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),	1. Paria, N.D., Plant Taxonomy & Biodiversity, 2022, Santra Publication	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.	Pvt. Ltd. 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.			
	3.2. Dicotyledons: Nymphaeaceae, Magnoliaceae, Ranunculaceae, Leguminosae (subfamilies), Euphorbiaceae, Malvaceae, Umbelliferae (Apiaceae), Labiatae (Lamiaceae), Cruciferae (Brassicaceae), Solanaceae, Scrophulariaceae, Acanthaceae, Rubiaceae, Cucurbitaceae, Compositae (Asteraceae).		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 as biofertilizers: (AH)	2.1. *Rhizobium*- 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. *Azospirillum*- Isolation, carrier-based inoculants, mass multiplication, associative effect of different microorganisms		3		
	2.3. *Azotobacter*- Classification, characteristics, crop response to Azotobacter inoculants, maintenance and mass multiplication.		3		
3. Cyanobacteria: (AH)	3.1. Cyanobacteria (Blue green algae), *Azolla* and *Anabaena* azollae association, nitrogen fixation, Factors affecting growth, blue green algae and *Azolla* 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 *Frankia*.		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. *Trichoderma*: Isolation, mass production, formulation, quality control and field application.		2		
	6.3. *Pseudomonas*- Isolation, beneficial Pseudomonas strains in agriculture, mode of action.		2		
	6.4. Fungi as bioinsecticide- *Metarhizium anisopliae*, *Beauveria bassiana* and *Verticillium lecanii* overview, mode of action and use in agriculture.		2		
	6.5. Nematophagous fungi-overview, mode of action.		1		
	6.6. Bacteria as bioinsecticide- *Bacillus thuringiensis* -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 *Azotobacter*, phosphate- solubilizing microbes and *Trichoderma*. 2. Isolation and identification of phosphate-solubilizing fungi. 3. Study of Arbuscular Mycorrhizal fungi. 4. Isolation of *Azotobacter* and *Trichoderma* from the soil. 5. Evaluation of *in vitro* antagonistic activity of *Trichoderma* species in the dual culture system.	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.	
		Total	30 hr.		

LESSON PLAN

Department Name: BOTANY

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

Paper Name & Code: PLANT GEOGRAPHY, ECOLOGY AND EVOLUTION (THEORY), BOT-H-CC-4-8-TH

Planned					
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
PLANT GEOGRAPHY 1. Phytogeographical regions: **(SB)**	1.1. Phytogeographical regions of India (Chatterjee 1960)	1. Chapman and Riss. Ecology: Principles and Applications, Latest Ed., Cambridge University Press 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. 4. Begon, M., Herper, J.L. and Townsend, C.R. Ecology- Individuals, Populations and Communities (3rd ed.), Oxford Blackwell Science 5. Verma, P.S. & Agarwal, U.K. Concept of Ecology, Latest Ed., S. Chand & Company.	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.	
	1.2. Dominant flora of Eastern Himalaya, Western Himalaya and Sundarbans.		04		
2. Endemism: **(SB)**	2.1. Endemic types and Factors		02		
	2.2. Age & Area hypothesis and Epibiotic theory		02		
	2.3. Endemism in Indian flora.	1. Ecology, environmental Science & Conservation. S.P. Singh, J.S. Singh: S. Chand (G/L) & Company Ltd	02		
ECOLOGY 1. Preliminary idea on: **(SB)**	1.1. Habitat and Niche.	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: **(SB)**	2.1. Community- Characteristics and diversity.	1. Ecology, environmental Science & Conservation. S.P. Singh, J.S. Singh: S. Chand (G/L) & Company Ltd	02		
	2.2. Ecological succession –Primary and secondary, Seral stages (with reference to Hydrosere), autogenic and allogenic succession.		03		
3. Biological indicator and	3.1. Plant indicators (metallophytes).	1. Ecology, environmental Science &	02		

Planned					
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
bioremediation. **(SB)**	3.2. Phytoremediation.	Conservation. S.P. Singh, J.S. Singh: S. Chand (G/L) & Company Ltd	02		
4. Conservation of Biodiversity. **(SB)**	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	05		
	4.2. Biodiversity hotspots- criteria, Indian hotspot.		04		
	4.3. *In- situ* and *ex-situ* conservation,		03		
	4.4. Seed-banks.		02		
	4.5. Cryopreservation.		02		
EVOLUTION 1. Introduction and Theories **(AH)**	1.1. Introduction.	1. Simpson, G. Plant Systematics, 2006, Elsevier Academic Press. 2. Futuyma., D. Evolution. 2015. (3rd Ed.) Sinauer Associates	02		
	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 **(AH)**	2.1. Brief idea on: Stabilizing directional, disruptive and sexual selection; Speciation: Sympatric and allopatric speciation; Coevolution, Adaptive radiation, Reproductive isolation.		04	Blackboard, Powerpoint presentation, class notes, e-resources	
3. Phylogeny. **(AH)**	3.1. Simplified phylogeny of bacteria, algae, fungi, bryophyte, pteridophyte and gymnosperm.		03		
	3.2. Phylogenetic tree.		03		
		Total	60 hr.		

LESSON PLAN

Department Name: BOTANY

Name of Faculty: SHARMISTHA BASU (SB), SUDIP KUMAR SINHA (SKS)

Paper Name & Code: PLANT GEOGRAPHY, ECOLOGY AND EVOLUTION (PRACTICAL), BOT-H-CC-4-8-P

Planned					
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
PLANT GEOGRAPHY (SB)	1. Field visit- at least one long excursion at different phytogeographical region of India. 2. Study of local flora and submission of a project report highlighting phytogeographical characteristics of the region.	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.	Laboratory method. Practical demonstration. Visit to field and study flora	
ECOLOGY (SKS)	1. Study of community structure by quadrat method and determination of (i) Minimal size of the quadrat, (ii) Frequency, density and abundance of components,	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.	
ECOLOGY (SB)	2. Comparative Anatomical Studies Of Leaves Form Polluted and Less Polluted Areas. 3. Measurement of Dissolved O_2 By Azide Modification of Winkler's Method. 4. Comparison of Free CO_2 from Different Sources,	1. College Botany Practical (Volume-1) S. C. Santra T. P. Chatterjee, A. P. Das.	6x2 = 12 hr.	Laboratory method. Practical demonstration. Visit to field and collection of water sample to study some ecological parameters.	
		Total	30 hr. including field work		

LESSON PLAN

Department Name: BOTANY

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

Paper Name & Code: ECONOMIC BOTANY (THEORY), BOT-H-CC-4-9-TH

Planned					
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
1. Origin of cultivated crops: (RY)	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.	1. Kochhar, S.L. (2012). Economic Botany in Tropics, MacMillan & Co. New Delhi, India. 2. Wickens, G.E. (2001). Economic Botany: Principles & Practices. Kluwer Academic Publishers, The Netherlands.	06	Verbal / Oral lectures in English language with proper black board illustrations for all kinds of contents [note: if necessary, PPT, notes hard copy as well as soft copy can be provided to students].	
2. Cereals: (RY)	Rice and wheat (origin, morphology, processing and uses).		06		
3. Legumes: (RY)	Origin, morphology and uses of gram and mung bean. Importance to man and environment.		06		
4. Sugar and starches: (RY)	Morphology and processing of sugarcane, products and byproducts of sugarcane industry. Potato- morphology, propagation and uses.		05		
5. Spices: (AD)	Listing of important spices, their family and part used.	Pandey B.P., Economic Botany; Latest Edition, reprint 1999; S. Chand Publishing.	06	Chalk and talk, Power-Point Presentation, display of preserved specimens.	
6. Beverages: (AD)	Tea (morphology, processing and uses)	Verma V., Text book of Economic Botany, Ane Books Pvt Ltd, 2009.	05	Chalk and talk, Power-point Presentation.	
7. Oil and fats: (RY)	General description, classification, extraction, their uses and health implications of mustard, soybean, coconut (Botanical name, family and uses). Essential oils- general account,	1. Kochhar, S.L. (2012). Economic Botany in Tropics, MacMillan & Co. New Delhi, India. 2. Wickens, G.E. (2001). Economic Botany: Principles & Practices. Kluwer Academic	10	Verbal / Oral lectures in English language with proper black board illustrations for all kinds of contents	

Planned					
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
	extraction methods, comparison with fatty oils and their uses.	Publishers, The Netherlands.		[note: if necessary, PPT, notes hard copy as well as soft copy can be provided to students].	
8. Drug-yielding plants: **(AD)**	Therapeutic and habit-forming drugs with special reference to *Cinchona*, *Digitalis*, *Papavar*, *Cannabis* and Tobacco (morphology, processing, uses and health hazards).	1. Kochhar S. L., Economic Botany-A comprehensive Study, Cambridge University Press, 2016. 2. Pandey B.P., Economic Botany; reprint 1999; S. Chand Publishing.	08	Chalk and talk, Power-Point Presentation, display of preserved specimens.	
9. Timber: **(AD)**	General account with special reference to Sal and Teak.	1. Pandey B.P., Economic Botany; reprint 1999; S. Chand Publishing.	04	Chalk and talk, Power-Point Presentation,	
10. Fibers: **(AD)**	Cotton and Jute (Morphology, extraction and uses).	1. Kochhar S. L., Economic Botany-A comprehensive Study, Cambridge University Press, 2016.	04		
		TOTAL	60 hr.		

LESSON PLAN

Department Name: BOTANY

Name of Faculty: SUDIP KUMAR SINHA (SKS)

Paper Name & Code: ECONOMIC BOTANY (PRACTICAL), BOT-H-CC-4-9-P

Planned					
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
1. Cereals: (SKS)	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).	1. Pandey, B.P. 2017. Modern Practical Botany Vol 1. S Chand & Company Pvt.	06	Laboratory method. Practical demonstration. Write up provided in printed form.	
2. Legume: (SKS)	Soybean, ground nut (habit, fruit, seed structure, micro-chemical tests).		04		
3. Source of sugars and starches: (SKS)	es: 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.		04		
4. Beverage: (SKS)	Tea- tea leaves, tests for tannin.		02		
5. Edible oil: (SKS)	Mustard- plant specimen, seeds, tests for fat in crushed seeds.		02		
6. Drug: (SKS)	Habit sketch of *Digitalis*, *Papaver* and *Cannabis*.		02		
7. Timber: (SKS)	Sal, Teak- section of young stem.		02		
8. Fibre: (SKS)	Jute- specimen, transverse section of stem, tests for lignin on T.S. of stem and study of fibre following maceration technique.		04		
9. Field visit:	One field visit to give an idea about cultivation of Rice/Jute/Tea/Potato	-------	04	One day whole day excursion.	
		Total	30 hr. including field work		

LESSON PLAN

Department Name: BOTANY

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

Paper Name & Code: GENETICS (THEORY), BOT-H-CC-4-10-Th

Planned					
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
1. Introduction: (PC)	Mendelian genetics and its extension.	1. Gardner, E.J., Simmons, M.J. & Snustad, D.P. Principles of Genetics (8th ed.) 1991, John Wiley & Sons.	8	Power point presentation	
2. Linkage, Crossing over and Gene Mapping: (PC)	2.1. Complete and incomplete linkage (example), linked gene does not assort independently (example), linkage group, 2.2. Crossing over, crossing over produces recombination (example), detection of crossing over (McClintock's experiment), and 2.3. Molecular mechanism of crossing over (Holliday model), 2.4. Gene mapping with three-point test cross, detection of middle gene in three-point test cross, calculation of recombination frequencies, 2.5. Co-efficient of coincidence and interference, mapping function, 2.6. Problems on gene mapping, 2.7. Molecular mapping – ISH, FISH (brief idea).	1.Tamarin, Robert H. Principles of Genetic (7th ed., 2002, Tata McGraw Hil. 2. Hartl, D.L. & Jones, E.W. Genetics , 2005, Jones & Barlett Publishers. 3. Lewin, B. Genes VIII, 2004, Pearson Educational International. 4. Sen, S. & Kar, D.K. Cytology& Genetics, 2005, Narosa Publishing House.	16	Chalk and Talk and PowerPoint presentation	
3. Epistasis and Polygenic inheritance: (PC)	Epistasis and Polygenic inheritance in plants.	1. Brown, T.A. Genomes 3, 2007, Garland Science Publishing. 2. Snustad, D.P. & Simmons, M.J. Principles of Genetics (2nd ed.), 2000, (4th ed.), 2006, John Wiley & Sons. 3. Klug, W.S. & Cummings, M.R. Concepts of Genetics, 2003, Pearson Education.	4	PowerPoint presentation	
4. Aneuploidy and Polyploidy: (PC)	Types, examples, meiotic behaviour and importance of: 4.1. Aneuploidy, 4.2. Polyploidy, 4.3. Speciation and evolution through polyploidy.	1. Strickberg, M.W. Genetics, McMillan. 2. Jain, H.K. Genetics, 1999, Oxford & IBH Publishing Company.	8	Chalk and talk and PowerPoint presentation	

Planned					
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
5. Chromosomal aberration: **(AH)**	Types and meiotic behaviour of: 5.1. Deletion, 5.2. Duplication, 5.3. Translocation, and 5.4. Inversion.	1. Klug, W.S. & Cummings, M.R. Concepts of Genetics, 2003, Pearson Education. 2. Kar, D.K. and Halder, S. Cell Biology, Genetics and Molecular Biology 2008, New Central Book Agency.	8	Blackboard and PowerPoint presentation	
6. Mutation: **(AH)**	6.1. Point mutation-Transition, Transversion and Frame shift mutation, 6.2. Molecular mechanisms (tautomerisation, alkylation, deamination, base analogue incorporation, dimerisation), 6.3. DNA repair (brief idea).	1. Russel, P.J. Fundamental of Genetics (2nd ed.), 2000, Pearson Education. 2. Klug, W.S. & Cummings, M.R. Concepts of Genetics, 2003, Pearson Education.	10	Blackboard and PowerPoint presentation	
7. Structural organisation of Gene: **(AH)**	7.1. One Gene–one polypeptide concept, 7.2. Split gene, 7.3. Overlapping gene, 7.4. Repetitive DNA tandem and interspersed, 7.5. Transposon (Ac-Ds system), 7.6. Homoeotic gene in plants (ABCE Quartet model of flowering).	1. Snustad, D.P. & Simmons, M.J. Principles of Genetics (2nd ed.), 2000, (4th ed.), 2006, John Wiley & Sons. 2. Tamarin, Robert H. Principles of Genetic (7th ed., 2002, Tata McGraw Hill.	6	Blackboard and PowerPoint presentation	
		TOTAL	60 hr.		

LESSON PLAN

Department Name: BOTANY

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

Paper Name & Code: GENETICS (PRACTICAL), BOT-H-CC-4-10-P

Planned					
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
1. Introduction to chromosome preparation: (PC)	Pre-treatment, Fixation, Staining, Squash and Smear preparation, Preparation of permanent slides.	1. Sharma, A.K. and Sharma, A. Chromosome Technique, 1980, Bu. Sen, 2.S. & Kar, D.K. Cytology& Genetics, 2005, Narosa Publishing House. tterworth Publications.	2	Hands on demonstration.	
2. Determination of mitotic index: (PC)	Determination of mitotic index and frequency of different mitotic stages in pre-fixed root tips of *Allium cepa*.	1. Sen, S. & Kar, D.K. Cytology& Genetics, 2005, Narosa Publishing House.	2	Hands on demonstration.	
3. Study of mitotic chromosome: (PC)	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: 24 *Allium cepa, Aloe vera, Lens esculenta.*	1. Sen, S. & Kar, D.K. Cytology& Genetics, 2005, Narosa Publishing House. 2. Sharma, A.K. and Sharma, A. Chromosome Technique, 1980, Bu. Sen.	6X2 = 12	Hands on demonstration.	
4. Study of chromosomal aberrations: (PC)	Study of chromosomal aberrations developed due to exposure to any two pollutants/ pesticides etc.	1. Kar, D.K. and Halder, S. Cell Biology, Genetics and Molecular Biology 2008, New Central Book Agency.	2	Hands on demonstration.	
5. Study of meiotic chromosome: (AH)	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.	1. Pandey B.P. Modern Practical Botany, 2011, S. Chand Publication.	4X2 = 8	Working out and study from fresh/preserved specimens.	
6. Identification from permanent slides: (AH)	Meiosis – (i) normal stages (ii) abnormal stages – laggard, anaphase bridge, ring chromosome (*Rhoeo discolor*); Mitosis – (i) normal stages, (ii) abnormal stages early separation, late separation, multipolarity, sticky bridge, laggard, fragmentation, (ii) pollen mitosis.	1. Kar, D.K. and Halder, S. Cell Biology, Genetics and Molecular Biology 2008, New Central Book Agency.	2X2 = 4	Demonstration of permanent slides	
		TOTAL	30 hr.		

LESSON PLAN

Department Name: BOTANY

Name of Faculty: RAJENDRA YONZONE (RY)

Paper Name & Code: PLANT BREEDING (THEORY), BOT-A-SEC-B-4-1

Planned					
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
1. Plant breeding: (RY)	Introduction and objectives, breeding systems- modes of reproduction in crop plants, important achievements and undesirable consequence of plant breeding.	1. Chaudhuri, H.K. Elementary Principles of Plant Breeding, Latest Ed., Oxford & IBH. 2. Singh, B.D. Plant Breeding, Principles & Methods (7th ed.), 2005, Kalyani Publishers. 3. Roy, D. Plant Breeding: Analysis & Exploitation of Variation, 2000, Narosa Publishing House. 4. Kar, D.K. and Halder, S. Plant Breeding & Biometry, 2006, New Central Book Agency. 5. Dutta, Animesh K. Basic Biostatistics & its application 2006, New Central Book Agency.	04	Verbal / Oral lectures in English language with proper black board illustrations for all kinds of contents [note: if necessary, PPT, notes hard copy as well as soft copy can be provided to student.	
2. Methods of crop improvement: (RY)	Introduction- centres of origin and domestication of crop plants, plant genetics resources; acclimatization, selection methods- for self-pollination, cross pollinated and vegetatively propagated plants, hybridization- for self, cross and vegetatively propagated plants, procedure, advantages and limitations.		06		
3. Maintenance of germplasm: (RY)	3.1. Mass selections and Pure line selection, 3.2. Back cross method.		06		
4. Heterosis and hybrid seed production: (RY)	Heterosis and hybrid seed production, 4.1. Male sterility and its use in plant breeding.		02		
5. Inbreeding: (RY)	Inbreeding and inbreeding depression, effect of outcrossing- a very brief idea.		04		
6. Molecular Breeding: (RY)	Molecular Breeding (use of DNA markers in plant breeding).		02		
7. Mutation and Polyploidy: (RY)	Role of mutations, polyploidy, distant hybridization and role of biotechnology in crop improvements.		06		
		TOTAL	30 hr.		

LESSON PLAN

Department Name: BOTANY

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

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: (AH)	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: **(AH)**	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: **(AH)**	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: **(AH)**	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), ANJAN HAZRA (AH)

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: (AH)	1. Determination of loss of water per stoma per hour.	1. Mukherjee, S. & Ghosh, A. Plant Physiology (2nd ed.), 2005, New Central Book Agency. 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 *Rhoeo* leaf by plasmolytic method.		03		
PLANT PHYSIOLOGY: (SKS)	5. Effect of temperature on absorption of water by storage tissue and determination of Q_{10}.	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.	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 *Avena* coleopotile 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).	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	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.		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		

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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 *Rhizobium*.		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		
	ß-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		

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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 (***Camellia sinensis / Terminalia chebula).***	S.K. Jain, Manual of Ethnobotany, Scientific Publishers, Jodhpur 1999.	06	Laboratory method. Practical demonstration	
	(b) Alkaloid (***Catharanthus roseus).***		03		
2. Powder microscopy: (SB)	Powder microscopy – *Zingiber* and *Holarrhena.*		09		
3. Histochemical tests of: (SB)	Curcumin (*Curcuma longa*).		03		
	Starch in non-lignified vessel (*Zingiber*).		03		
	Alkaloid (stem of *Catharanthus* and bark of *Holarrhena*).		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, Tayaru. 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		
(PC)	2.6. Data sources in Taxonomy: Supportive evidences from Phytochemistry, Cytology, Palynology and Molecular biology data (Protein and Nucleic acid homology).		04	Chalk and talk and power point presentation.	
3. Systematic study of angiosperm taxa: Diagnostic features,	3.1. Monocotyledons: Alismataceae, Gramineae (Poaceae), Cyperaceae, Palmae (Arecaceae), Liliaceae, Musaceae, Zingiberaceae, Cannaceae,	1. Paria, N.D., Plant Taxonomy & Biodiversity, 2022, Santra Publication	05	Blackboard, class notes, e-resources.	

Planned					
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
systematic position (Bentham & Hooker) and economically important plants (parts used and uses) of the following families: **(AH)**	Orchidaceae. 3.2. Dicotyledons: Nymphaeaceae, Magnoliaceae, Ranunculaceae, Leguminosae (subfamilies), Euphorbiaceae, Malvaceae, Umbelliferae (Apiaceae), Labiatae (Lamiaceae), Cruciferae (Brassicaceae), Solanaceae, Scrophulariaceae, Acanthaceae, Rubiaceae, Cucurbitaceae, Compositae (Asteraceae).	Pvt. Ltd. 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 (*Cordyceps* and *Ganoderma*).		04		
4. Disease and	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**
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: SUDIP KUMAR SINHA (SKS)

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: (SKS)	Macro and microscopic identification of some common edible mushrooms (*Agaricus*, *Pleurotus*)	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: (SKS)	Media preparation.		2x2 = 4	Hands on experiment.	
3. Demonstration: (SKS)	Fungal tissue culture.		2x2 = 4	Hands on experiment.	
4. Subculturing: (SKS)	Sub-culturing for maintenance of culture.		2x2 = 4	Hands on experiment.	
5. Demonstration: (SKS)	Spawn production.		1x2 = 2	Hands on experiment.	
6. Cultivation: (SKS)	Cultivation of *Pleurotus*/*Calocybe*.		4x2 = 8	Hands on experiment.	
		TOTAL	30 hr.		

LESSON PLAN

Department Name: BOTANY

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

Paper Name & Code: PLANT PHYSIOLOGY AND METABOLISM (THEORY), BOT-G-CC-4-4-TH

Planned					
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
1. Proteins: (AD)	1.1. Primary, secondary and tertiary structure.	1. Panday, S.N. & Sinha, B.K. Plant Physiology (4th ed.), 2006, Vikas Publishing House Pvt. Ltd.	02	Chalk and talk, Power-Point Presentation.	
	1.2. Nucleic acid-DNA structure, RNA types.		03		
	1.3. Enzyme-Classifications with examples (IUBMB), Mechanism of action.		03		
2. Transport in plants: (AD)	2.1. Ascent of sap and Xylem cavitation.	1. Mukherjee, S. & Ghosh, A. Plant Physiology (2nd ed.), 2005, New Central Book Agency.	02		
	2.2. Phloem transport and source-sink relation.		02		
3. Transpiration: (AD)	3.1. Mechanism of stomatal movement, significance.	1. Panday, S.N. & Sinha, B.K. Plant Physiology (4th ed.), 2006, Vikas Publishing House Pvt. Ltd.	04		
4. Photosynthesis: (RY)	4.1. Pigments, Action spectra and Enhancement effect.	1. Panday, S.N. & Sinha, B.K. Plant Physiology (4th ed.), 2006, Vikas Publishing House Pvt. Ltd. 2. Jain, V.K. Fundamental of Plant Physiology (7th ed.) 2004. S. Chand and Company.	04	Chalk and talk.	
	4.2. Electron transport system and Photophosphorylation.		04		
	4.3. C3 and C4 photosynthesis, CAM- Reaction and Significance.		04		
5. Respiration: (RY)	5.1. Glycolysis & Krebs cycle— Reactions and Significance.		04		
	5.2. ETS and oxidative phosphorylation.		04		
6. Nitrogen metabolism: (AD)	6.1. Biological dinitrogen fixation.	1. Jain, V.K. Fundamental of Plant Physiology (7th ed.) 2004. S. Chand and Company.	04	Chalk and talk, Power-Point Presentation.	
	6.2. Amino acid synthesis (reductive amination and transamination).		02		
7. Plant Growth regulators: (AD)	7.1. Physiological roles of Auxin, Gibberellin, Cytokinin, Ethylene, ABA.	1. Srivastava, L.M. Plant Growth and Development, 2001, Academy Press.	10		

Planned					
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
8. Photoperiodism: (RY)	Plant types, Role of phytochrome and GA in flowering.	1. Jain, V.K. Fundamental of Plant Physiology (7th ed.) 2004. S. Chand and Company.	04		
	Vernalization.		02		
9. Senescence: (RY)	Brief idea		92		
		TOTAL	60 hr.		

LESSON PLAN

Department Name: BOTANY

Name of Faculty: ADITI DEY (AD), SHARMISTHA BASU (SB)

Paper Name & Code: PLANT PHYSIOLOGY AND METABOLISM (PRACTICAL), BOT-G-CC-4-4-P

Planned					
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
1. Plant Physiology: (AD/SB)	i) Experiment on Plasmolysis.	1. Dr. P. Maji, Focus on College Practical Botany, Rita Book Agency, Latest Edition. 2. Mukherjee, S. & Ghosh, A. Plant Physiology (2nd ed.), 2005, New Central Book Agency.	3x2 = 6	Laboratory method. Practical demonstration.	
	ii) Measurement of leaf area (graphical method) and determination of transpiration rate per unit area by weighing method.		3x2 = 6		
	iii) Imbibition of water by dry seeds - proteinaceous and fatty seeds.		3x2 = 6		
	iv) Evolution of O_2 during photosynthesis (using graduated tube).		3x2 = 6		
	v) Evolution of CO_2 during aerobic respiration and measurement of volume.		3x2 = 6		
		TOTAL	30 hr.		

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 *Vigna*.		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		