOLOGY	Familiarization of basic equipments in plant tissue culture	MM	Demonstration, interactive discussion	3 hr
	Study through photographs/ charts/ models of anther culture, somatic embyogenesis, endosperm and embryo culture, micropropagation	MM	Demonstration, interactive discussion	6 hr
	Preparation of basal media. Sterilization techniques	MM	Demonstration, interactive discussion	5 hr

	Demonstration of any tissue culture technique during visit in a plant tissue culture lab	MM	Demonstration, interactive discussion	3 hr

SEMESTER VI

CORE COURSE-13 (THEORETICAL)

PLANT PHYSIOLOGY (BOT-A-CC-6-13-TH)

TOPIC	SUB-TOPIC	TEACHER	TEACHING METHOD	CLASS HOUR
PLANT PHYSIOLOGY	Plant-water relations: Concept of water potential, components of water potential in plant system, Soil-plantAtmosphere continuum concept, Cavitation in xylem and embolism, Stomatal physiologymechanism of opening and closing, Role of carbon di-oxide, potassium ion, abscisic acid and blue light in stomatal movement, Antitranspirants.	RP	Online teaching through Google meet, ppt, interactive discussion	4 hr
	Mineral nutrition: Essential and beneficial elements, macro- and micronutrients, methods of study and use of nutrient solutions, criteria for essentiality, mineral	DS	Online teaching through Google meet, ppt,	2 hr

	deficiency symptoms, roles of essential elements, chelating agents.		interactive discussion	
	Organic Translocation: Phloem sap, P-protein, Phloem loading and unloading, Mass-flow (pressure flow) hypothesis and its critical evaluation.	DS	Online teaching through Google meet, ppt, interactive discussion	2 hr
	Plant Growth Regulators: Physiological roles of Auxin, Gibberellin, Cytokinin, Abscisic acid, Ethylene, Chemical nature – IAA, GA_3, Kinetin, Biosynthesis and bioassay of IAA, Mode of action of IAA, Brassinosteroids and Polyamines as PGRs (brief idea).	DS	Online teaching through Google meet, ppt, interactive discussion	4 hr
	Photomorphogenesis: Concept of photomorphogenesis, Photoperiodism and plant types, Perception of photoperiodic stimulus, Critical day length, concept of light monitoring, Phytochrome, cryptochrome and phototropins-chemical nature and role in photomorphogenesis, Role of GA in flowering, Vernalisation – role of low	DS	Online teaching through Google meet, ppt, interactive discussion	3 hr

	temperature in flowering, Concept of biological clock and biorhythm.			
	Seed dormancy: Types, Causes and Methods of breaking seed dormancy, Biochemistry of seed germination.	DS	Online teaching through Google meet, ppt, interactive discussion	3 hr
	Physiology of Senescence and Ageing	DS	Online teaching through Google meet, ppt, interactive discussion	1 hr

CORE COURSE-13 (PRACTICAL)

PLANT PHYSIOLOGY PLANT PHYSIOLOGY (BOT-A-CC-6-13-P)

TOPIC	SUB-TOPIC	TEACHER	TEACHING METHOD	CLASS HOUR
PLANT PHYSIOLOGY	Determination of loss of water per stoma per hour.	DS	Demonstration, interactive discussion	2 hr
	Relationship between transpiration and evaporation.	DS	Demonstration, interactive discussion	2 hr
	Measurement of osmotic pressure of storage tissue by weighing method.	DS	Demonstration, interactive discussion	2 hr
	Measurement of osmotic pressure of Rhoeo leaf by plasmolytic method.	DS	Demonstration, interactive discussion	2 hr
	Effect of temperature on absorption of water by storage tissue and determination of Q10.	DS	Demonstration, interactive discussion	2 hr

	Rate of imbibition of water by starchy, proteinaceous and fatty seeds and effect of seed coat.	DS	Demonstration, interactive discussion	2 hr
	To study the phenomenon of seed germination (effect of light).	DS	Demonstration, interactive discussion	2 hr
	To study the induction of amylase activity in germinating grains.	DS	Demonstration, interactive discussion	2 hr
	To study the effect of different concentrations of IAA on Avena coleopotile elongation (IAA bioassay)	DS	Demonstration, interactive discussion	2 hr

CORE COURSE 14 (THEORETICAL)

PLANT METABOLISM (BOT-A-CC-6-14-TH)

TOPIC	SUB-TOPIC	TEACHER	TEACHING METHOD	CLASS HOUR
PLANT METABOLISM	Concept of metabolism: Introduction, Anabolic and catabolic metabolic pathways, regulation of	MM	Online teaching through Google	3 hr

	metabolism, role of regulatory enzymes (allosteric, covalent modulation and isozymes)		meet, ppt, interactive discussion	
	Photosynthesis: Chemical structure of chlorophyll a and b, absorption and action spectra, biological significance of carotenoid pigments, Red drop and Emerson effect, Components of photosystems (light harvesting complex), photochemical reaction centres, Cyclic and noncyclic electron transport, Water splitting mechanism, Calvin cycle – Biochemical reactions & stoichiometry, HSK Pathway– three variants of the pathway, Photosynthetic efficiency of C3 and C4 plants and crop productivity, Photorespiration – mechanism and significance, Crassulacean Acid Metabolism– mechanism and ecological significance.	MM	Online teaching through Google meet, ppt, interactive discussion	5 hr
	Respiration: EMP pathway, regulation and its anabolic role, Conversion of Pyruvic acid to Acetyl CoA, TCA-cycle and its amphibolic role, Oxidative pentose phosphate pathway and its significance, Mitochondrial electron transport system, uncouplers,	MM	Online teaching through Google meet, ppt, interactive discussion	4 hr

	Oxidation of cytosolic $NADH^{+}H^{+}$, Stoichiometry of glucose oxidation (aerobic).			
	Nitrogen Metabolism: Assimilation of nitrate by plants, Biochemistry of dinitrogen fixation in Rhizobium, General principle of amino acid biosynthesis (including GS and GOGAT enzyme system).	MM	Online teaching through Google meet, ppt, interactive discussion	2 hr
	Lipid metabolism: synthesis and breakdown of triglycerides, ß-oxidation, glyoxalate cycle, gluconeogenesis and its role in mobilization of the lipids during seed germinbations, α- oxidation	MM	Online teaching through Google meet, ppt, interactive discussion	3 hr
	Mechanism of signal transduction: Mechanism of signal transduction: receptor-ligand interactions, second messenger concept, calcium-calmodilin, G protein, MAP-kinase cascade.	MM	Online teaching through Google meet, ppt, interactive discussion	2 hr

CORE COURSE 14 (PRACTICAL)

PLANT METABOLISM (BOT-A-CC-6-14-P)

TOPIC	SUB-TOPIC	TEACHER	TEACHING METHOD	CLASS HOUR
PLANT METABOLISM	A basic idea of chromatography	MM	Demonstration, interactive discussion	2 hr
	Separation of plastidial pigments by solvent and paper chromatography	MM	Demonstration, interactive discussion	3 hr
	Estimation of total chlorophyll content from different chronologically aged leaves (young, mature and senescence) by Arnon method	MM	Demonstration, interactive discussion	3 hr
	Effect of HCO_3 concentration on oxygen evolution during photosynthesis in an aquatic plant and to find out the optimum and toxic concentration (either by volume measurement or bubble counting)	MM	Demonstration, interactive discussion	3 hr

	Measurement of oxygen uptake by respiring tissue (per g/hr.)	MM	Demonstration, interactive discussion	2 hr
	Determination of the RQ of germinating seeds.	MM	Demonstration, interactive discussion	2 hr
	Test of seed viability by TTC method.	MM	Demonstration, interactive discussion	3 hr

DISCIPLINE SPECIFIC ELECTIVE COURSES DSE-A

MEDICINAL AND ETHNOBOTANY (BOT-A-DSE-A-6-3-TH) THEORETICAL

TOPIC	SUB-TOPIC	TEACHER	TEACHING METHOD	CLASS HOUR
Medicinal botany	History, scope and importance of medicinal plant, a brief idea about indigenous medicinal sciences- ayurveda, siddha and unani. Polyherbal formulations.	DS	Online teaching through Google meet, ppt, interactive discussion	2 hr

Pharmacognosy	Pharmacognosy and its importance in modern medicine, Crude drugs, Classification of drugs- chemical and pharmacological, Drug evaluation– organoleptic, microscopic, chemical, physical and biological, Major pharmacological groups of plant drugs and their uses.	DS	Online teaching through Google meet, ppt, interactive discussion	4 hr
Secondary metabolites	Definition of secondary metabolites and difference with primary metabolites , Interrelationship of basic metabolic pathways with secondary metabolite biosynthesis (outlines only), Major types–terpenoids, phenolics, flavonoids, alkaloids and their protective action against pathogenic microbes and herbivores.	DS	Online teaching through Google meet, ppt, interactive discussion	3 hr
Pharmacologically active constituents	Source plants (one example) parts used and uses of: Steroids (Solasodin, Diosgenin, Digitoxin), Tannin (Catechin), Resins (Gingerol, Curcuminoids), Alkaloids (Quinine, Atropine. Pilocarpine, Strychnine, Reserpine, Vinblastine), Phenols (Sennocide and Capsaicin).	DS	Online teaching through Google meet, ppt, interactive discussion	2 hr
Ethnobotany and folk medicine	Definition, methods of study, application, Indian scenario, national interacts, Palaeo-ethnobotany, folk medicines in ethnobotany, ethnomedicine,	DS	Online teaching through Google meet, ppt,	3 hr

	ethnoecology, ethnic communities of India, application of natural products to certain diseasesJaudice, cardiac, infertility, diabetics, blood pressure and skin diseases		interactive discussion	

DISCIPLINE SPECIFIC ELECTIVE COURSES DSE-A

MEDICINAL AND ETHNOBOTANY (BOT-A-DSE-A-6-3-P) (PRACTICAL)

TOPIC	SUB-TOPIC	TEACHER	TEACHING METHOD	CLASS HOUR
CHEMICAL TESTS	Tannin (Camellia sinensis / Terminalia chebula), (b) Alkaloid (Catharanthus roseus)	DS	Demonstration, interactive discussion	3 hr
POWDER MICROSCOPY	Zingiber and Holarrhena	DS	Demonstration, interactive discussion	2 hr
HISTOCHEMICAL TESTS	Curcumin (Curcuma longa), Starch in non-lignified vessel (Zingiber), Alkaloid (stem of Catharanthus and bark of Holarrhena).	DS	Demonstration, interactive discussion	3 hr

DISCIPLINE SPECIFIC ELECTIVE COURSES DSE-B

Natural resource management (BOT-A-DSE-B-6-8-TH) THEORETICAL

TOPIC	SUB-TOPIC	TEACHER	TEACHING METHOD	CLASS HOUR
Natural resources	Definition and types	MM	Online teaching through Google meet, ppt, interactive discussion	1 hr
Sustainable utilization	Concept, approaches (economic, ecological and socio-cultural).	MM	Online teaching through Google meet, ppt, interactive discussion	2 hr
Land	Utilization (agricultural, pastoral, horticultural, silvicultural); Soil degradation and management.	MM	Online teaching through Google meet, ppt, interactive discussion	2 hr

Water	Fresh water (rivers, lakes, groundwater, aquifers, watershed); Marine; Estuarine; Wetlands; Threats and management strategies.	MM	Online teaching through Google meet, ppt, interactive discussion	3 hr
Biological Resources	Biodiversity-definition and types; Significance; Threats; Management strategies; Bioprospecting; IPR; CBD; National Biodiversity Action Plan).	MM	Online teaching through Google meet, ppt, interactive discussion	3 hr
Forests	Definition, Cover and its significance (with special reference to India); Major and minor Forest products; Depletion; Management.	MM	Online teaching through Google meet, ppt, interactive discussion	2 hr
Energy	Renewable and non-renewable sources of energy.	MM	Online teaching through Google meet, ppt, interactive discussion	2 hr

Contemporary practices in resource management	EIA, GIS, Participatory Resource Appraisal, Ecological Footprint with emphasis on carbon footprint, Resource Accounting; Waste management.	MM	Online teaching through Google meet, ppt, interactive discussion	3 hr
National and international efforts	National and international efforts in resource management and conservation	MM	Online teaching through Google meet, ppt, interactive discussion	3 hr

DISCIPLINE SPECIFIC ELECTIVE COURSES DSE-B

Natural resource management (BOT-A-DSE-B-6-8-P)

(PRACTICAL)

TOPIC	SUB-TOPIC	TEACHER	TEACHING METHOD	CLASS HOUR
Natural resource management	Estimation of solid waste generated by a domestic system (biodegradable and non-biodegradable) and its impact on land degradation.	MM	Online teaching through Google meet, ppt,	3 hr

			interactive discussion	
	Estimation of foliar dust deposition.	MM	Online teaching through Google meet, ppt, interactive discussion	2 hr
	Determination of total solid in water (TDS)	MM	Online teaching through Google meet, ppt, interactive discussion	3 hr
	Determination of chemical properties of soil by rapid spot test (carbonate, iron, nitrate)	MM	Online teaching through Google meet, ppt, interactive discussion	3 hr
	Estimation of organic carbon percentage present in soil sample	MM	Online teaching through Google meet, ppt,	3 hr

			interactive discussion	
	Collection of data on forest cover of specific area	MM	Online teaching through Google meet, ppt, interactive discussion	3 hr

DEPARTMENT OF BOTANY

TEACHING PLAN FOR GENERAL COURSE (UNDER CBCS SYSTEM)

ACADEMIC SESSION 2018-19

SEMESTER-I GENERAL

PLANT DIVERSITY I
(BOT-G-CC-1-1-TH)

(THEORETICAL)

TOPIC	SUBTOPIC	TEACHER	TEACHING METHOD	CLASS HOUR
Introduction	Introduction to different plant groups	DS	Class lecture, power point presentation, interactive discussion	2 hr
Phycology	Diagnostic characters and examples of Cyanophyceae, Rhodophyceae, Chlorophyceae, Charophyceae and Phaeophyceae, Classification: Criteria and system of Fritsch, Life histories of *Chlamydomonas*, *Chara* and *Ectocarpus*, Role of algae in the environment,	RP	Class lecture, power point presentation,	5 hr

	agriculture, biotechnology and industry.		interactive discussion	
Mycology	Diagnostic characters and examples of Oomycotina, Mastigomycotina, Zygomycotina, Ascomycotina, Basidiomycotina, Deuteromycotina (Ainsworth, 1973). Life histories of *Rhizopus* and *Ascobolus*, Economic importance of fungi, Fungal symbioses: *Mycorrhiza*, Lichen and their importance.	RP	Class lecture, power point presentation, interactive discussion	6 hr
Phytopathology	Symptoms - necrotic, hypoplastic and hyperplastic, Koch's postulates, Biotrophs and Necrotrophs, Disease triangle, Pathotoxins and phytoalexins (brief concept), Symptoms, causal organism, disease cycle and control measures of plant diseases (Late blight of potato, Brown spot of Rice, Stem rot of jute).	MM	Class lecture, power point presentation, interactive discussion	5 hr
Bryophytes	Unifying features of archaegoniates and transition to land habit, Amphibian nature of bryophytes, Diagnostic characters and examples of Hepaticopsida, Anthocerotopsida and Bryopsida (Proskauer 1957), Life histories of *Marchantia* and *Funaria*, Ecological and economic importance.	DS	Class lecture, power point presentation, interactive discussion	6 hr
Anatomy	Stomata - Types (Metcalfe & Chalk), Anatomy of root, stem and leaf of monocots and dicots, Stelar types and evolution, Secondary growth – normal in dicot stem and anomaly in stem of *Tecoma* & *Dracaena*	DS	Class lecture, power point presentation,	6 hr

			interactive discussion	

SEMESTER-I GENERAL

PLANT DIVERSITY I (PRACTICAL)
(BOT-G-CC-1-1-P)

TOPIC	SUBTOPIC	TEACHER	TEACHING METHOD	CLASS HOUR
Work out	Microscopic preparation, drawing and labeling of *Chlamydomonas*, *Chara*, *Ectocarpus*, *Rhizopus* and *Ascobolus*-	BP	Demonstration, interactive discussion	5 hr
Anatomical studies	Stem- *Cucurbita*, sunflower and maize. Root- *Colocassia*, gram and orchid. Leaf- Nerium	BP	Demonstration, interactive discussion	6 hr
Identification	Cryptogamic specimens (macroscopic/microscopic as prescribed in the theoretical syllabus. Pathological specimens (herbarium sheets) of Late blight of potato, Brown spot of rice and stem rot of jute.	BP	Demonstration, interactive discussion	3 hr

Excursion/ field work	Study of plant diversity, habitat of algae and fungi	BP	Demonstration, interactive discussion	4 hr

SEMESTER II
CC-2/GE-2
PLANT DIVERSITY II (BOT-G-CC-2-2-TH)
THEORETICAL

TOPIC	SUBTOPIC	TEACHER	TEACHING METHOD	CLASS HOUR
Pteridophytes	Diagnostic characters and examples of Psilophyta, Lycophyta, Sphenophyta & Filicophyta (Gifford & Foster 1989). Life histories of *Selaginella* and *Pteris*, Economic importance.	DS	Class lecture, power point presentation, interactive discussion	5 hr
Gymnosperms	Progymnosperms (brief idea), Diagnostic characters and examples of Cycadophyta, Coniferophyta and Gnetophyta (Gifford & Foster 1989), Life histories of Cycas and Pinus, Williamsonia (reconstructed), Economic importance of Gymnosperms.	DS	Class lecture, power point presentation, interactive discussion	5 hr

Paleobotany & Palynology	Fossil, fossilization process and factors of fossilization, Importance of fossil study. Geological time scale, Palynology - Definition, spore & pollen (brief idea), Applications.	MM	Class lecture, power point presentation, interactive discussion	5 hr
Angiosperm Morphology	Inflorescence types with examples, Flower, Fruits and seeds- type and examples.	RP	Class lecture, power point presentation, interactive discussion	5 hr
Taxonomy of Angiosperms	Artificial, Natural and Phylogenetic systems of c1assificaiton with one example each, Diagnostic features of following families- Malvaceae, Leguminosae (Fabaceae), Cucurbitaceae, Rubiaceae, Compositae (Asteraceae), Solanaceae, Acanthaceae, Labiatae (Lamiaceae), Orchidaceae, Gramineae (Poaceae).	RP	Class lecture, power point presentation, interactive discussion	7 hr

SEMESTER II
CC-2/GE-2
PLANT DIVERSITY II (PRACTICAL-)

(BOT-G-CC-2-2-P)

TOPIC	SUBTOPIC	TEACHER	TEACHING METHOD	CLASS HOUR
WORK OUT	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.	BP	Demonstration, interactive discussion	5 hr
Identification	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.	BP	Demonstration, interactive discussion	3 hr
Spot identification	Spot identification of the following Angiospermic plants (scientific names and families): *Sida rhombifolia* (Malvaceae), *Abutilon indicum* (Malvaceae), *Cassia sophera* (Fabaceae), *Tephrosia*	BP	Demonstration, interactive discussion	4 hr

	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).			
Field excursion	Local Excursions (at least two including one to Acharya Jagadish Chandra Bose Botanic Garden, Shibpur, Howrah)	BP	Demonstration, interactive discussion	3 hr
Herbarium	Demonstration for preparation of herbarium	BP	Demonstration, interactive discussion	3 hr

ACADEMIC SESSION 2019-20

SEMESTER-I GENERAL

PLANT DIVERSITY I
(BOT-G-CC-1-1-TH)

(THEORETICAL)

TOPIC	SUBTOPIC	TEACHER	TEACHING METHOD	CLASS HOUR
Introduction	Introduction to different plant groups	DS	Class lecture, power point presentation, interactive discussion	2 hr
Phycology	Diagnostic characters and examples of Cyanophyceae, Rhodophyceae, Chlorophyceae, Charophyceae and Phaeophyceae, Classification: Criteria and system of Fritsch, Life histories of *Chlamydomonas*, *Chara* and *Ectocarpus*, Role of algae in the environment, agriculture, biotechnology and industry.	RP	Class lecture, power point presentation, interactive discussion	5 hr
Mycology	Diagnostic characters and examples of Oomycotina, Mastigomycotina, Zygomycotina, Ascomycotina, Basidiomycotina, Deuteromycotina (Ainsworth, 1973). Life histories of *Rhizopus* and *Ascobolus*, Economic	RP	Class lecture, power point presentation,	6 hr

	importance of fungi, Fungal symbioses: *Mycorrhiza*, Lichen and their importance.		interactive discussion	
Phytopathology	Symptoms - necrotic, hypoplastic and hyperplastic, Koch's postulates, Biotrophs and Necrotrophs, Disease triangle, Pathotoxins and phytoalexins (brief concept), Symptoms, causal organism, disease cycle and control measures of plant diseases (Late blight of potato, Brown spot of Rice, Stem rot of jute).	MM	Class lecture, power point presentation, interactive discussion	5 hr
Bryophytes	Unifying features of archaegoniates and transition to land habit, Amphibian nature of bryophytes, Diagnostic characters and examples of Hepaticopsida, Anthocerotopsida and Bryopsida (Proskauer 1957), Life histories of *Marchantia* and *Funaria*, Ecological and economic importance.	DS	Class lecture, power point presentation, interactive discussion	6 hr
Anatomy	Stomata - Types (Metcalfe & Chalk), Anatomy of root, stem and leaf of monocots and dicots, Stelar types and evolution, Secondary growth – normal in dicot stem and anomaly in stem of *Tecoma* & *Dracaena*	DS	Class lecture, power point presentation, interactive discussion	6 hr

SEMESTER-I GENERAL

PLANT DIVERSITY I (PRACTICAL)
(BOT-G-CC-1-1-P)

TOPIC	SUBTOPIC	TEACHER	TEACHING METHOD	CLASS HOUR
Work out	Microscopic preparation, drawing and labeling of *Chlamydomonas*, *Chara*, *Ectocarpus*, *Rhizopus* and *Ascobolus*-	BP	Demonstration, interactive discussion	5 hr
Anatomical studies	Stem- *Cucurbita*, sunflower and maize. Root- *Colocassia*, gram and orchid. Leaf- Nerium	BP	Demonstration, interactive discussion	6 hr
Identification	Cryptogamic specimens (macroscopic/microscopic as prescribed in the theoretical syllabus. Pathological specimens (herbarium sheets) of Late blight of potato, Brown spot of rice and stem rot of jute.	BP	Demonstration, interactive discussion	3 hr
Excursion/ field work	Study of plant diversity, habitat of algae and fungi	BP	Demonstration, interactive discussion	4 hr

SEMESTER II
CC-2/GE-2
PLANT DIVERSITY II (BOT-G-CC-2-2-TH)
THEORETICAL

TOPIC	SUBTOPIC	TEACHER	TEACHING METHOD	CLASS HOUR
Pteridophytes	Diagnostic characters and examples of Psilophyta, Lycophyta, Sphenophyta & Filicophyta (Gifford & Foster 1989). Life histories of *Selaginella* and *Pteris*, Economic importance.	DS	Class lecture, power point presentation, interactive discussion	5 hr
Gymnosperms	Progymnosperms (brief idea), Diagnostic characters and examples of Cycadophyta, Coniferophyta and Gnetophyta (Gifford & Foster 1989), Life histories of Cycas and Pinus, Williamsonia (reconstructed), Economic importance of Gymnosperms.	DS	Class lecture, power point presentation, interactive discussion	5 hr
Paleobotany & Palynology	Fossil, fossilization process and factors of fossilization, Importance of fossil study. Geological time scale, Palynology - Definition, spore & pollen (brief idea), Applications.	MM	Class lecture, power point presentation,	5 hr

			interactive discussion	
Angiosperm Morphology	Inflorescence types with examples, Flower, Fruits and seeds- type and examples.	RP	Class lecture, power point presentation, interactive discussion	5 hr
Taxonomy of Angiosperms	Artificial, Natural and Phylogenetic systems of c1assificaiton with one example each, Diagnostic features of following families- Malvaceae, Leguminosae (Fabaceae), Cucurbitaceae, Rubiaceae, Compositae (Asteraceae), Solanaceae, Acanthaceae, Labiatae (Lamiaceae), Orchidaceae, Gramineae (Poaceae).	RP	Class lecture, power point presentation, interactive discussion	7 hr

SEMESTER II
CC-2/GE-2
PLANT DIVERSITY II (PRACTICAL-)

(BOT-G-CC-2-2-P)

TOPIC	SUBTOPIC	TEACHER	TEACHING METHOD	CLASS HOUR
WORK OUT	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.	BP	Demonstration, interactive discussion	5 hr
Identification	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.	BP	Demonstration, interactive discussion	3 hr
Spot identification	Spot identification of the following Angiospermic plants (scientific names and families): *Sida rhombifolia* (Malvaceae), *Abutilon indicum* (Malvaceae), *Cassia sophera* (Fabaceae), *Tephrosia*	BP	Demonstration, interactive discussion	4 hr

	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).			
Field excursion	Local Excursions (at least two including one to Acharya Jagadish Chandra Bose Botanic Garden, Shibpur, Howrah)	BP	Demonstration, interactive discussion	3 hr
Herbarium	Demonstration for preparation of herbarium	BP	Demonstration, interactive discussion	3 hr

SEMESTER III GENERAL
CC-3/GE-3
(BOT-G-CC-3-3-TH)
(THEORETICAL)

TOPIC	SUBTOPIC	TEACHER	TEACHING METHOD	CLASS HOUR
CELL BIOLOGY, GENETICS	Ultrastructure of nuclear envelope, nucleolus and their functions, Molecular organisation of metaphase chromosome (Nucleosome concept).	MM	Class lecture, power point presentation, interactive discussion	3 hr
	Chromosomal aberrations- deletion, duplication, inversion & translocation, Aneuploidy & Polyploidy-types, importance and role in evolution.	MM	Class lecture, power point presentation, interactive discussion	3 hr
	Central Dogma, Transcription and Translation.	MM	Class lecture, power point presentation,	4 hr

			interactive discussion	
	Genetic Code- properties.	MM	Class lecture, power point presentation, interactive discussion	2 hr
	Linkage group and Genetic map (three-point test cross).	MM	Class lecture, power point presentation, interactive discussion	3 hr
	Mutation – Point mutation (tautomerisation; transition, transversion and frame shift), Mutagen-physical and chemical.	MM	Class lecture, power point presentation, interactive discussion	3 hr
	Brief concept of Split gene, Transposons.	MM	Class lecture, power point presentation,	1 hr

			interactive discussion	
MICROBIOLOGY	Viruses- Discovery, general structure, replication (general account), DNA virus (T-phage); Lytic and lysogenic cycle, RNA virus (TMV); Economic importance;	DS	Class lecture, power point presentation, interactive discussion	4 hr
	Bacteria- discovery, general characteristics and cell structure; reproduction- vegetative, asexual and recombination (conjugation, transformation and transduction); Economic importance.	DS	Class lecture, power point presentation, interactive discussion	5 hr

SEMESTER III GENERAL
CC-3/GE-3
(BOT-G-CC-3-3-TH)
(RACTICAL)

(BOT-G-CC-3-3-P)

TOPIC	SUBTOPIC	TEACHER	TEACHING METHOD	CLASS HOUR
Cell Biology:	Staining (Aceto-orcein) and squash preparation of onion root tip: study of mitotic stages. Determination of mitotic index (from onion root tip).	MM	Demonstration, experimental work	4 hr
Microbiology	Workout Gram staining (curd/any natural source)	DS	Demonstration, experimental work	3 hr
Identification	Cytological slides of different mitotic and meiotic stages. Different forms of bacteria (*Coccus*, *Bacillus*, *Spiral*)	MM, DS	Demonstration	3 hr

SEMESTER- III GENERAL

SEC-A

BIOFERTILIZERS (BOT-G-SEC-A-3/5-2)

(THEORITICAL)

TOPIC	SUBTOPIC	TEACHER	TEACHING METHOD	CLASS HOUR
Biofertilizers	General account about microbes used as biofertilisers; *Rhizobium* identification, mass multiplication. Actinorrhizal symbiosis.	BP	Class lecture, power point presentation, interactive discussion	3 hr
Azospirillum	Identification, mass multiplication, associative effect of different microorganisms. *Azotobacter* and crop response to *Azotobacter* inoculums.	BP	Class lecture, power point presentation, interactive discussion	3 hr
Cyanobacteria	*Azolla*, *Anabaena* and *Azolla* association, blue green algae and *Azolla* in rice cultivation.	BP	Class lecture, power point presentation,	4 hr

			interactive discussion	
Mycorrhizal association	Types of Mycorrhizal association- Brief idea, Its influence on growth and yield of crop plants.	RP	Class lecture, power point presentation, interactive discussion	3 hr
Organic farming	Green manuring and organic fertilizers, Biocompost and vermicompost- making methods and field applications. Recycling of biodegradable municipal, industrial and agricultural wastes.	RP	Class lecture, power point presentation, interactive discussion	2 hr

SEMESTER IV
CC-4/ GE-4
(BOT-G-CC-4-4-TH)
THEORETICAL

TOPIC	SUBTOPIC	TEACHER	TEACHING METHOD	CLASS HOUR
Proteins	Primary, secondary and tertiary structure, Nucleic acid- DNA structure, RNA types, Enzyme- Classifications with examples (IUBMB), Mechanism of action.	RP	Class lecture, power point presentation, interactive discussion	3 hr
Transport in plants	Ascent of sap and Xylem cavitation, Phloem transport and source-sink relation.	RP	Class lecture, power point presentation, interactive discussion	2 hr
Transpiration	Mechanism of stomatal movement, significance.	RP	Class lecture, power point presentation,	2 hr

			interactive discussion	
Photosynthesis	Pigments, Action spectra and Enhancement effect, Electron transport system and Photophosphorylation, C3 and C4 photosynthesis, CAM- Reaction and Significance.	RP	Class lecture, power point presentation, interactive discussion	4 hr
Respiration	Glycolysis & Krebs cycle— Reactions and Significance, ETS and oxidative phosphorylation.	DS	Class lecture, power point presentation, interactive discussion	3 hr
Nitrogen metabolism	Biological dinitrogen fixation, Amino acid synthesis (reductive amination and transamination).	DS	Class lecture, power point presentation, interactive discussion	2 hr
Plant Growth regulators	Physiological roles of Auxin, Gibberellin, Cytokinin, Ethylene, ABA	DS	Class lecture, power point presentation,	3 hr

			interactive discussion	
Photoperiodism	(Plant types, Role of phytochrome and GA in flowering) and Vernalization	DS	Class lecture, power point presentation, interactive discussion	3 hr
Senescence	Brief idea.	DS	Class lecture, power point presentation, interactive discussion	1 hr

SEMESTER IV
CC-4/ GE-4
(BOT-G-CC-4-4-P)
PRACTICAL

TOPIC	SUBTOPIC	TEACHER	TEACHING METHOD	CLASS HOUR
Plant Physiology	Experiment on Plasmolysis.	DS	Demonstration, experimental work	2 hr
	Measurement of leaf area (graphical method) and determination of transpiration rate per unit area by weighing method.	DS	Demonstration, experimental work	2 hr
	Imbibition of water by dry seeds - proteinaceous and fatty seeds.	DS	Demonstration, experimental work	2 hr
	Evolution of O_2 during photosynthesis (using graduated tube).	DS	Demonstration, experimental work	2 hr
	Evolution of CO_2 during aerobic respiration and measurement of volume.	DS	Demonstration, experimental work	2 hr

SEMESTER- IV GENERAL

SEC B

MUSHROOM CULTURE TECHNOLOGY (BOT-G-SEC-D-4/6-4)

(THEORITICAL)

TOPIC	SUBTOPIC	TEACHER	TEACHING METHOD	CLASS HOUR
Mushroom	Nutritional and medicinal value of mushrooms. Poisonous mushrooms.	RP	Class lecture, power point presentation, interactive discussion	2 hr
Cultivation techniques/ technology of edible mushrooms in India	*Volvarealla volvacea, Pleuretus citrinopyrineatus, Agaricus bisporus*.	RP	Class lecture, power point presentation, interactive discussion	4 hr
Storage	Short term and long term, storage, drying.	RP	Class lecture, power point presentation,	2 hr

			interactive discussion	
Food preparation	Types of foods prepared from mushroom. Cost and benefit ratio	RP	Class lecture, power point presentation, interactive discussion	2 hr
Research centres	National and regional.	RP	Class lecture, power point presentation, interactive discussion	2 hr

ACADEMIC SESSION 2020-21

SEMESTER-I GENERAL

PLANT DIVERSITY I
(BOT-G-CC-1-1-TH)

(THEORETICAL)

TOPIC	SUBTOPIC	TEACHER	TEACHING METHOD	CLASS HOUR
Introduction	Introduction to different plant groups	DS	Online teaching through Google meet, ppt, interactive discussion	2 hr
Phycology	Diagnostic characters and examples of Cyanophyceae, Rhodophyceae, Chlorophyceae, Charophyceae and Phaeophyceae, Classification: Criteria and system of Fritsch, Life histories of *Chlamydomonas*, *Chara* and *Ectocarpus*, Role of algae in the environment, agriculture, biotechnology and industry.	RP	Online teaching through Google meet, ppt, interactive discussion	5 hr

Mycology	Diagnostic characters and examples of Oomycotina, Mastigomycotina, Zygomycotina, Ascomycotina, Basidiomycotina, Deuteromycotina (Ainsworth, 1973). Life histories of *Rhizopus* and *Ascobolus*, Economic importance of fungi, Fungal symbioses: *Mycorrhiza*, Lichen and their importance.	RP	Online teaching through Google meet, ppt, interactive discussion	6 hr
Phytopathology	Symptoms - necrotic, hypoplastic and hyperplastic, Koch's postulates, Biotrophs and Necrotrophs, Disease triangle, Pathotoxins and phytoalexins (brief concept), Symptoms, causal organism, disease cycle and control measures of plant diseases (Late blight of potato, Brown spot of Rice, Stem rot of jute).	MM	Online teaching through Google meet, ppt, interactive discussion	5 hr
Bryophytes	Unifying features of archaegoniates and transition to land habit, Amphibian nature of bryophytes, Diagnostic characters and examples of Hepaticopsida, Anthocerotopsida and Bryopsida (Proskauer 1957), Life histories of *Marchantia* and *Funaria*, Ecological and economic importance.	DS	Online teaching through Google meet, ppt, interactive discussion	6 hr
Anatomy	Stomata - Types (Metcalfe & Chalk), Anatomy of root, stem and leaf of monocots and dicots, Stelar types and evolution, Secondary growth – normal in dicot stem and anomaly in stem of *Tecoma* & *Dracaena*	DS	Online teaching through	6 hr

			Google meet, ppt, interactive discussion	

SEMESTER-I GENERAL

PLANT DIVERSITY I (PRACTICAL)
(BOT-G-CC-1-1-P)

TOPIC	SUBTOPIC	TEACHER	TEACHING METHOD	CLASS HOUR
Work out	Microscopic preparation, drawing and labeling of *Chlamydomonas*, *Chara*, *Ectocarpus*, *Rhizopus* and *Ascobolus*-	RP	Demonstration, interactive discussion	5 hr
Anatomical studies	Stem- *Cucurbita*, sunflower and maize. Root- *Colocassia*, gram and orchid. Leaf- Nerium	RP	Demonstration, interactive discussion	6 hr
Identification	Cryptogamic specimens (macroscopic/microscopic as prescribed in the theoretical syllabus. Pathological specimens (herbarium sheets) of Late blight of potato, Brown spot of rice and stem rot of jute.	RP	Demonstration, interactive discussion	3 hr

Excursion/ field work	Study of plant diversity, habitat of algae and fungi	RP	Demonstration, interactive discussion	4 hr

SEMESTER II
CC-2/GE-2
PLANT DIVERSITY II (BOT-G-CC-2-2-TH)
THEORETICAL

TOPIC	SUBTOPIC	TEACHER	TEACHING METHOD	CLASS HOUR
Pteridophytes	Diagnostic characters and examples of Psilophyta, Lycophyta, Sphenophyta & Filicophyta (Gifford & Foster 1989). Life histories of *Selaginella* and *Pteris*, Economic importance.	DS	Online teaching through Google meet, ppt, interactive discussion	5 hr
Gymnosperms	Progymnosperms (brief idea), Diagnostic characters and examples of Cycadophyta, Coniferophyta and Gnetophyta (Gifford & Foster 1989), Life histories of Cycas and Pinus, Williamsonia (reconstructed), Economic importance of Gymnosperms.	DS	Online teaching through Google meet,	5 hr

			ppt, interactive discussion	
Paleobotany & Palynology	Fossil, fossilization process and factors of fossilization, Importance of fossil study. Geological time scale, Palynology - Definition, spore & pollen (brief idea), Applications.	MM	Online teaching through Google meet, ppt, interactive discussion	5 hr
Angiosperm Morphology	Inflorescence types with examples, Flower, Fruits and seeds- type and examples.	RP	Online teaching through Google meet, ppt, interactive discussion	5 hr
Taxonomy of Angiosperms	Artificial, Natural and Phylogenetic systems of c1assificaiton with one example each, Diagnostic features of following families- Malvaceae, Leguminosae (Fabaceae), Cucurbitaceae, Rubiaceae, Compositae (Asteraceae), Solanaceae, Acanthaceae, Labiatae (Lamiaceae), Orchidaceae, Gramineae (Poaceae).	RP	Online teaching through Google meet, ppt, interactive discussion	7 hr

SEMESTER II
CC-2/GE-2
PLANT DIVERSITY II (PRACTICAL-)

(BOT-G-CC-2-2-P)

TOPIC	SUBTOPIC	TEACHER	TEACHING METHOD	CLASS HOUR
WORK OUT	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.	RP	Demonstration, interactive discussion	5 hr
Identification	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.	RP	Demonstration, interactive discussion	3 hr
Spot identification	Spot identification of the following Angiospermic plants (scientific names and families): *Sida rhombifolia* (Malvaceae), *Abutilon indicum* (Malvaceae), *Cassia sophera* (Fabaceae), *Tephrosia*	RP	Demonstration, interactive discussion	4 hr

	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).			
Field excursion	Local Excursions (at least two including one to Acharya Jagadish Chandra Bose Botanic Garden, Shibpur, Howrah)	RP	Demonstration, interactive discussion	3 hr
Herbarium	Demonstration for preparation of herbarium	RP	Demonstration, interactive discussion	3 hr

SEMESTER III GENERAL
CC-3/GE-3
(BOT-G-CC-3-3-TH)
(THEORETICAL)

TOPIC	SUBTOPIC	TEACHER	TEACHING METHOD	CLASS HOUR
CELL BIOLOGY, GENETICS	Ultrastructure of nuclear envelope, nucleolus and their functions, Molecular organisation of metaphase chromosome (Nucleosome concept).	MM	Online teaching through Google meet, ppt, interactive discussion	3 hr
	Chromosomal aberrations- deletion, duplication, inversion & translocation, Aneuploidy & Polyploidy-types, importance and role in evolution.	MM	Online teaching through Google meet, ppt, interactive discussion	3 hr

	Central Dogma, Transcription and Translation.	MM	Online teaching through Google meet, ppt, interactive discussion	4 hr
	Genetic Code- properties.	MM	Online teaching through Google meet, ppt, interactive discussion	2 hr
	Linkage group and Genetic map (three-point test cross).	MM	Online teaching through Google meet, ppt, interactive discussion	3 hr
	Mutation – Point mutation (tautomerisation; transition, transversion and frame shift), Mutagen-physical and chemical.	MM	Online teaching through	3 hr

			Google meet, ppt, interactive discussion	
	Brief concept of Split gene, Transposons.	MM	Online teaching through Google meet, ppt, interactive discussion	1 hr
MICROBIOLOGY	Viruses- Discovery, general structure, replication (general account), DNA virus (T-phage); Lytic and lysogenic cycle, RNA virus (TMV); Economic importance;	DS	Online teaching through Google meet, ppt, interactive discussion	4 hr
	Bacteria- discovery, general characteristics and cell structure; reproduction- vegetative, asexual and recombination (conjugation, transformation and transduction); Economic importance.	DS	Online teaching through Google meet, ppt, interactive discussion	5 hr

SEMESTER III GENERAL
CC-3/GE-3
(BOT-G-CC-3-3-TH)
(RACTICAL)

(BOT-G-CC-3-3-P)

TOPIC	SUBTOPIC	TEACHER	TEACHING METHOD	CLASS HOUR
Cell Biology:	Staining (Aceto-orcein) and squash preparation of onion root tip: study of mitotic stages. Determination of mitotic index (from onion root tip).	MM	Demonstration, experimental work	4 hr
Microbiology	Workout Gram staining (curd/any natural source)	DS	Demonstration, experimental work	3 hr
Identification	Cytological slides of different mitotic and meiotic stages. Different forms of bacteria (*Coccus*, *Bacillus*, *Spiral*)	MM, DS	Demonstration	3 hr

SEMESTER- III GENERAL

SEC-A

BIOFERTILIZERS (BOT-G-SEC-A-3/5-2)

(THEORITICAL)

TOPIC	SUBTOPIC	TEACHER	TEACHING METHOD	CLASS HOUR
Biofertilizers	General account about microbes used as biofertilisers; *Rhizobium* identification, mass multiplication. Actinorrhizal symbiosis.	RP	Online teaching through Google meet, ppt, interactive discussion	3 hr
Azospirillum	Identification, mass multiplication, associative effect of different microorganisms. *Azotobacter* and crop response to *Azotobacter* inoculums.	RP	Online teaching through Google meet, ppt, interactive discussion	3 hr

Cyanobacteria	*Azolla*, *Anabaena* and *Azolla* association, blue green algae and *Azolla* in rice cultivation.	RP	Online teaching through Google meet, ppt, interactive discussion	4 hr
Mycorrhizal association	Types of Mycorrhizal association- Brief idea, Its influence on growth and yield of crop plants.	RP	Online teaching through Google meet, ppt, interactive discussion	3 hr
Organic farming	Green manuring and organic fertilizers, Biocompost and vermicompost- making methods and field applications. Recycling of biodegradable municipal, industrial and agricultural wastes.	RP	Online teaching through Google meet, ppt, interactive discussion	2 hr

SEMESTER IV
CC-4/ GE-4
(BOT-G-CC-4-4-TH)
THEORETICAL

TOPIC	SUBTOPIC	TEACHER	TEACHING METHOD	CLASS HOUR
Proteins	Primary, secondary and tertiary structure, Nucleic acid- DNA structure, RNA types, Enzyme- Classifications with examples (IUBMB), Mechanism of action.	DS	Online teaching through Google meet, ppt, interactive discussion	3 hr
Transport in plants	Ascent of sap and Xylem cavitation, Phloem transport and source-sink relation.	DS	Online teaching through Google meet, ppt, interactive discussion	2 hr
Transpiration	Mechanism of stomatal movement, significance.	DS	Online teaching through	2 hr

			Google meet, ppt, interactive discussion	
Photosynthesis	Pigments, Action spectra and Enhancement effect, Electron transport system and Photophosphorylation, C3 and C4 photosynthesis, CAM- Reaction and Significance.	DS	Online teaching through Google meet, ppt, interactive discussion	4 hr
Respiration	Glycolysis & Krebs cycle— Reactions and Significance, ETS and oxidative phosphorylation.	DS	Online teaching through Google meet, ppt, interactive discussion	3 hr
Nitrogen metabolism	Biological dinitrogen fixation, Amino acid synthesis (reductive amination and transamination).	DS	Online teaching through Google meet, ppt, interactive discussion	2 hr

Plant Growth regulators	Physiological roles of Auxin, Gibberellin, Cytokinin, Ethylene, ABA	DS	Online teaching through Google meet, ppt, interactive discussion	3 hr
Photoperiodism	(Plant types, Role of phytochrome and GA in flowering) and Vernalization	DS	Online teaching through Google meet, ppt, interactive discussion	3 hr
Senescence	Brief idea.	DS	Online teaching through Google meet, ppt, interactive discussion	1 hr

SEMESTER IV
CC-4/ GE-4
(BOT-G-CC-4-4-P)
PRACTICAL

TOPIC	SUBTOPIC	TEACHER	TEACHING METHOD	CLASS HOUR
Plant Physiology	Experiment on Plasmolysis.	DS	Demonstration, experimental work	2 hr
	Measurement of leaf area (graphical method) and determination of transpiration rate per unit area by weighing method.	DS	Demonstration, experimental work	2 hr
	Imbibition of water by dry seeds - proteinaceous and fatty seeds.	DS	Demonstration, experimental work	2 hr
	Evolution of O_2 during photosynthesis (using graduated tube).	DS	Demonstration, experimental work	2 hr
	Evolution of CO_2 during aerobic respiration and measurement of volume.	DS	Demonstration, experimental work	2 hr

SEMESTER- IV GENERAL

SEC B

MUSHROOM CULTURE TECHNOLOGY (BOT-G-SEC-D-4/6-4)

(THEORITICAL)

TOPIC	SUBTOPIC	TEACHER	TEACHING METHOD	CLASS HOUR
Mushroom	Nutritional and medicinal value of mushrooms. Poisonous mushrooms.	RP	Online teaching through Google meet, ppt, interactive discussion	2 hr
Cultivation techniques/ technology of edible mushrooms in India	*Volvarealla volvacea, Pleuretus citrinopyrineatus, Agaricus bisporus*.	RP	Online teaching through Google meet, ppt, interactive discussion	4 hr

Storage	Short term and long term, storage, drying.	RP	Online teaching through Google meet, ppt, interactive discussion	2 hr
Food preparation	Types of foods prepared from mushroom. Cost and benefit ratio	RP	Online teaching through Google meet, ppt, interactive discussion	2 hr
Research centres	National and regional.	RP	Online teaching through Google meet, ppt, interactive discussion	2 hr

SEMESTER- V

DSE A
PHYTOCHEMISTRY AND MEDICINAL BOTANY (BOT-G-DSE-A-5-1-TH)
(THEORETICAL)

TOPIC	SUBTOPIC	TEACHER	TEACHING METHOD	CLASS HOUR
Medicinal botany	History, scope and importance of medicinal plants, a broef idea about indigenous medicinal sciences- Ayurbeda, Siddha and Unani. Polyherbal formulations.	DS	Online teaching through Google meet, ppt, interactive discussion	5 hr
Phramacognosy	Scope and its importance, Primary metabolites, Secondary metabolites- alkaloids, terpenoids, phenolics and their functions.	DS	Online teaching through Google meet, ppt, interactive discussion	5 hr
Organoleptic	Evaluation of crude drugs.	DS	Online teaching	2 hr

			through Google meet, ppt, interactive discussion	
Pharmcologically active constituents	Source plants (one example), parts used and uses of: Steroids (Diosgenin, Digitoxin), Tannin (Catechin), Resins (Gingerol, Curcumnoids), Alkaloids (Strychnine, Reserpine, Vinblastine), Phenols (Capsaicin).	DS	Online teaching through Google meet, ppt, interactive discussion	3 hr
Ethnobotany and folk medicine	Brief idea, Applications of ethnobotany, Application of natural product to certain diseases- Jaundice, Cardiac and Diabetics.	DS	Online teaching through Google meet, ppt, interactive discussion	3 hr

SEMESTER- V

DSE A

PHYTOCHEMISTRY AND MEDICINAL BOTANY (BOT-G-DSE-A-5-1-P)

(PRACTICAL)

TOPIC	SUBTOPIC	TEACHER	TEACHING METHOD	CLASS HOUR
Preparations of chemicals	Preparations of solution and buffers	DS	Demonstration	2 hr
Acquaintance with laboratory instruments-	Autoclave, Incubator, Clinical centrifuge, Analytical balance, pH meter, Colorimeter, Water bath, Distillation plant, Laminar air flow	DS	Demonstration	2 hr
Qualitative test	Proteins and carbohydrates, reducing and non reducing sugar (glucose, fructose and sucrose)	DS	Demonstration	4 hr
Chemical Tests	Tannin and alkaloid	DS	Demonstration	4 hr
Identification	Identification of medicinal plants	DS	Demonstration	3 hr
Field study	Listing of medicinal plants	DS	Demonstration	3 hr

SEMESTER- V GENERAL

SEC-A

BIOFERTILIZERS (BOT-G-SEC-A-3/5-2)

(THEORITICAL)

TOPIC	SUBTOPIC	TEACHER	TEACHING METHOD	CLASS HOUR
Biofertilizers	General account about microbes used as biofertilisers; *Rhizobium* identification, mass multiplication. Actinorrhizal symbiosis.	RP	Class lecture, power point presentation, interactive discussion	3 hr
Azospirillum	Identification, mass multiplication, associative effect of different microorganisms. *Azotobacter* and crop response to *Azotobacter* inoculums.	RP	Class lecture, power point presentation, interactive discussion	3 hr
Cyanobacteria	*Azolla*, *Anabaena* and *Azolla* association, blue green algae and *Azolla* in rice cultivation.	RP	Class lecture, power point presentation,	4 hr

			interactive discussion	
Mycorrhizal association	Types of Mycorrhizal association- Brief idea, Its influence on growth and yield of crop plants.	RP	Class lecture, power point presentation, interactive discussion	3 hr
Organic farming	Green manuring and organic fertilizers, Biocompost and vermicompost- making methods and field applications. Recycling of biodegradable municipal, industrial and agricultural wastes.	RP	Class lecture, power point presentation, interactive discussion	2 hr

SEMESTER- VI

DSE B

HORTICULTURAL PRACTICES AND POST HARVEST TECHNOLOGY (BOT-G-DSE-B-6-4-TH)
THEORETICAL

TOPIC	SUBTOPIC	TEACHER	TEACHING METHOD	CLASS HOUR
Horticulture-	role in rural economy and employment generation. Urban horticulture- its scope and importance.	DS	Online teaching through Google meet, ppt, interactive discussion	3 hr
Ornamental plants	Identification and salient features of some ornamental plants (rose, marigold, gladiolus, gerberas, tube rose, carnations, cacti and succulents). Ornamental flowering trees (Gulmohor, Lagerstromia, Shimul, Coral tree and jacaranda).	DS	Online teaching through Google meet, ppt, interactive discussion	5 hr

Identification of some fruits and vegetable plants	Citrus, Banana, Papaya, Mango, Jackfruit, Chillies and cucurbits. Fruit processing- scope and benefits.	DS	Online teaching through Google meet, ppt, interactive discussion	4 hr
Horticultural techniques	Propagation methods, application of manure, fertilizers, nutrients and PGR. Weed control. Biofertilizers and biopesticides.	DS	Online teaching through Google meet, ppt, interactive discussion	4 hr
Post harvest technology	Importance of post harvest technology in horticultural practices. Harvesting and handling of fruits, vegetables and cut flower. Methods of preservation and processing.	DS	Online teaching through Google meet, ppt, interactive discussion	4 hr
Disease control and management	field and post harvest diseases of common crops. Crop sanitation, quarantine practices. Identification of common diseases and pest of fruits and vegetable crops.	DS	Online teaching through	3 hr

			Google classroom, Google meet, ppt, interactive discussion	

SEMESTER VI GENERAL

HORTICULTURAL PRACTICES AND POST HARVEST TECHNOLOGY (BOT-G-DSE-B-6-4-P)

(PRACTICAL)

(JANUARY TO JUNE)

TOPIC	SUBTOPIC	TEACHER	TEACHING METHOD	CLASS HOUR
Field trips:	gardens, standing crop sites, nurseries, vegetable gardens, horticultural fields and cold storages.	RP	Demonstration	3 hr

SEMESTER- VI GENERAL

SEC B

MUSHROOM CULTURE TECHNOLOGY (BOT-G-SEC-D-4/6-4)

(THEORITICAL)

TOPIC	SUBTOPIC	TEACHER	TEACHING METHOD	CLASS HOUR
Mushroom	Nutritional and medicinal value of mushrooms. Poisonous mushrooms.	RP	Class lecture, power point presentation, interactive discussion	2 hr
Cultivation techniques/ technology of edible mushrooms in India	*Volvarealla volvacea, Pleuretus citrinopyrineatus, Agaricus bisporus*.	RP	Class lecture, power point presentation, interactive discussion	4 hr
Storage	Short term and long term, storage, drying.	RP	Class lecture, power point presentation,	2 hr

			interactive discussion	
Food preparation	Types of foods prepared from mushroom. Cost and benefit ratio	RP	Class lecture, power point presentation, interactive discussion	2 hr
Research centres	National and regional.	RP	Class lecture, power point presentation, interactive discussion	2 hr