

LESSON PLAN

Department Name: BOTANY

Name of Faculty: ADITI DEY (AD), RAJENDRA YONZONE (RY)

Paper Name & Code: PLANT SYSTEMATICS (THEORETICAL), BOT-H-CC2-2-TH

Planned					
Unit / Group / Module / Article	Topics	Reference Books	No of Lecture Planned	Content Delivery Technique	Remarks / Comments
1. Introduction: (RY)	1.1. Components of Systematics: Nomenclature, Identification, Classification.	1. Singh, G. Plant Systematics: An Integrated Approach (3rd ed.), 2016, CRC Press. 2. Sambamurty, A.V.S.S. Taxonomy of Angiosperms, 2005, I.K. International Pvt. Ltd. 3. Dutta, S.C. Systematic Botany, Latest Ed., Wiley Eastern. 4. Jones, S.B. and Luchsinger, A.E. Plant Systematics (2nd ed.), 1987, McGraw Hill Book Company.	02	Chalk and talk,	
	1.2. Taxonomy and its phases - Pioneer, Consolidation, Biosystematic and Encyclopaedic; alpha- and omega- taxonomy.		03		
	1.3. 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.		05		
2. Systems of classification: (RY)	2.1. Broad outline of Bentham & Hooker (1862-1883) and Takhtajan (1997)- systems of classification with merits and demerits. Brief idea of angiosperm phylogeny group (APG IV classification).		05		
	2.2. Systematics in Practice: Herbaria and Botanic Gardens – their role in teaching and research.		04		
	2.3. Dichotomous keys – indented and bracketed.		02		
	2.4. Brief idea on Phenetics and cladistics: Monophyletic, polyphyletic and paraphyletic groups; Plesiomorphy and apomorphy.		02		
	2.5. Numerical taxonomy- methods and significance.	03			
	2.6. Data sources in Taxonomy: Supportive evidences from Phytochemistry, Cytology, Palynology and Molecular biology data (Protein and Nucleic acid homology).	04			
3. Systematic study of angiosperm taxa:	3.1. Monocotyledons: Alismataceae, Gramineae (Poaceae), Cyperaceae, Palmae (Arecaceae),		05	Chalk and talk, Power-Point Presentation	

Planned					
Unit / Group / Module / Article	Topics	Reference Books	No of Lecture Planned	Content Delivery Technique	Remarks / Comments
Diagnostic features, systematic position (Bentham & Hooker) and economically important plants (parts used and uses) of the following families. (AD)	Liliaceae, Musaceae, Zingiberaceae, Cannaceae, Orchidaceae.	1. Paria, N.D., Plant Taxonomy & Biodiversity, 2022, Santra Publication Pvt. Ltd.			
	3.2. Dicotyledons: Nymphaeaceae, Magnoliaceae, Ranunculaceae, Leguminosae (subfamilies), Euphorbiaceae, Malvaceae, Umbelliferae (Apiaceae), Labiatae (Lamiaceae), Cruciferae (Brassicaceae), Solanaceae, Scrophulariaceae, Acanthaceae, Rubiaceae, Cucurbitaceae, Compositae (Asteraceae).	2. Dutta, S.C. Systematic Botany, Latest Ed., Wiley Eastern. 3. Judd, W.S., Campbell, C.S., Kellogg, E.A., Stevens, P.F. and Donoghue, M.J. Plant Systematics, A Phylogenetic Approach (4th ed.), 2016, Sinauer Associates, Inc.	10		
		TOTAL	45 hr.		

LESSON PLAN

Department Name: BOTANY

Name of Faculty: RAJENDRA YONZONE (RY)

Paper Name & Code: PLANT SYSTEMATICS (PRACTICAL), BOT-H-CC2-2-P

Planned					
Unit / Group / Module / Article	Topics	Reference Books	No of Lecture Planned	Content Delivery Technique	Remarks / Comments
1. 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 Bentham and Hooker system of classification: (RY)	Work out, drawing, measurements, description, preparation of floral formula and floral diagram, identification up to genus of different members available locally from the following families: Malvaceae, Leguminosae (Papilionaceae), Acanthaceae, Solanaceae, Scrophulariaceae, Labiatae (Lamiaceae), Rubiaceae.	1. Prain, D. Bengal Plants (Vol I & II), Bishen Singh Mahendra Pal Singh. 2. Singh, G. Plant Systematics: An Integrated Approach (3rd ed.), 2016, CRC Press. 3. Dr. P. Maji, Focus on College Practical Botany, Rita Book Agency, Latest Edition.	18	Hands-on practice with fresh specimens.	
2. Spot identification: (RY)	Spot identification (Binomial, Family) of common wild plants from families included in the theoretical syllabus.	Paria, N.D., Plant Taxonomy & Biodiversity, 2022, Santra Publication Pvt. Ltd.	3	Study of fresh specimens.	
3. Field work: (RY)	At least three excursions including one excursion to Acharya Jagadish Chandra Bose Indian Botanic Garden (Shibpur, Howrah) and one to Central National Herbarium (CNH).	-----	3X3=9 hr.	Field study, collection of specimens, demonstration of the Preservation techniques and visit to the herbarium.	
		TOTAL	30 hr.		

LESSON PLAN

Department Name: BOTANY

Name of Faculty: SHARMISTHA BASU (SB), ANJAN HAZRA (AH)

Paper Name & Code: BIOFERTILIZERS AND BIOPESTICIDES (THEORY), BOT-H-SEC-2-TH

Planned					
Unit / Group / Module / Article	Topics	Reference Books	No of Lecture Planned	Content Delivery Technique	Remarks / Comments
1. General account: (SB)	1.1. General account and components of organic farming; microbes used as biofertilizers, general account on mass production of biofertilizers	1. Acharya, K., Sen, S. & Rai, M. Biofertilizers and Biopesticides, 2019, Techno World, Kolkata. 2. Sathe, T.V. Vermiculture and Organic Farming 2004. Daya Publishers. 3. Subha Rao, N. S. Soil Microbiology, 2000, Oxford & IBH Publishers, New Delhi. 4. Vayas, S.C. Vayas, S. & Modi, H.A Bio-fertilizers and organic Farming, 1998, Akta Prakashan, Nadiad	3	Face to face teaching, Chalk and talk method, content delivery through PPT, posting of educational videos, instructional materials and M.C.Q. practice questions in google classroom for self-pace learning.	
	1.2. Manure- Green manuring and organic fertilizers; types and methods of composting; vermicompost and field applications; recycling of biodegradable municipal, agricultural and industrial wastes.		3		
2. Nitrogen fixing bacteria biofertilizers: (AH)	2.1. <i>Rhizobium</i> - Isolation, identification, mass multiplication, carrier-based inoculant formulation, filed application;	1. Acharya, K., Sen, S. & Rai, M. Biofertilizers and Biopesticides, 2019, Techno World, Kolkata. 2. Vayas, S.C. Vayas, S. & Modi, H.A Bio-fertilizers and organic Farming, 1998, Akta Prakashan, Nadiad	3	Blackboard, class notes, PowerPoint presentation, e-resources	
	2.2. <i>Azospirillum</i> - Isolation, carrier-based inoculants, mass multiplication, associative effect of different microorganisms		3		
	2.3. <i>Azotobacter</i> - Classification, characteristics, crop response to Azotobacter inoculants, maintenance and mass multiplication.		3		
3. Cyanobacteria: (AH)	3.1. Cyanobacteria (Blue green algae), <i>Azolla</i> and <i>Anabaena azollae</i> association, nitrogen fixation, Factors affecting growth, blue green algae and <i>Azolla</i> in rice cultivation.	1. Subha Rao, N. S. Soil Microbiology, 2000, Oxford & IBH Publishers, New Delhi.	3		
	3.2. Actinorhizal symbiosis- Actinorhizal plants, infection process, isolation of <i>Frankia</i> .		3		
4. Mycorrhizal association:	4.1. Types of mycorrhizal association, phosphorus nutrition, growth and yield.	1. Acharya, K., Sen, S. & Rai, M. Biofertilizers and Biopesticides, 2019, Techno World, Kolkata. 2. Sathe, T.V. Vermiculture and Organic	3	Face to face teaching, Chalk and talk method, content delivery through PPT, posting of	

Planned					
Unit / Group / Module / Article	Topics	Reference Books	No of Lecture Planned	Content Delivery Technique	Remarks / Comments
(SB)	4.2. Colonization of VAM – isolation and inoculum production of VAM and its influence on growth and yield of crop plants.	Farming 2004. Daya Publishers. 3. Subha Rao, N. S. Soil Microbiology, 2000, Oxford & IBH Publishers, New Delhi.	3	educational videos, instructional materials and M.C.Q. practice questions in google classroom for self-pace learning.	
5. Other biofertilizers: (SB)	5.1. Phosphate, Potash and Zinc Solubilizing Microbes- Isolation, characterization, mass production, field application.		3		
	5.2. Plant Growth Promoting Rhizobacteria (PGPR) as biofertilizers, mode of action of PGPR.		3		
6. Biopesticides: (AH)	6.1. Introduction; General features of potential biopesticides; Prospect and limitation.	1. Acharya, K., Sen, S. & Rai, M. Biofertilizers and Biopesticides, 2019, Techno World, Kolkata 2. Kaushik, B. D. Kumar, D. Shamim, M. Biofertilizers and Biopesticides in Sustainable Agriculture, Apple Academic Press, 2019	2	Blackboard, class notes, PowerPoint presentation, e-resources	
	6.2. <i>Trichoderma</i> : Isolation, mass production, formulation, quality control and field application.		2		
	6.3. <i>Pseudomonas</i> - Isolation, beneficial <i>Pseudomonas</i> strains in agriculture, mode of action.		2		
	6.4. Fungi as bioinsecticide- <i>Metarhizium anisopliae</i> , <i>Beauveria bassiana</i> and <i>Verticillium lecanii</i> overview, mode of action and use in agriculture.		2		
	6.5. Nematophagous fungi-overview, mode of action.		1		
	6.6. Bacteria as bioinsecticide- <i>Bacillus thuringiensis</i> -Characterization, mass production and field application.		2		
	6.7. Virus as bioinsecticide- Baculovirus-characterization, bioformulation, mass production and field application.		1		
		TOTAL	45 hr.		

LESSON PLAN

Department Name: BOTANY

Name of Faculty: ANJAN HAZRA (AH)

Paper Name & Code: BIOFERTILIZERS AND BIOPESTICIDES (PRACTICAL), BOT-H-SEC-2-P

Planned					
Unit / Group / Module / Article	Topics	Reference Books	No of Lecture Planned	Content Delivery Technique	Remarks / Comments
Work out on Biofertilizers and Biopesticides: (AH)	1. Preparation of selective media for isolation of <i>Azotobacter</i> , phosphate- solubilizing microbes and <i>Trichoderma</i> .	1. Subha Rao, N. S. Soil Microbiology, 2000, Oxford & IBH Publishers, New Delhi. 2. Dubey, R.C. & Maheshwari, D.K. Practical Microbiology, 2010, S. Chand Publication	15x2 = 30	Collection of samples from field, experiments at laboratory.	
	2. Isolation and identification of phosphate-solubilizing fungi.				
	3. Study of Arbuscular Mycorrhizal fungi.				
	4. Isolation of <i>Azotobacter</i> and <i>Trichoderma</i> from the soil.				
	5. Evaluation of <i>in vitro</i> antagonistic activity of <i>Trichoderma</i> species in the dual culture system.				
		Total	30 hr.		

LESSON PLAN

Department Name: BOTANY

Name of Faculty: ADITI DEY (AD), PAYEL CHATTERJEE (PC)

Paper Name & Code: PHYCOLOGY (THEORY), BOT-H-CC5-4-TH

Planned					
Unit / Group / Module / Article	Topics	Reference Books	No of Lecture Planned	Content Delivery Technique	Remarks / Comments
1. General account: (AD)	1.1. Thallus organization and evolutionary trend in algal members of different groups, structure of algal cell, pigment types and variation.	1. Kumar, H.D. 1999. Introductory Phycology (2nd ed.), Affiliated East-West Press Pvt. Ltd. 2. Vashishta, B.R., Sinha, A.K. & Singh, V.P. 2002. Algae (9th ed.), S. Chand & Company 3. Sambamurty, A.S.S. 2005. A text book of Algae, I.K. International Pvt. Ltd. 4. Lee, R.E. 2018. Phycology (5th ed.), Cambridge University Press.	4	Chalk and talk, Power-point Presentation, Charts.	
	1.2. Ultrastructure of flagella and chloroplasts.		2		
	1.3. Process of reproduction in algae: Isogamy, Anisogamy, Oogamy- <i>Chlamydomonas</i> , <i>Oedogonium</i> , <i>Vaucheria</i> , Conjugation- <i>Spirogyra</i> ,		4		
	1.4. Life cycle pattern in algae- Haplontic: <i>Chara</i> , Diplontic: <i>Fucus</i> , Haplo-diplontic (Isomorphic): <i>Ectocarpus</i> , Haplodiplontic (Heteromorphic): <i>Laminaria</i> , Triphasic: <i>Polysiphonia</i> ,		4		
	1.5. Significant contributions of some phycologists (F. E. Fritsch, G. M. Smith, R. N. Singh, T.V. Desikachary, H.D. Kumar, M.O.P. Iyengar).		2		
2. Classification: (PC)	2.1. Classification by Lee (2018) up to phylum with examples.	1. Lee, R.E. 2018. Phycology (5th ed.), Cambridge University Press. 2. Kumar, H.D. 1999. Introductory Phycology (2nd ed.), Affiliated East-West Press Pvt. Ltd.	3	Chalk and Talk and PowerPoint presentation	
	2.2. Salient features of Cyanophyta (emphasis on cell ultrastructure, reproduction, structure and function of heterocyst), Rhodophyta, Chlorophyta (emphasis on phylogenetic significance of flagellar ultrastructure), Charophyta, Heterokontophyta (Phaeophyceae, Xanthophyceae; Bacillariophyceae - emphasis on cell structure, cell division, auxospore formation).		12		
3. Algal Ecology: (PC)	3.1. Role of phytoplanktons in aquatic ecosystem.	1. Graham, L.E. & Wilcox, L.W. 2000. Algae, Prentice Hall.	3		
	3.2. Algae in CO ₂ sequestration.		2		
	3.3. Phytoremediation by algae.		2		

Planned					
Unit / Group / Module / Article	Topics	Reference Books	No of Lecture Planned	Content Delivery Technique	Remarks / Comments
4. Algal Biotechnology: (AD)	4.1. Algal culture and cultivation (Photobioreactor).	1. Das, M.K. 2021. Algal Biotechnology. Daya Publishing House.	4	Chalk and talk, Power-point Presentation.	
	4.2. Algae as food, biofuel and biofertilizer.		3		
		TOTAL	45 hr.		

LESSON PLAN

Department Name: BOTANY

Name of Faculty: ADITI DEY (AD)

Paper Name & Code: PHYCOLOGY (PRACTICAL), BOT-H-CC5-4-P

Planned					
Unit / Group / Module / Article	Topics	Reference Books	No of Lecture Planned	Content Delivery Technique	Remarks / Comments
1. Workout: (AD)	Workout of the following algae with reproductive structure (Free hand drawing and drawing under drawing prism with magnification): <i>Spirogyra</i> , <i>Oedogonium</i> , <i>Chara</i> , <i>Ectocarpus</i> .	College Botany Practical (Volume-1) S. C. Santra T. P. Chatterjee, A. P. Das.	8x2 = 16	Collection of samples from field, experiments at laboratory.	
2. Study of preserved specimens: (AD)	(a) Permanent slides: <i>Nostoc</i> , <i>Gloeotrichia</i> , <i>Volvox</i> , <i>Vaucheria</i> , <i>Coleochaete</i> , <i>Polysiphonia</i> , Centric and Pennate diatom. (b) Macroscopic specimen: <i>Sargassum</i> .		4x2 = 8		
3. Field work: (AD)	One local excursion to be conducted for study and collection of algae.		6		
		Total	30 hr.		

LESSON PLAN

Department Name: BOTANY

Name of Faculty: SUDIP KUMAR SINHA (SKS), ANJAN HAZRA (AH)

Paper Name & Code: ARCHAEGONIATES (THEORY), BOT-H-CC6-4-TH

Planned					
Unit / Group / Module / Article	Topics	Reference Books	No of Lecture Planned	Content Delivery Technique	Remarks / Comments
BRYOPHYTES					
1. Introduction to Monosporangiophyta (Bryophytes): (SKS)	1.1. Unifying features of archaegoniates; transition to land habit.	1. Parihar, N.S. Introduction to Embryophyta (Vol. 1 Bryophyta), Central Book Distributors. 2. Shaw, A. J. & Bernard, G. 2009. Bryophyte Biology, Cambridge University Press. 3. Rashid, A. 1998. An Introduction to Bryophyta, Vikas Publishing House. 4. Chopra, R.N. & Kumar, P.K. Biology of Bryophyta, Latest Ed., Wiley Eastern. 5. Vashista, B.R. Bryophyta, Latest Ed., S. Chand & Company.	01	Face to face teaching, Chalk and talk method, content delivery through PPT, posting of educational videos, instructional materials and M.C.Q. practice questions in google classroom for self-pace learning.	
	1.2. Origin of Alternation of Generations (Homologous and Antithetic theory).		01		
	1.3. Evolution of sporophytes (Progressive and Regressive concept).		01		
	1.4. Origin of bryophytes.		01		
	1.5. Bryophytes as bio indicators of pollution.		01		
2. Classification: (SKS)	2.1. Classification (Crandall-Stotler <i>et al</i> , 2009; Renzaglia <i>et al</i> , 2009, Goffinet <i>et al</i> , 2009;) up to class with diagnostic characters and examples.		01		
3. Life History: (SKS)	Gametophyte structure and reproduction, development and structure of sporophyte, spore dispersal in:				
	3.1. <i>Riccia</i> .		01		
	3.2. <i>Marchantia</i> .		01		
	3.3. <i>Anthoceros</i> .		01		
	3.4. <i>Funaria</i> .		01		
PTERIDOPHYTES					
1. General Account: (AH)	1.1. Colonisation and rise of early land plants.	1. Spore, K.R. The Morphology of Pteridophyte, Latest Ed., Huchinson & Co. Ltd. 2. Rashid, A. An Introduction to Pteridophyte, Latest Ed., Vani Educational Books.	01	Blackboard, Powerpoint presentation, class notes, e-resources.	
	1.2. Origin and evolution of stellar structure.		01		
	1.3. Economic importance.		01		
2. Life History:	Sporophyte structure, reproduction and structure of gametophyte in:				

Planned						
Unit / Group / Module / Article	Topics	Reference Books	No of Lecture Planned	Content Delivery Technique	Remarks / Comments	
(AH)	2.1. <i>Psilotum</i> .	3. Vashista, P.C. Pteridophyta, Latest Ed., S. Chand & Company Pvt. Ltd. 4. Gifford, E. M. & Foster, A. S. 1998. Morphology & Evolution of Vascular Plants (3rd ed.), Freeman and Co.	01	Blackboard, Powerpoint presentation, class notes, e-resources.		
	2.2. <i>Lycopodium</i> .		01			
	2.3. <i>Selaginella</i> .		01			
	2.4. <i>Equisetum</i> .		01			
	2.5. <i>Pteris</i> .		01			
	2.6. <i>Marsilea</i> .		01			
3. Telome concept: (AH)	Telome concept and its significance in the origin of different groups of Pteridophytes.		04			
4. Heterospory: (AH)	Heterospory and origin of seed habit.		02			
GYMNOSPERMS						
1. Progymnosperms: (AH)	Diagnostic characters of the group:	1. Vashishta, P.C. Gymnosperm, Latest Ed., S. Chand & Company Pvt. 2. Bhatnagar, S.P. & P. Moitra, 1997. Gymnosperm, New Age International 3. Biswas, C. & Johri, P.M. 1997. The Gymnosperm, Narosa Publishing House. 4. Dutta, S.C. 1984. An Introduction to Gymnosperms (3rd ed.), Kalyani Publishers.				
	1.1. Vegetative and reproductive features of Archaeopteris.		03			
	1.2. Phylogenetic importance.		03			
2. Life History: (AH)	Distribution in India; vegetative, anatomical and reproductive structures of sporophyte, development of gametophyte in:					
	2.1. <i>Cycas</i> ..		03			
	2.2. <i>Pinus</i> .		03			
	2.3. <i>Ginkgo</i> .		02			
	2.4. <i>Gnetum</i> .		02			
3. Pollination and Embryogeny: (AH)	Pollination and Embryogeny of gymnosperms.					02
4. Phylogeny: (AH)	4.1. Evolutionary significance of gymnosperms.		02			
		Total	45 hr.			

LESSON PLAN

Department Name: BOTANY

Name of Faculty: PAYEL CHATTERJEE (PC)

Paper Name & Code: ARCHAEGONIATES (PRACTICAL), BOT-H-CC6-4-P

Planned					
Unit / Group / Module / Article	Topics	Reference Books	No of Lecture Planned	Content Delivery Technique	Remarks / Comments
BRYOPHYTES					
1. Study from permanent slides: (PC)	<i>Riccia</i> (V.S. of thallus with sporophyte), <i>Marchantia</i> (L.S. through gemma cup, antheridiophore, archegoniophore, sporophyte), <i>Anthoceros</i> (L.S. of sporophyte), <i>Funaria</i> (L.S. of capsule).	College Botany Practical (Volume-1) S. C. Santra T. P. Chatterjee, A. P. Das.	2X2 = 4	Demonstration of permanent slides	
PTERIDOPHYTES					
1. Morphological study of the sporophytic plant body: (PC)	<i>Psilotum</i> , <i>Lycopodium</i> , <i>Ophioglossum</i> and <i>Marsilea</i> .	College Botany Practical (Volume-1) S. C. Santra T. P. Chatterjee, A. P. Das.	4x2 = 8	Study from fresh/preserved specimens.	
2. Work out of the reproductive structures: (PC)	<i>Lycopodium</i> , <i>Selaginella</i> , <i>Equisetum</i> , <i>Pteris</i> .		4x2 = 8	Working out and study from fresh/preserved specimens.	
3. Study from permanent slides: (PC)	<i>Psilotum</i> (T.S. of synangium), <i>Ophioglossum</i> (L.S. of spike), <i>Dryopteris</i> (sorus and gametophyte), <i>Marsilea</i> (L.S. of sporocarp).		2X2 = 4	Demonstration of permanent slides	
GYMNOSPERMS					
1. Study from permanent slides: (PC)	T.S. of leaf and wood anatomy of <i>Cycas</i> and <i>Pinus</i> , <i>Cycas</i> (L.S. of ovule), <i>Pinus</i> (L.S. of male and female cone), <i>Ginkgo</i> (L.S. of female strobilus), <i>Gnetum</i> (L.S. of male cone and ovule).	College Botany Practical (Volume-1) S. C. Santra T. P. Chatterjee, A. P. Das.	3x2 = 6	Demonstration of permanent slides	
		Total	30 hr.		

LESSON PLAN

Department Name: BOTANY

Name of Faculty: ADITI DEY (AD), ANJAN HAZRA (AH)

Paper Name & Code: PALAEOBOTANY AND PALYNOLOGY (THEORY), BOT-H-CC7-4-TH

Planned					
Unit / Group / Module / Article	Topics	Reference Books	No of Lecture Planned	Content Delivery Technique	Remarks / Comments
PALAEOBOTANY					
1. Geological time scale: (AD)	Geological time scale with dominant plant groups through ages and major important evolutionary events (development of vascular tissue, origin of roots, and leaves and seeds).		04	Face to face teaching, Chalk and talk method, content delivery through PPT, posting of educational videos, instructional materials and M.C.Q. practice questions in google classroom for self-pace learning.	
2. Plant Fossil: (AD)	2.1. Types: Body fossil (micro- and mega fossils), Trace fossil, Chemical fossil, Index fossil.	1. Stewart, W.N. & Rothwell, G.W. Palaeobotany & Evolution of Plants, Latest Ed., Cambridge University Press. 2. Agashe, S.N. Palaeobotany, Latest Ed., Oxford & IBH. 3. Taylor, T.N. and Taylor, E.L. 1993. The biology and evolution of fossil plants, First Ed. Englewood Cliffs: Prentice Hall.	01		
	2.2. Different modes of preservation (Schopf, 1975).		01		
	2.3. Conditions favouring fossilization.		01		
	2.4. Nomenclature and Reconstruction.		01		
	2.5. Principle of fossil dating (a brief idea).		01		
	2.6. Relative (biostratigraphy and index fossil) and Absolute dating (^{238}U - ^{206}Pb , ^{14}C Method).		02		
	2.7. Importance of fossil study.		01		
3. Fossil Pteridophytes: (AD)	Structural features, geological distribution and evolutionary significance of:				
	3.1. <i>Rhynia</i> .		02		
	3.2. <i>Lepidodendron</i> (Reconstructed).		02		
	3.3. <i>Calamites</i> (Reconstructed).	02			
4. Fossil Gymnosperms: (AD)	Structural features and geological distribution of reconstructed genera:				
	4.1. <i>Lyginopteris</i>	02			
	4.2. <i>Williamsonia</i> .	02			
	4.3. <i>Cordaites</i> .	02			
5. Indian Gondwana System: (AD)	Brief idea of Gondwana; Threefold division of Indian Gondwana with major mega fossil assemblages.		04		

Planned						
Unit / Group / Module / Article	Topics	Reference Books	No of Lecture Planned	Content Delivery Technique	Remarks / Comments	
PALYNOLOGY						
6. Introduction: (AH)	6.1. Pollen and non-pollen palynomorphs (spores and phytoliths), types of phytoliths.	1. Nair, P.K. Pollen Morphology of Angiosperms, Latest Ed., Scholar Publications. 2. Bhattacharya, K., Majumdar, M.R. & Gupta Bhattacharya, S. 2006. A Text Book of Palynology, New Central Book Agency.	02	Blackboard, Powerpoint presentation, class notes, e-resources.		
	6.2. Pollen aperture types Origin and evolution of stellar structure.		01			
	6.3. NPC classification (Erdtman).		01			
	6.4. Pollen wall- sporopollenin, stratification and ornamentation (sculpturing).		01			
7. Applied Palynology: (AH)	Basic concepts of:					
	7.1. Palaeopalynology (definition, role of fossil spore/ pollen/ phytolith in vegetation and climate reconstruction).		01			
	7.2. Aeropalynology- basic mechanism of spore/pollen allergy.		02			
	7.3. Common spore/pollen allergies, pollen calendar.		02			
	7.4. Aeroallergens-common pollen-allergy causing plants of India, brief idea of basic tests for diagnosis– skin testing (Prick Test), Radioallergosorbent- Test (RAST) and Enzyme-Linked Immuno- Sorbent - Assay (ELISA).		02			
	7.5. Forensic palynology- definition, sources of pollen as forensic evidence– soil, clothing and foot wear, vehicles, human bodies, animal fur, spider web.		02			
	7.6. Applications and limitations of forensic palynology.	01				
7.7. Pollination biology and melisso palynology- types of pollination, pollinator groups, pollen-pistil interactions and its significance; common Indian bee plants, types of honey, botanical and geographical origin of honey, absolute pollen count; bee keeping.	02					
	Total	45 hr.				

LESSON PLAN

Department Name: BOTANY

Name of Faculty: ADITI DEY (AD), ANJAN HAZRA (AH)

Paper Name & Code: PALAEOBOTANY AND PALYNOLOGY (PRACTICAL), BOT-H-CC7-4-P

Planned					
Unit / Group / Module / Article	Topics	Reference Books	No of Lecture Planned	Content Delivery Technique	Remarks / Comments
PALAEOBOTANY AND PALYNOLOGY					
1. Morphological study: (AH)	<i>Ptilophyllum</i> and <i>Glossopteris</i> leaf fossils.	1. College Botany Practical (Volume-1) S. C. Santra T. P. Chatterjee, A. P. Das.	2x2 = 4	Demonstration of paleo specimen	
2. Study from permanent slides: (AH)	T.S. of stem of <i>Rhynia</i> , <i>Lepidodendron</i> , <i>Calamites</i> , <i>Lyginopteris</i> , <i>Cordaites</i> .		2X3 = 6	Demonstration of permanent slides	
3. Study of pollen types: (AD)	Study of pollen types (colpate, porate and colporate) from permanent slides. Slides may be prepared from specimens: colpate (<i>Leonurus sibiricus/ Brassica sp.</i>), porate (<i>Hibiscus rosa-sinensis</i>), colporate (<i>Cassia sophera/ C. tora</i>).	1. Bhattacharya, K., Majumdar, M.R. & Gupta Bhattacharya, S. 2006. A Text Book of Palynology, New Central Book Agency.	2x4 = 8	Preparation of slide	
4. Detection of honey type: (AD)	Detection of honey type (uni/bi/ multifloral) based on microscopic analysis.		2x3 = 6	Preparation of slide	
5. Field work: (AD)	Visit to a palaeobotanical/palynological laboratory/ institute/ museum.		6		
		Total	30 hr.		

LESSON PLAN

Department Name: BOTANY

Name of Faculty: SHARMISTHA BASU (SB)

Paper Name & Code: PHARMACOGNOSY & ETHNOBOTANY (THEORY), BOT-H-CC8-4-TH

Unit / Group / Module / Article	Topics	Reference Books	No of Lecture Planned	Content Delivery Technique	Remarks / Comments
1. Medicinal botany: (SB)	History, scope and importance of medicinal plant in herbal drug industry.	1. Trease & Evans. Pharmacognosy, Saunders. 2. Trivedi P.C. 2006. Medicinal Plants: Ethnobotanical approach, Agrobios India 3. S.K. Jain, Manual of Ethnobotany, Scientific Publishers, Jodhpur 1995.	01	Face to face teaching, Chalk and talk method, content delivery through PPT, posting of educational videos, instructional materials and M.C.Q. practice questions in google classroom for self-space learning	
	A brief idea about traditional systems of medicine- ayurveda, siddha and unani.		02		
	Polyherbal formulations.		01		
2. Pharmacognosy- General account: (SB)	2.1. Pharmacognosy and its introduction and importance in modern medicine.		01		
	2.2. Crude drugs.		01		
	2.3. Classification of plant drugs- chemical and pharmacological action.		02		
	2.4. Drug evaluation– organoleptic, microscopic, chemical, physical and biological.		02		
	2.5. Major pharmacological groups of plant drugs and their uses.		01		
	2.6. Conservation of endangered and endemic medicinal plants.		01		
3. Secondary metabolites: (SB)	3.1. Secondary metabolites and their differences with primary metabolites.		02		
	3.2. Interrelationship of basic metabolic pathways (Shikimate, Mevalonate, Acetate & MEP) with secondary metabolite biosynthesis (outlines only).	03			
	3.3. Major types and classification–terpenoids, phenolics, flavonoids, alkaloids and and their pharmacological importance.	03			
4. Pharmacologically active constituents: (SB)	Source plants (one example) parts used and uses of: 4.1. Steroids (Solasodin, Diosgenin, Digitoxin).		01		

Unit / Group / Module / Article	Topics	Reference Books	No of Lecture Planned	Content Delivery Technique	Remarks / Comments
	4.2. Tannin (Catechin).		01		
	4.3. Resins (Gingerol, Curcuminoids).		01		
	4.4. Alkaloids (Quinine, Atropine, Pilocarpine, Strychnine, Reserpine, Vinblastine, Taxol, Pyrolizidine).		01		
	4.5. Phenols (Sennocide and Capsaicin).		01		
5. Ethnobotany and folk medicine: (SB)	Definition, methods of study, application.		02		
	Indian scenario, national interacts.		02		
	folk medicines in ethnobotany.		02		
	Ethnomedicine.		01		
	Ethnoecology.		01		
	Ethnic communities of India, sacred grove.		01		
	Application of natural products to certain diseases- Jaundice, cardiac, infertility, diabetics, blood pressure and skin diseases, challenges in application of ethno medicines with reference to modern medicines.		03		
6. Nutraceuticals: (SB)	General introduction, classification, inorganic mineral supplements, multivitamins, digestive enzymes, probiotics, prebiotics, dietary fibres, health drinks, antioxidants, polyunsaturated fatty acids, herbs as functional foods- future of pharmacognosy.		08		
		TOTAL	45 hr.		

LESSON PLAN

Department Name: BOTANY

Name of Faculty: SHARMISTHA BASU (SB)

Paper Name & Code: PHARMACOGNOSY & ETHNOBOTANY (PRACTICAL), BOT-H-CC8-4-P

Planned					
Unit / Group / Module / Article	Topics	Reference Books	No of Lecture Planned	Content Delivery Technique	Remarks / Comments
1. Chemical tests for: (SB)	(a) Tannin (<i>Camellia sinensis</i> / <i>Terminalia chebula</i>).	S.K. Jain, Manual of Ethnobotany, Scientific Publishers, Jodhpur 1999.	2x2 = 4	Laboratory method. Practical demonstration	
	(b) Alkaloid (<i>Catharanthus roseus</i>).		2x2 = 4		
2. Powder microscopy: (SB)	Powder microscopy – <i>Zingiber</i> and <i>Holarrhena</i> .		2x2 = 4		
3. Histochemical tests of: (SB)	Curcumin (<i>Curcuma longa</i>).		02		
	Starch in non-lignified vessel (<i>Zingiber</i>).		02		
	Alkaloid (stem of <i>Catharanthus</i> and bark of <i>Holarrhena</i>).		2x2 = 4		
4. Palisade ratio and vein-islet number: (SB)	Determination of palisade ratio and vein-islet number of Vasak leaves.		2x2 = 4		
5. Identification from fresh specimen/herbarium of some commonly used medicinal plants: (SB)	a. <i>Azadirachta indica</i> (Neem), b. <i>Justicia adhatoda</i> (Vasak), c. <i>Andrographis paniculata</i> (Kalmegh), d. <i>Saraca asoca</i> (Ashoka), e. <i>Holarrhena pubescens</i> (Kurchi), f. <i>Centella asiatica</i> (Thankuni), g. <i>Zingiber officinale</i> (Ginger), h. <i>Catharanthus roseus</i> (Nayantara), i. <i>Phyllanthus emblica</i> (Amla), j. <i>Terminalia chebula</i> (Haritaki), k. <i>Terminalia arjuna</i> (Arjun), l. <i>Piper longum</i> (Long pepper), m. <i>Curcuma longa</i> (Turmeric), n. <i>Bacopa monnieri</i> (Brahmi)		2x3 = 6		
		TOTAL	30 hr.		

LESSON PLAN

Department Name: BOTANY

Name of Faculty: SUDIP KUMAR SINHA (SKS)

Paper Name & Code: PLANT PHYSIOLOGY (THEORY), BOT-H-CC-6-13-TH

Planned						
Unit / Group / Module / Article	Topics	Reference Books	No of Lecture Planned	Content Delivery Technique	Remarks / Comments	
1. Plant-water relations: (SKS)	1.1. Concept of water potential, components of water potential in plant system.	1. Jain, V.K. Fundamental of Plant Physiology (7th ed.) 2004. S. Chand and Company 2. Taiz, L., & Zeiger, E. Plant Physiology (4th ed.), 2006, Sinauer Associates, Inc. Publishers. 3. Hopkins, W.G. & Hüner, N.P. Introduction to Plant Physiology (3rd ed.) 2004, John Wiley & Sons. 4. Mukherjee, S. & Ghosh, A. Plant Physiology (2nd ed.), 2005, New Central Book Agency.	03	Chalk and talk, PowerPoint presentation, online tests, Class notes.		
	1.2. Soil-plant Atmosphere continuum concept, Cavitation in xylem and embolism.		01			
	1.3. Stomatal physiology mechanism of opening and closing, Role of CO ₂ , K ⁺ , abscisic acid and blue light in stomatal movement; Antitranspirants.		02			
2. Mineral nutrition: (SKS)	Essential and beneficial elements, macro- and micronutrients, methods of study and use of nutrient solutions, criteria for essentiality, mineral deficiency symptoms, roles of essential elements, chelating agents.		06			
	3. Organic Translocation: (SKS)		3.1. Phloem sap, P-protein.			01
			3.2. Phloem loading and unloading.			02
3.3. Mass-flow (pressure flow) hypothesis and its critical evaluation.		03				
4. Plant Growth Regulators: (SKS)	4.1. Physiological roles of Auxin, Gibberellin, Cytokinin, Abscisic acid, Ethylene.	1. Taiz, L., & Zeiger, E. Plant Physiology (4th ed.), 2006, Sinauer Associates, Inc. Publishers. 2. Mukherjee, S. & Ghosh, A. Plant Physiology (2nd ed.), 2005, New Central Book Agency.	10	Blackboard, PowerPoint presentation, Class notes, E-contents		
	4.2. Chemical nature – IAA, GA3, Kinetin.		02			
	4.3. Biosynthesis and bioassay of IAA.		02			
	4.4. Mode of action of IAA.		02			
	4.5. Brassinosteroids and Polyamines as PGRs (brief idea).		02			

Planned					
Unit / Group / Module / Article	Topics	Reference Books	No of Lecture Planned	Content Delivery Technique	Remarks / Comments
5. Photomorphogenesis: (SKS)	5.1. Concept of photomorphogenesis.	1. Taiz, L., & Zeiger, E. Plant Physiology (4th ed.), 2006, Sinauer Associates, Inc. Publishers. 2. Singhal, G.S. Concepts of Photobiology: Photosynthesis & Photomorphogenesis, 1999. Narosa Publishing House. 3. Hopkins, W.G. & Hüner, N.P. Introduction to Plant Physiology (3rd ed.) 2004, John Wiley & Sons.	01		
	5.2. Photoperiodism and plant types.		01		
	5.3. Perception of photoperiodic stimulus.		01		
	5.4. Critical day length, concept of light monitoring.		02		
	5.5. Phytochrome, cryptochrome and phototropins- chemical nature and role in photomorphogenesis.		02		
	5.6. Role of GA in flowering.		01		
	5.7. Vernalisation – role of low temperature in flowering.		02		
	5.8. Concept of biological clock and biorhythm.		02		
6. Seed dormancy: (SKS)	6.1. Types, Causes and Methods of breaking seed dormancy.	1. Jain, V.K. Fundamental of Plant Physiology (7th ed.) 2004. S. Chand and Company. 2. Taiz, L., & Zeiger, E. Plant Physiology (4th ed.), 2006, Sinauer Associates, Inc. Publishers.	04		
	6.2. Biochemistry of seed germination.		02		
7. Senescence and Ageing: (SKS)	Physiology of Senescence and Ageing.	1. Jain, V.K. Fundamental of Plant Physiology (7th ed.) 2004. S. Chand and Company. 2. Mukherjee, S. & Ghosh, A. Plant Physiology (2nd ed.), 2005, New Central Book Agency.	06		
		TOTAL	60 hr.		

LESSON PLAN

Department Name: BOTANY

Name of Faculty: SUDIP KUMAR SINHA (SKS)

Paper Name & Code: PLANT PHYSIOLOGY (PRACTICAL), BOT-H-CC-6-13-P

Planned					
Unit / Group / Module / Article	Topics	Reference Books	No of Lecture Planned	Content Delivery Technique	Remarks / Comments
PLANT PHYSIOLOGY: (SKS)	1. Determination of loss of water per stoma per hour.	1. College Botany Practical (Volume-2) S. C. Santra T. P. Chatterjee, A. P. Das. 2. Bendre, A. & Kumar, A. A Text Book of Practical Botany, 2018, Rastogi Publications.	06	Hands-on experiments	
	2. Relationship between transpiration and evaporation.		03		
	3. Measurement of osmotic pressure of storage tissue by weighing method.		03		
	4. Measurement of osmotic pressure of <i>Rhoeo</i> leaf by plasmolytic method.		03		
	5. Effect of temperature on absorption of water by storage tissue and determination of Q_{10} .		03	Hands-on experiments	
	6. Rate of imbibition of water by starchy, proteinaceous and fatty seeds and effect of seed coat.		03		
	7. To study the phenomenon of seed germination (effect of light).		03		
	8. To study the induction of amylase activity in germinating grains.		03		
	9. To study the effect of different concentrations of IAA on <i>Avena</i> coleoptile elongation (IAA bioassay).		03		
	TOTAL	30 hr.			

LESSON PLAN

Department Name: BOTANY

Name of Faculty: SUDIP KUMAR SINHA (SKS)

Paper Name & Code: PLANT METABOLISM (THEORY), BOT-H-CC-6-14-TH

Unit / Group / Module / Article	Topics	Reference Books	No of Lecture Planned	Content Delivery Technique	Remarks / Comments
1. Metabolism: (SKS)	Concept of metabolism: Introduction, Anabolic and catabolic metabolic pathways, regulation of metabolism, role of regulatory enzymes (allosteric, covalent modulation and isozymes).		04	Chalk and talk, PowerPoint presentation, online tests, Class notes.	
2. Photosynthesis: (SKS)	2.1. Chemical structure of chlorophyll a and b, absorption and action spectra, biological significance of carotenoid pigments.	1. General principle of amino acid biosynthesis (including GS and GOGAT enzyme system). 2. Jain, V.K. Fundamental of Plant Physiology (7th ed.) 2004. S. Chand and Company. 3. Mukherjee, S. & Ghosh, A. Plant Physiology (2nd ed.), 2005, New Central Book Agency. 4. Taiz, L., & Zeiger, E. Plant Physiology (4th ed.), 2006, Sinauer Associates, Inc. Publishers. 5. Lehninger Principles of Biochemistry. Sixth Edition. 2013. David L. Nelson, Michael M. Cox. Freeman, Macmillan. 6. Buchanon, Gruissen and Jones. Plant Physiology & Biochemistry: Biochemistry and Molecular Biology of plants, 2000, I.K. International.	04		
	2.2. Red drop and Emerson effect, Components of photosystems (light harvesting complex), photochemical reaction centres, Cyclic and noncyclic electron transport, Water splitting mechanism.		04		
	2.3. Calvin cycle – Biochemical reactions & stoichiometry.		02		
	2.4. HSK Pathway–three variants of the pathway.		02		
	2.5. Photosynthetic efficiency of C ₃ and C ₄ plants and crop productivity.		01		
	2.6. Photorespiration – mechanism and significance.		01		
	2.7. Crassulacean Acid Metabolism–mechanism and ecological significance.		02		
3. Respiration: (SKS)	3.1. EMP pathway, regulation and its anabolic role.		02		
	3.2. Conversion of Pyruvic acid to Acetyl CoA.		01		
	3.3. TCA-cycle and its amphibolic role.		02		
	3.4. Oxidative pentose phosphate pathway and its significance.	02			

Unit / Group / Module / Article	Topics	Reference Books	No of Lecture Planned	Content Delivery Technique	Remarks / Comments
	3.5. Mitochondrial electron transport system, uncouplers.		02		
	3.6. Oxidation of cytosolic NADH+H ⁺ .		02		
	3.7. Stoichiometry of glucose oxidation (aerobic).		01		
4. Nitrogen Metabolism: (SKS)	4.1. Assimilation of nitrate by plants.		03		
	4.2. Biochemistry of dinitrogen fixation in <i>Rhizobium</i> .		04		
	4.3. General principle of amino acid biosynthesis (including GS and GOGAT enzyme system).		03		
5. Lipid metabolism: (SKS)	5.1. synthesis and breakdown of triglycerides.		02		
	β-oxidation.		02		
	Glyoxylate cycle.		02		
	gluconeogenesis and its role in mobilization of the lipids during seed germinations.		01		
	α- oxidation.	01			
6. Signal Transduction: (SKS)	Mechanism of signal transduction: receptor-ligand interactions, second messenger concept, calcium-calmodulin, G protein, MAP-kinase cascade.	10			
		TOTAL	60 hr.		

LESSON PLAN

Department Name: BOTANY

Name of Faculty: SUDIP KUMAR SINHA (SKS)

Paper Name & Code: PLANT METABOLISM (PRACTICAL), BOT-H-CC-6-14-P

Planned					
Unit / Group / Module / Article	Topics	Reference Books	No of Lecture Planned	Content Delivery Technique	Remarks / Comments
PLANT METABOLISM: (SKS)	1. A basic idea of chromatography: Principle, paper chromatography and column chromatography; demonstration of column chromatography.	1. College Botany Practical (Volume-2) S. C. Santra T. P. Chatterjee, A. P. Das. 2. Bendre, A. & Kumar, A. A Text Book of Practical Botany, 2018, Rastogi Publications.	06	Hands-on experiments	
	2. Separation of plastidial pigments by solvent and paper chromatography.		06		
	3. Estimation of total chlorophyll content from different chronologically aged leaves (young, mature and senescence) by Arnon method.		03		
	4. 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).		03		
	5. Measurement of oxygen uptake by respiring tissue (per g/hr.)		06		
	6. Determination of the RQ of germinating seeds.		03		
	7. Test of seed viability by TTC method.		03		
		TOTAL	30 hr.		

LESSON PLAN

Department Name: BOTANY

Name of Faculty: SHARMISTHA BASU (SB)

Paper Name & Code: MEDICINAL AND ETHNOBOTANY (THEORY), BOT-A-DSE-A-6-3-TH

Unit / Group / Module / Article	Topics	Reference Books	No of Lecture Planned	Content Delivery Technique	Remarks / Comments
1. Medicinal botany: (SB)	History, scope and importance of medicinal plant.	1. Trease & Evans. Pharmacognosy, Saunders. 2. Trivedi P.C. 2006. Medicinal Plants: Ethnobotanical approach, Agrobios India 3. S.K. Jain, Manual of Ethnobotany, Scientific Publishers, Jodhpur 1995.	03	Face to face teaching, Chalk and talk method, content delivery through PPT, posting of educational videos, instructional materials and M.C.Q. practice questions in google classroom for self-pace learning	
	A brief idea about indigenous medicinal sciences- ayurveda, siddha and unani.		05		
	Polyherbal formulations.		02		
2. Pharmacognosy- General account: (SB)	2.1. Pharmacognosy and its importance in modern medicine.		02		
	2.2. Crude drugs.		02		
	2.3. Classification of drugs- chemical and pharmacological.		03		
	2.4. Drug evaluation– organoleptic, microscopic, chemical, physical and biological.		03		
	2.5. Major pharmacological groups of plant drugs and their uses.		03		
3. Secondary metabolites: (SB)	3.1. Definition of secondary metabolites and difference with primary metabolites.		04		
	3.2. Interrelationship of basic metabolic pathways with secondary metabolite biosynthesis (outlines only).		05		
	3.3. Major types–terpenoids, phenolics, flavonoids, alkaloids and their protective action against pathogenic microbes and herbivores.		05		
4. Pharmacologically active constituents: (SB)	Source plants (one example) parts used and uses of: 4.1. Steroids (Solasodin, Diosgenin, Digitoxin).		02		
	4.2. Tannin (Catechin).		01		
	4.3. Resins (Gingerol, Curcuminoids).	01			

Unit / Group / Module / Article	Topics	Reference Books	No of Lecture Planned	Content Delivery Technique	Remarks / Comments
	4.4. Alkaloids (Quinine, Atropine, Pilocarpine, Strychnine, Reserpine, Vinblastine).		01		
	4.5. Phenols (Sennocide and Capsaicin).		01		
5. Ethnobotany and folk medicine: (SB)	Definition, methods of study, application.		03		
	Indian scenario, national interacts.		02		
	Palaeo-ethnobotany.		02		
	folk medicines in ethnobotany.		03		
	Ethnomedicine.		01		
	Ethnoecology.		01		
	Ethnic communities of India.		01		
	Application of natural products to certain diseases- Jaudice, cardiac, infertility, diabetics, blood pressure and skin diseases.		04		
		TOTAL	60 hr.		

LESSON PLAN

Department Name: BOTANY

Name of Faculty: SHARMISTHA BASU (SB)

Paper Name & Code: MEDICINAL AND ETHNOBOTANY (PRACTICAL), BOT-A-DSE-A-6-3-P

Planned						
Unit / Group / Module / Article	Topics	Reference Books	No of Lecture Planned	Content Delivery Technique	Remarks / Comments	
1. Chemical tests for: (SB)	(a) Tannin (<i>Camellia sinensis</i> / <i>Terminalia chebula</i>).	S.K. Jain, Manual of Ethnobotany, Scientific Publishers, Jodhpur 1999.	06	Laboratory method.		
	(b) Alkaloid (<i>Catharanthus roseus</i>).		03			
2. Powder microscopy: (SB)	Powder microscopy – <i>Zingiber</i> and <i>Holarrhena</i> .		09			Practical demonstration
3. Histochemical tests of: (SB)	Curcumin (<i>Curcuma longa</i>).		03			
	Starch in non-lignified vessel (<i>Zingiber</i>).		03			
	Alkaloid (stem of <i>Catharanthus</i> and bark of <i>Holarrhena</i>).		06			
		TOTAL	30 hr.			

LESSON PLAN

Department Name: BOTANY

Name of Faculty: RAJENDRA YONZONE (RY), ANJAN HAZRA (AH)

Paper Name & Code: NATURAL RESOURCE MANAGEMENT (THEORY), BOT-A-DSE-B-6-4-TH

Unit / Group / Module / Article	Topics	Reference Books	No of Lecture Planned	Content Delivery Technique	Remarks / Comments
1. Natural resources: (RY)	Definition and types.	1. Vasudevan, N. (2006). Essentials of Environmental Science. Narosa Publishing House, New Delhi. 2. Singh, J. S., Singh, S.P. and Gupta, S. (2006). Ecology, Environment and Resource Conservation. Anamaya Publications, New Delhi. 3. Rogers, P.P., Jalal, K.F. and Boyd, J.A. (2008). An Introduction to Sustainable Development. Prentice Hall of India Private Limited, New Delhi.	02	Lectures in English language with proper black board illustrations for all kinds of contents.	
2. Sustainable utilization: (RY)	Concept, approaches (economic, ecological and socio-cultural).		06		
3. Land: (RY)	Utilization (agricultural, pastoral, horticultural, silvicultural); Soil degradation and management.		08		
4. Water: (RY)	Fresh water (rivers, lakes, groundwater, aquifers, watershed); Marine; Estuarine; Wetlands; Threats and management strategies.		08		
5. Biological Resources: (RY)	Biodiversity-definition and types; Significance; Threats; Management strategies; Bioprospecting; IPR; CBD; National Biodiversity Action Plan).		12		
6. Forests: (AH)	Definition, Cover and its significance (with special reference to India); Major and minor. Forest products; Depletion; Management.	1. Vasudevan, N. (2006). Essentials of Environmental Science. Narosa Publishing House, New Delhi. 2. Singh, J. S., Singh, S.P. and Gupta, S. (2006). Ecology, Environment and Resource Conservation. Anamaya Publications, New Delhi. 3. Rogers, P.P., Jalal, K.F. and Boyd, J.A. (2008). An Introduction to Sustainable Development. Prentice Hall of India Private Limited, New Delhi.	06	Blackboard, PowerPoints presentation, Class notes.	
7. Energy: (AH)	Renewable and non-renewable sources of energy.		06		
8. Contemporary practices in resource management: (AH)	EIA, GIS, Participatory Resource Appraisal, Ecological Footprint with emphasis on carbon footprint, Resource Accounting; Waste management.		08	Blackboard, Powerpoint presentation, E-contents.	
9. National and international efforts: (AH)	National and international efforts in resource management and conservation.	04			
		TOTAL	60 hr.		

LESSON PLAN

Department Name: BOTANY

Name of Faculty: ANJAN HAZRA (AH)

Paper Name & Code: NATURAL RESOURCE MANAGEMENT (PRACTICAL), BOT-A-DSE-B-6-4-P

Planned					
Unit / Group / Module / Article	Topics	Reference Books	No of Lecture Planned	Content Delivery Technique	Remarks / Comments
Natural resource management (AH)	Estimation of solid waste generated by a domestic system (biodegradable and nonbiodegradable) and its impact on land degradation.	1. Sreemahadevan Pillai P. R. A comprehensive laboratory manual for Environmental science and Technology, 2009, New Age International. 2. Thatikunta, Ramesh & G, Swarajya & Prasadini, Prabhu & LV, Tayar. Environmental science - A practical manual, 2018, BS Publications.	06	Hands-on experiments, Household survey, field visit	
	Estimation of foliar dust deposition.		06		
	Determination of total solid in water (TDS).		06		
	Determination of chemical properties of soil by rapid spot test (carbonate, iron, nitrate).		06		
	Estimation of organic carbon percentage present in soil sample.		06		
	Collection of data on forest cover of specific area.		06		
		TOTAL	30 hr.		

LESSON PLAN

Department Name: BOTANY

Name of Faculty: ANJAN HAZRA (AH), PAYEL CHATTERJEE (PC)

Paper Name & Code: PLANT SYSTEMATICS (THEORETICAL), BOT-MD-CC2-2-TH

Planned					
Unit / Group / Module / Article	Topics	Reference Books	No of Lecture Planned	Content Delivery Technique	Remarks / Comments
1. Introduction: (PC)	1.1. Components of Systematics: Nomenclature, Identification, Classification;	1. Singh, G. Plant Systematics: An Integrated Approach (3rd ed.), 2016, CRC Press. 2. Sambamurty, A.V.S.S. Taxonomy of Angiosperms, 2005, I.K. International Pvt. Ltd. 3. Dutta, S.C. Systematic Botany, Latest Ed., Wiley Eastern. 4. Jones, S.B. and Luchsinger, A.E. Plant Systematics (2nd ed.), 1987, McGraw Hill Book Company.	02	Chalk and talk and power point presentation.	
	1.2. Taxonomy and its phases - Pioneer, Consolidation, Biosystematic and Encyclopaedic; alpha- and omega-taxonomy,		03		
	1.3. 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.		05		
2. Systems of classification: (AH)	2.1. Broad outline of Bentham & Hooker (1862-1883) and Takhtajan (1997)- systems of classification with merits and demerits. Brief idea of angiosperm phylogeny group (APG IV classification)		05	Blackboard, class notes, e-resources.	
	2.2. Systematics in Practice: Herbaria and Botanic Gardens – their role in teaching and research		04		
	2.3. Dichotomous keys – indented and bracketed.		02		
	2.4. Brief idea on Phenetics and cladistics: Monophyletic, polyphyletic and paraphyletic groups; Plesiomorphy and apomorphy.		02		
	2.5. Numerical taxonomy- methods and significance.	03			
	2.6. Data sources in Taxonomy: Supportive evidences from Phytochemistry, Cytology, Palynology and Molecular biology data (Protein and Nucleic acid homology).	04			
3. Systematic study of angiosperm taxa:	3.1. Monocotyledons: Alismataceae, Gramineae (Poaceae), Cyperaceae, Palmae (Arecaceae),		05	Blackboard, class notes, e-resources.	

Planned					
Unit / Group / Module / Article	Topics	Reference Books	No of Lecture Planned	Content Delivery Technique	Remarks / Comments
Diagnostic features, systematic position (Bentham & Hooker) and economically important plants (parts used and uses) of the following families: (PC & AH)	Liliaceae, Musaceae, Zingiberaceae, Cannaceae, Orchidaceae.	1. Paria, N.D., Plant Taxonomy & Biodiversity, 2022, Santra Publication Pvt. Ltd.			
	3.2. Dicotyledons: Nymphaeaceae, Magnoliaceae, Ranunculaceae, Leguminosae (subfamilies), Euphorbiaceae, Malvaceae, Umbelliferae (Apiaceae), Labiatae (Lamiaceae), Cruciferae (Brassicaceae), Solanaceae, Scrophulariaceae, Acanthaceae, Rubiaceae, Cucurbitaceae, Compositae (Asteraceae).	2. Dutta, S.C. Systematic Botany, Latest Ed., Wiley Eastern. 3. Singh, G. Plant Systematics: An Integrated Approach (3rd ed.), 2016, CRC Press. 4. Hait, G., Ghosh, A. and Bhattacharya, K. A Text Book of Botany, 2007, New Central Book Agency.	10		
		TOTAL	45 hr.		

LESSON PLAN

Department Name: BOTANY

Name of Faculty: ADITI DEY (AD), PAYEL CHATTERJEE (PC)

Paper Name & Code: PLANT SYSTEMATICS (PRACTICAL), BOT-MD-CC2-2-P

Planned					
Unit / Group / Module / Article	Topics	Reference Books	No of Lecture Planned	Content Delivery Technique	Remarks / Comments
1. 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 Bentham and Hooker system of classification (AD/PC)	Work out, drawing, measurements, description, preparation of floral formula and floral diagram, identification up to genus of different members available locally from the following families: Malvaceae, Leguminosae (Papilionaceae), Acanthaceae, Solanaceae, Scrophulariaceae, Labiatae (Lamiaceae), Rubiaceae.	1. Prain, D. Bengal Plants (Vol I & II), Bishen Singh Mahendra Pal Singh. 2. Singh, G. Plant Systematics: An Integrated Approach (3rd ed.), 2016, CRC Press. 3. Dr. P. Maji, Focus on College Practical Botany, Rita Book Agency, Latest Edition.	18	Hands-on practice with fresh specimens	
2. Spot identification: (AD/PC)	Spot identification (Binomial, Family) of common wild plants from families included in the theoretical syllabus.	Paria, N.D., Plant Taxonomy & Biodiversity, 2022, Santra Publication Pvt. Ltd.	3	Study of fresh Specimens.	
3. Field work: (AD/PC)	At least three excursions including one excursion to Acharya Jagadish Chandra Bose Indian Botanic Garden (Shibpur, Howrah) and one to Central National Herbarium (CNH).	-----	3X3=9 hr.	Field study, collection of specimens, demonstration of the Preservation technique Field study, collection of specimens, demonstration of techniques of plant specimen preservation and herbarium preparation. Visit to the Herbarium s and visit to the herbarium.	
		TOTAL	30 hr.		

LESSON PLAN

Department Name: BOTANY

Name of Faculty: RAJENDRA YONZONE (RY)

Paper Name & Code: MUSHROOM CULTIVATION TECHNOLOGY (THEORY), BOT-MD-SEC-1-TH

Planned					
Unit / Group / Module / Article	Topics	Reference Books	No of Lecture Planned	Content Delivery Technique	Remarks / Comments
1. Introduction: (RY)	1.1. Introduction, History of mushroom cultivation.	1. Acharya,K., Roy, A. & Sarkar, J. Mushroom Cultivation Technology, 2020, Techno World, Kolkata.. 2. Tewari, P. & Kapoor, S.C. Mushroom Cultivation, 1988, Mittal Publications, Delhi.	02	Chalk and talk.	
	1.2. Current overview of mushroom production in the world.		01		
	1.3. Mushroom biology-classification of mushrooms, edible mushrooms in India, poisonous mushrooms, mushroom poisoning.		03		
2. Infrastructure and instruments: (RY)	2.1. Infrastructure-structural design and layout of mushroom farm, substrates (locally available).		03		
	2.2. Appliances- weighing balance, autoclave, laminar air flow, incubator, hot air oven, spirit lamp, Bunsen burner, pH meter, laboratory heater, low-cost stoves, water bath, humidifier, water sprayer, vessels, inoculation hook and inoculation loop, sieves, culture racks, tray, polythene bags.		04		
	2.3. Methods of sterilization.		02		
3. Cultivation procedure: (RY)	3.1. Cultivation technology-overview of cultivation strategies, composting technology in mushroom production, mushroom bed preparation, culture media, pure culture, maintenance and preservation of pure culture.		05	Chalk and talk, Power-Point Presentation	
	3.2. Production of spawn- cultivation of oyster mushroom, paddy-straw mushroom, milky mushroom and white button mushroom.		03		
	3.3. Cultivation of medicinal mushroom (<i>Cordyceps</i> and <i>Ganoderma</i>).		04		
	4.1. Mushroom diseases and management strategies.			03	Chalk and talk, Power-Point Presentation

Planned					
Unit / Group / Module / Article	Topics	Reference Books	No of Lecture Planned	Content Delivery Technique	Remarks / Comments
4. Disease and Management: (RY)	4.2. Post-harvest technology-short-term storage (Refrigeration- up to 24 hours), long-term storage (canning, pickles, papads etc.), drying, storage in salt solutions.		04		
	4.3. Food preparations from mushrooms.		02		
5. Additional Topics: (RY)	5.1. Uses of spent mushroom substrate.		01		
	5.2. Strain improvements in cultivated mushroom; Nutritional and medicinal value of edible mushrooms.		02		
	5.3. Research centres- National level and regional level.		01		
	5.4. Cost-benefit ratio.		01		
	5.5. Mushroom based Industry.		02		
	5.6. Mushroom market in India and abroad.		02		
		TOTAL	45 hr.		

LESSON PLAN

Department Name: BOTANY

Name of Faculty: ANJAN HAZRA (AH)

Paper Name & Code: MUSHROOM CULTIVATION TECHNOLOGY (PRACTICAL), BOT-MD-SEC-1-P

Planned					
Unit / Group / Module / Article	Topics	Reference Books	No of Lecture Planned	Content Delivery Technique	Remarks / Comments
1. Section, staining, slide preparation, description, drawing: (AH)	Macro and microscopic identification of some common edible mushrooms (<i>Agaricus</i> , <i>Pleurotus</i>)	1. Som, D. 2021. A Practical Manual on Mushroom Cultivation. P.K. Publishers & Distributors. 2. Stamets, P. and Chilton, J.S. 1985. The Mushroom Cultivator: A Practical Guide to Growing Mushrooms at Home. Richmond Publishing Co Ltd. 3. Reyes, R.G., Kalaw, S.P., Cruz, D.G.V., Tokunaga, K., Sumi, R., Mori, N. and Eguchi F. 2018. A practical guide to mushroom pharming. SEAMEO BIOTROP.	4x2 = 8	Study of fresh Specimens.	
2. Media types and composition: (AH)	Media preparation.		2x2 = 4	Hands on experiment.	
3. Demonstration: (AH)	Fungal tissue culture.		2x2 = 4	Hands on experiment.	
4. Subculturing: (AH)	Sub-culturing for maintenance of culture.		2x2 = 4	Hands on experiment.	
5. Demonstration: (AH)	Spawn production.		1x2 = 2	Hands on experiment.	
6. Cultivation: (AH)	Cultivation of <i>Pleurotus/Calocybe</i> .		4x2 = 8	Hands on experiment.	
		TOTAL	30 hr.		

LESSON PLAN

Department Name: BOTANY

Name of Faculty: SUDIP KUMAR SINHA (SKS), ANJAN HAZRA (AH)

Paper Name & Code: PHARMACOGNOSY & ETHNOBOTANY (THEORY), BOT-MD-CC4-4-TH

Unit / Group / Module / Article	Topics	Reference Books	No of Lecture Planned	Content Delivery Technique	Remarks / Comments
1. Medicinal botany: (AH)	History, scope and importance of medicinal plant in herbal drug industry.	1. Trease & Evans. Pharmacognosy, Saunders. 2. Trivedi P.C. 2006. Medicinal Plants: Ethnobotanical approach, Agrobios India 3. S.K. Jain, Manual of Ethnobotany, Scientific Publishers, Jodhpur 1995.	01	Face to face teaching, Chalk and talk method, content delivery through PPT, posting of educational videos, instructional materials and M.C.Q. practice questions in google classroom for self-space learning	
	A brief idea about traditional systems of medicine- ayurveda, siddha and unani.		02		
	Polyherbal formulations.		01		
2. Pharmacognosy- General account: (AH)	2.1. Pharmacognosy and its introduction and importance in modern medicine.		02		
	2.2. Crude drugs.		01		
	2.3. Classification of plant drugs- chemical and pharmacological action.		02		
	2.4. Drug evaluation– organoleptic, microscopic, chemical, physical and biological.		03		
	2.5. Major pharmacological groups of plant drugs and their uses.		02		
	2.6. Conservation of endangered and endemic medicinal plants.		02		
3. Secondary metabolites: (SKS)	3.1. Secondary metabolites and their differences with primary metabolites.		03		
	3.2. Interrelationship of basic metabolic pathways (Shikimate, Mevalonate, Acetate & MEP) with secondary metabolite biosynthesis (outlines only).	04			
	3.3. Major types and classification–terpenoids, phenolics, flavonoids, alkaloids and and their pharmacological importance.	03			
4. Pharmacologically active constituents: (SKS)	Source plants (one example) parts used and uses of: 4.1. Steroids (Solasodin, Diosgenin, Digitoxin).		01		

Unit / Group / Module / Article	Topics	Reference Books	No of Lecture Planned	Content Delivery Technique	Remarks / Comments
	4.2. Tannin (Catechin).		01		
	4.3. Resins (Gingerol, Curcuminoids).		01		
	4.4. Alkaloids (Quinine, Atropine, Pilocarpine, Strychnine, Reserpine, Vinblastine, Taxol, Pyrolizidine).		01		
	4.5. Phenols (Sennocide and Capsaicin).		01		
5. Ethnobotany and folk medicine: (AH)	Definition, methods of study, application.		02		
	Indian scenario, national interacts.		02		
	folk medicines in ethnobotany.		02		
	Ethnomedicine.		02		
	Ethnoecology.		01		
	Ethnic communities of India, sacred grove.		02		
	Application of natural products to certain diseases- Jaundice, cardiac, infertility, diabetics, blood pressure and skin diseases.		03		
		TOTAL	45 hr.		

LESSON PLAN

Department Name: BOTANY

Name of Faculty: SUDIP KUMAR SINHA (SKS)

Paper Name & Code: PHARMACOGNOSY & ETHNOBOTANY (PRACTICAL), BOT-MD-CC4-4-P

Planned					
Unit / Group / Module / Article	Topics	Reference Books	No of Lecture Planned	Content Delivery Technique	Remarks / Comments
1. Chemical tests for: (SKS)	(a) Tannin (<i>Camellia sinensis</i> / <i>Terminalia chebula</i>).	S.K. Jain, Manual of Ethnobotany, Scientific Publishers, Jodhpur 1999.	2x2 = 4	Laboratory method. Practical demonstration	
	(b) Alkaloid (<i>Catharanthus roseus</i>).		2x2 = 4		
2. Powder microscopy: (SKS)	Powder microscopy – <i>Zingiber</i> and <i>Holarrhena</i> .		2x2 = 4		
3. Histochemical tests of: (SKS)	Curcumin (<i>Curcuma longa</i>).		02		
	Starch in non-lignified vessel (<i>Zingiber</i>).		2x2 = 4		
	Alkaloid (stem of <i>Catharanthus</i> and bark of <i>Holarrhena</i>).		2x2 = 4		
4. Identification from fresh specimen/herbarium of some commonly used medicinal plants: (SKS)	a. <i>Azadirachta indica</i> (Neem), b. <i>Justicia adhatoda</i> (Vasak), c. <i>Andrographis paniculata</i> (Kalmegh), d. <i>Saraca asoca</i> (Ashoka), e. <i>Centella asiatica</i> (Thankuni), f. <i>Catharanthus roseus</i> (Nayantara), g. <i>Phyllanthus emblica</i> (Amla), h. <i>Terminalia chebula</i> (Haritaki), i. <i>Bacopa monnieri</i> (Brahmi)	2x4 = 8			
		TOTAL	30 hr.		

LESSON PLAN

Department Name: BOTANY

Name of Faculty: RAJENDRA YONZONE (RY)

Paper Name & Code: PLANT GEOGRAPHY, ECOLOGY AND EVOLUTION (THEORY), BOT-MD-CC5-4-TH

Planned					
Unit / Group / Module / Article	Topics	Reference Books	No of Lecture Planned	Content Delivery Technique	Remarks / Comments
PLANT GEOGRAPHY 1. Phytogeographical regions: (RY)	1.1. Phytogeographical regions of India (Chatterjee 1960)	1. Chapman and Riss. Ecology: Principles and Applications, Latest Ed., Cambridge University Press	02	Chalk and talk method, group discussion, class test.	
	1.2. Dominant flora of Eastern Himalaya, Western Himalaya, Indian deserts and Sundarbans.	2. Shukla, R.S. & Chandel, P.S. Plant Ecology, Latest Ed., S. Chandel and Co. 3. Kumar, H.D. Modern Concept of Ecology, Latest Ed. Vikas Publishing House.	03		
2. Endemism: (RY)	2.1. Endemic types and Factors	4. Begon, M., Herper, J.L. and Townsend, C.R. Ecology- Individuals, Populations and Communities (3rd ed.), Oxford Blackwell Science	01		
	2.2. Age & Area hypothesis and Epibiotic theory	5. Verma, P.S. & Agarwal, U.K. Concept of Ecology, Latest Ed., S. Chand & Company.	02		
	2.3. Endemism in Indian flora.	1. Ecology, environmental Science & Conservation. S.P. Singh, J.S. Singh: S. Chand (G/L) & Company Ltd	01		
ECOLOGY 1. Preliminary idea on: (RY)	1.1. Habitat and Niche (fundamental and realized).	1. Ecology, environmental Science & Conservation. S.P. Singh, J.S. Singh: S. Chand (G/L) & Company Ltd	01		
	1.2. Ecotone and edge-effect.		01		
	1.3. Microclimate.		01		
	1.4. Ecads, ecotype and ecoclines.		01		
	1.5. Carrying capacity.		01		
2. Community ecology: (RY)	2.1. Community- Characteristics and diversity (α , β , γ).	1. Ecology, environmental Science & Conservation. S.P. Singh, J.S. Singh: S. Chand (G/L) & Company Ltd	01		
	2.2. Ecological succession –Primary and secondary, Seral stages (with reference to Lithosere and Hydrosere), autogenic and allogenic succession, Climax community.		03		
	3.1. Plant indicators (metallophytes).		01		

Planned				Content Delivery Technique	Remarks / Comments
Unit / Group / Module / Article	Topics	Reference Books	No of Lecture Planned		
3. Biological indicator and bioremediation: (RY)	3.2. Phytoremediation.	1. Ecology, environmental Science & Conservation. S.P. Singh, J.S. Singh: S. Chand (G/L) & Company Ltd	02		
4. Conservation of Biodiversity: (RY)	4.1. Level of Biodiversity: genetic, species & ecosystem diversity.	1. Ecology, environmental Science & Conservation. S. P. Singh, J.S. Singh: S. Chand (G/L) & Company Ltd	02		
	4.2. Biodiversity hotspots- criteria, Indian hotspots.		01		
	4.3. <i>In-situ</i> and <i>ex-situ</i> conservation.		02		
	4.4. Causes of extinction.		01		
	4.5. IUCN Red List categories.		01		
	4.6. Seed-banks.		01		
	4.7. Cryopreservation.		01		
	4.8. Geographic Information System and Remote Sensing (brief idea).		01		
EVOLUTION	1.1. Introduction.	1. Simpson, G. Plant Systematics, 2006, Elsevier Academic Press. 2. Futuyma., D. Evolution. 2015. (3rd Ed.) Sinauer Associates	02		
1. Introduction and Theories: (RY)	1.2. Theories of evolution: Natural selection, Group selection, Neutral theory of molecular evolution.		02		
	1.3. Phyletic gradualism, Punctuated equilibrium and Stasis.		02		
	2. Terminology: (RY)		2.1. Brief idea on: Stabilizing directional, disruptive and sexual selection; Speciation: Sympatric and allopatric speciation; Coevolution, Adaptive radiation, Reproductive isolation.		
3. Phylogeny: (RY)	3.1. Simplified phylogeny of bacteria, algae, fungi, bryophyte, pteridophyte and gymnosperm.		02		
	3.2. Phylogenetic tree.		02		
		Total	60 hr.		

LESSON PLAN

Department Name: BOTANY

Name of Faculty: RAJENDRA YONZONE (RY), SUDIP KUMAR SINHA (SKS)

Paper Name & Code: PLANT GEOGRAPHY, ECOLOGY AND EVOLUTION (PRACTICAL), BOT-MD-CC5-4-P

Planned					
Unit / Group / Module / Article	Topics	Reference Books	No of Lecture Planned	Content Delivery Technique	Remarks / Comments
PLANT GEOGRAPHY (RY)	1. Field visit- at least one long excursion at any phytogeographical region of India.	College Botany Practical (Volume-1) S. C. Santra T. P. Chatterjee, A. P. Das.	Long Excursion Will Be Conducted. 6 To 10 Days to Other Phytogeographical area. One whole day excursion to any local area.	Visit to field and study flora.	
	2. Study of local flora and submission of a project report highlighting phytogeographical characteristics of the region.				
ECOLOGY (SKS)	1. Study of community structure by quadrat method and determination of (i) Minimal size of the quadrat, (ii) Frequency, density and abundance,	1. Shukla, R.S. & Chandel, P.S. Plant Ecology, Latest Ed., S. Chandel and Co. 2. College Botany Practical (Volume-1) S. C. Santra T. P. Chatterjee, A. P. Das.	To be done during long excursion.	On field study. Write up provided in printed form.	
	2. Estimation of foliar dust deposition.		4x2 = 8 hr.	Laboratory method. Practical demonstration. Visit to field and collection of water sample to study some ecological parameters.	
	3. Measurement of Dissolved O ₂ By Azide Modification of Winkler's Method.				
	4. Determination of chemical properties of soil by rapid spot test (carbonate, iron, nitrate).				
	5. Estimation of organic carbon percentage present in soil sample.				
	Total	30 hr. including field work			

LESSON PLAN

Department Name: BOTANY

Name of Faculty: SHARMISTHA BASU (SB)

Paper Name & Code: PLANT BIOTECHNOLOGY (THEORY), BOT-G-SEC-B-4/6-1

Planned					
Unit / Group / Module / Article	Topics	Reference Books	No of Lecture Planned	Content Delivery Technique	Remarks / Comments
1. Plant tissue culture: (SB)	1.1. Introduction and basic concepts.	1. Chawla, H.S. An Introduction to Plant Biotechnology (2nd ed.), 2002, Oxford & IBH. 2. Walker, J.M. & Rapley, R. Molecular Biology & Biotechnology, 2000, Royal Society of Chemistry Publishing House. 3. Dubey, R.C. Biotechnology, Latest Ed., S. Chand & Company Pvt. Ltd. 4. Bhojwani, S.S. & Razdan, M.I. Plant Tissue Culture: Theory and Practise, Elsevier.	02	PPT, video lessons, Google classroom, chalk and talk method.	
	1.2. Cellular potency.		01		
	1.3. Callus culture and plant regeneration.		01		
2. Micropropagation: (SB)	2.1. Somatic embryogenesis and artificial seed.		04		
3. Protoplast culture: (SB)	3.1. Protoplast culture and its application.		06		
4. Recombinant DNA technology: (SB)	4.1. Recombinant DNA.		03		
	4.2. Restriction enzymes.		02		
	4.3. Plasmids as vectors.		03		
5. Cloning: (SB)	5.1. Gene cloning (basic steps).		04		
6. Achievements in crop biotechnology: (SB)	6.1. Pest resistant plant (Bt cotton).		02		
	6.2. Transgenic crops with improved quality (Flavr Savr tomato and golden rice).	02			
		TOTAL	30 hr.		

LESSON PLAN

Department Name: BOTANY

Name of Faculty: RAJENDRA YONZONE (RY)

Paper Name & Code: ECONOMIC BOTANY (THEORY), BOT-G-DSE-B-6-1-TH

Planned					
Unit / Group / Module / Article	Topics	Reference Books	No of Lecture Planned	Content Delivery Technique	Remarks / Comments
1. Origin of cultivated plants: (RY)	1.1. Concepts of centres of origin and their importance with reference to Vavilov's work.	1. Pandey B.P., Economic Botany; Latest Edition, reprint 1999; S. Chand Publishing. 2. Verma V., Text book of Economic Botany, Ane Books Pvt Ltd, 2009. 3. Kochhar, S.L. (2012). Economic Botany in Tropics, MacMillan & Co. New Delhi, India.	12	Chalk and talk method, group discussion, class test.	
2. Rice: (RY)	2.1. Origin, morphology and uses.		12		
3. Legumes: (RY)	3.1. General account with special reference to <i>Vigna</i> .		08		
4. Beverages: (RY)	4.1. Tea- morphology, processing and uses.		10		
5. Study of the following economically important plants (Scientific names, families, parts used and importance): (RY)	5.1. Cereals- Rice, wheat.		02		
	5.2. Pulses- Mong, gram.		02		
	5.3. Spices- Ginger, cumin.		01		
	5.4. Beverages- Tea, coffee.		02		
	5.5. Medicinal plants- Cinchona, neem, Ipecac, Vasaka.		02		
	5.6. Oil yielding plants- Mustard, groundnut, coconut.		02		
	5.7. Vegetables- Potato, radish, bottle gourd, cabbage.		02		
	5.8. Fibre yielding plants- Cotton, jute.	02			
	5.9. Timber yielding plants- Teak, Sal.	01			
	5.10. Fruits- Mango, apple.	01			
5.11. Sugar yielding plant- Sugarcane.	01				
		TOTAL	60 hr.		

LESSON PLAN

Department Name: **BOTANY**

Name of Faculty: **RAJENDRA YONZONE (RY)**

Paper Name & Code: **ECONOMIC BOTANY (PRACTICAL), BOT-G-DSE-B-6-1-P**

Planned					
Unit / Group / Module / Article	Topics	Reference Books	No of Lecture Planned	Content Delivery Technique	Remarks / Comments
Practical: (RY)	1. Study of economically important plants (rice/jute/tea) through herbarium specimens and field study.	1. Pandey, B.P. 2017. Modern Practical Botany Vol 1. S Chand & Company Pvt.	6x2 = 12	Laboratory method. Practical demonstration.	
	2. Study of cultivation practices in field and submission of report.		08		
	3. Study of local economically important plants and submission of report with photographs.		10		
		Total	30 hr. including field work		