LESSON PLAN

Department Name: BOTANY

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

Paper Name & Code: PLANT DIVERSITY (THEORY), BOT-H-CC1-1-Th

Planned					
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
1. Introduction to plant kingdom: (SB)	1.1. Origin of life and evolution of plant cells.	1. Kenrick,P. & Crane, P. The Origin & early diversification of land plants (1997), Smithsonian Institute Press. 2. Bell, P.R. & Hensley, A.R. Green plants; their Origin & Diversity (2nd ed.), 2000, Cambridge University Press.	01	Face to face teaching, Chalk and talk method, content delivery through PPT, students' discussion in the classroom and posting of learning materials, educational videos and practice questions in google classroom for self-pace learning.	
	1.2. Importance of plants as source of food, fuel and their role in ecosystem services (as carbon sink, sequestering etc.).		02		
2. Algae: (AD)	2.1. Salient features of Cyanophyceae, Chlorophyceae, Charophyceae, Phaeophyceae, Rhodophyceae and Bacillariophyceae.	1. Sharma, O.P. Text Book of Algae, Tata McGraw Hill.	02	Chalk and talk, Power-Point Presentation and Google Classroom.	
	2.2. Criteria and system of classification (Fritsch, 1935).		02		
	2.3. Economic importance of algae in environment, agriculture, biotechnology and industry.		02		
3. Fungi: (AD)	3.1. Salient features of Myxomycota, Mastigomycotina, Zygomycotina, Ascomycotina, Basidiomycotina, Deuteromycotina.	1. Sharma, P.D. the Fungi, Rastogi Publication.	02		
	3.2. System of classification up to Sub-division (Ainsworth, 1973).		01		
	3.3. Economic importance of fungi (food, medicine and agriculture),		02		
	3.4. Fungal symbioses: Mycorrhiza, Lichen and their importance.		01		
4. Bryophytes:	4.1. Salient features of Hepaticopsida, Anthocerotopsida and Bryopsida.	1. Vashista, B.R. Bryophyta, Latest Ed., S. Chand & Company Pvt. Ltd.	03		

Planned					
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
(AD)	4.2. System of classification up to Class (Proskauer 1957).		01		
	4.3. Amphibian nature of bryophytes.		01		
	4.4. Economic and ecological importance.		02		
5. Pteridophytes: **(SB)**	5.1. Salient features of Psilophyta, Lycophyta, Sphenophyta and Filicophyta.	1. Spore, K.R. The Morphology of Pteridophyte, Latest Ed., Huchinson & Co. Ltd. 2. Rashid, A. An Introduction to Pteridophyta, Latest Ed., Vani Educational Books. 3. Vashista, P.C. Pteridophyta, Latest Ed., S. Chand & Company Pvt. Ltd. 4. Gifford, E. M. & Foster, A. S. Morphology & Evolution of Vascular Plants (3rd ed.), 1998, Freeman and Co.	02	Face to face teaching, Chalk and talk method, content delivery through PPT, students' discussion in the classroom, explanation and elaboration of various groups of pteridophytes through charts, herbarium, wet preserved specimens kept at Botany Museum.	
	5.2. System of classification up to Division (Gifford & Foster 1989).		02		
	5.3. Economic importance (food, medicine & agriculture).		01		
6. Gymnosperms: **(AD)**	6.1. Salient features of Cycadophyta, Coniferophyta and Gnetophyta.	1. Vashishta, P.C. Gymnosperm, Latest Ed., S. Chand & Company Pvt. Ltd.	02	Chalk and talk, Power-Point Presentation and Google Classroom.	
	6.2. Outline classification up to Division: Progymnospermophyta to Gnetophyta (Gifford & Foster 1989).		02		
	6.3. Economic importance (wood, resin, essential oil & drugs).		02		
7. Angiosperms: **(SB)**	7.1. Types and morphology of leaf, stem and root.	1. Ganguli,H.C., Das, K.S.K. & Dutta, C.T. College Botany, Vol. I, latest Ed., New Central Book Agency. 2. Mitra, D., Guha, J. & Chowdhuri, S.K. Studies in Botany (Vols. I & II), Latest Ed., Das Printers.	03	Face to face teaching, Chalk and talk method, content delivery through PPT, students' discussion in the classroom, explanation and elaboration of various groups of pteridophytes through charts, herbarium, wet preserved specimens kept at Botany Museum.	
	7.2. Inflorescence types with examples.		03		
	7.3. Flower: Different parts and forms of calyx, corolla, androecium and gynoecium; aestivation and placentation.		04		
	7.4. Types with examples-fruits and seeds.		02		
		TOTAL	45 hr.		

LESSON PLAN

Department Name: BOTANY

Name of Faculty: SHARMISTHA BASU (SB)

Paper Name & Code: PLANT DIVERSITY (PRACTICAL), BOT-H-CC1-1-P

Planned					
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
1. Flower- dissection, drawing and study: (SB)	a) Different parts, b) Adhesion and cohesion, c) Placentation, d) Aestivation.	1. Chatterjee, T., Santra, S.C. and Das, A. Practical College Botany, New Central Book Agency. 2. Focus on college practical Botany by Prof. P. Maji. Rita Book Agency.	2x6=12	Laboratory method. Demonstration using different flower specimens. Hands on activities.	
2. Study of ovules: (SB)	Types (Fresh specimens/ permanent slides/ photographs).	1. Chatterjee, T., Santra, S.C. and Das, A. Practical College Botany, New Central Book Agency. 2. Mitra, D., Guha, J. & Chowdhuri, S.K. Studies in Botany (Vols. I & II), Latest Ed., Das Printers. 3. Focus on college practical Botany by Prof. P. Maji. Rita Book Agency.	2	Laboratory method. Demonstration using permanent slides and photographs.	
3. Fruits: (SB)	Different types- study from fresh/ preserved specimens.		2	Laboratory method. Demonstration using fresh specimens, preserved specimens, charts and photographs. Hands on activities.	
4. Inflorescence types: (SB)	Study from fresh/ preserved specimens.		2	Laboratory method. Demonstration using fresh specimens, preserved specimens, charts and photographs. Hands on activities.	
5. Identification on the basis of reproductive and structural features from preserved specimens/ permanent slides: (SB)	Algae (*Nostoc*, *Oedogonium* and *Ectocarpus*), Fungi (*Rhizopus*, *Ascobolus* and *Agaricus*), Bryophytes (*Marchantia*, *Anthoceros* and *Funaria*), Pteridophytes (*Selaginella*, *Equisetum* and *Pteris*), Gymnosperms (male cone and female cone/ megasporophyll of *Cycas, Pinus* and *Gnetum*).		2x5=10	Laboratory method. Demonstration using preserved specimens and permanent slides. Hands on activities.	

Planned					
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
3. Field work: **(SB)**	A field notebook supported with photographs taken during field study to be submitted giving comprehensive idea about different types of inflorescences, flowers and fruits.	------	One day local excursion to study plants in their natural habitat. 2hr	Experiential learning through field visits. immersive field trips, hands on activities.	
		TOTAL	30 hr.		

LESSON PLAN

Department Name: BOTANY

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

Paper Name & Code: MUSHROOM CULTIVATION TECHNOLOGY (THEORY), BOT-H-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: (AH)	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.	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.	05	Chalk and talk, Power-Point Presentation, class notes, e-resources	
	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		
	4.1. Mushroom diseases and management strategies.	1. Acharya, K., Roy, A. & Sarkar, J. Mushroom Cultivation	03	Chalk and talk	

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.	Technology, 2020, Techno World, Kolkata. 2. Tewari, P. & Kapoor, S.C. Mushroom Cultivation, 1988, Mittal Publications, Delhi.	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-H-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 (*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: (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 *Pleurotus*/*Calocybe.*		4x2 = 8	Hands on experiment.	
		TOTAL	30 hr.		

LESSON PLAN

Department Name: BOTANY

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

Paper Name & Code: ECONOMIC BOTANY (THEORY), BOT-H-CC-3-3-TH

Planned					
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
1. Origin of cultivated crops: **(SB)**	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. Mukherjee, S. College Botany, Vol. III, latest Ed., New Central Book Agency 2. Mitra, D., Guha, J., Chowdhuri, S.K. Studies in Botany, Vol. II, latest Ed. D.N. Moulik for Moulik Library. 3. Kochhar, S.L. 2012. Economic Botany in Tropics, MacMillan & Co. New Delhi, India.	04	Group discussion during class hours about already taught contents to evaluate the intelligence and over all knowledge of the students on the specific topic. Regular attendance highly preferred (Classroom performance).	
2. Cereals, pulses, oils and rubber: **(SB)**	2.1. Cereals: Rice, Wheat, Jowar and Bajra (cultivation, processing and uses), Millets as future cereals. Origin of Rice and Wheat.		03		
	2.2. Pulses and Legumes: Cultivation and uses of Gram, Mung Bean and Soyabean. Importance to man and environment.		02		
	2.3. Oil and fats: General description, Classification, Extraction, uses and health implications of Mustard, Groundnut, Sunflower, Coconut (Botanical name, family and uses). Essential oils- general account, extraction methods, comparison with fatty oils and their uses.		03		
	2.4. Rubber yielding plants: Para-rubber (*Hevea brasiliensis*), Assam rubber (*Ficus elastica*)- tapping, processing and uses.		02		
	2.5. Other natural rubber: Sources (Ceara rubber, Castilla rubber, Lagos silk rubber, Landolphia rubber, Guayule rubber, Dandelion rubber).		02		
3. Sugar, starch, spices and beverages: **(AD)/(SB)**	3.1. Processing of sugarcane to products and byproducts. Extraction/ processing from Potato, Sugar beet and Palmyra palm.		02		
	3.2. Spices and condiments: Scientific names, family, economically important		05		

Planned					
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
	parts and uses of Ajwain, Cumin, Black Cumin, Mustard, Fenugreek, Coriander, Chillies, Bay leaf, Black Pepper, Cardamom (small and big), Clove, Cinnamon, Onion, Garlic and Ginger.	1. Kochhar, S.L. 2012. Economic Botany in Tropics, MacMillan & Co. New Delhi, India. 2. Simpson, B.B. and Conner-Ogorzaly, M. 1986. Economic botany: plants in our world. 3.Pandey, B.P. 1978. Economic botany for degree honours and postgraduate students.		Chalk and Talk, PowerPoint presentation, Demonstrative Videos, Google Classroom.	
	3.3. Beverages: Tea and coffee (plant habit, processing and uses).		02		
4. Narcotics, timbers and fibres: **(AD)**	4.1. Habit forming drugs with special reference to Poppy, Cannabis and Tobacco (processing, uses and health hazards).		04		
	4.2. Timber: General account with special reference to Sal, Teak, Mahogany and Sissoo.		06		
	4.3. Fibers: Classification on the basis of origin of fibres, Cotton, Flax and Jute (extraction and uses).		06		
5. Vegetables and fruits: **(AD)**	5.1. Vegetables: Scientific names, family and edible parts- Potato, Pointed gourd, Brinjal, Tomato, Cauliflower, Cabbage, Lady´s finger, Ridge gourd, Cucumber, Spinach, Carrot, Pea, Beans, Drumstick, Radish and Sweet potato.		02		
	5.2. Fruits: Scientific names, family, types of fruits and edible parts: Mango, Papaya, Custard apple, Pineapple, Tamarind, Jackfruit, Banana, Guava, Pomegranate, Apple, Strawberry, Wood apple, Litchi and Grapes.		02		
		Total	45 hr.		

LESSON PLAN

Department Name: BOTANY

Name of Faculty: SUDIP KUMAR SINHA (SKS)

Paper Name & Code: ECONOMIC BOTANY (PRACTICAL), BOT-H-CC-3-3-P

Planned					
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
1. Identification: (SKS)	Identification of economically important plants (as listed below) from fresh/ herbarium sheets/ preserved specimens: Cereals: Rice and Wheat.	1. Pandey, B.P. 2017. Modern Practical Botany Vol 1. S Chand & Company Pvt.	03	Laboratory method. Practical demonstration. Write up provided in printed form.	
	Legume: Gram, Mung bean and Soybean (habit, fruit and seed structure).		03		
	Spices and condiments: Coriander, Cumin, Bay leaf, Black pepper, Cinnamon.		03		
	Tea and coffee (plant habit and parts used).		03		
	Common vegetables: Potato, Cucumber, Brinjal, Lady´s finger, Carrot, Sweet potato.		03		
	Fruits (only identify the type of fruit) as listed in theoretical syllabus (Mango, Papaya, Custard apple, Pineapple, Tamarind, Jackfruit, Banana, Guava, Pomegranate, Apple, Strawberry, Wood apple, Litchi and Grapes).		06		
	Fibres: jute and cotton (plant and parts used).		03		
2. Field visit: (SKS)	One field visit to give an idea about cultivation of Rice/Jute/Tea/Potato.		06	One day local excursion.	
		Total	30 hr. including field work		

LESSON PLAN

Department Name: BOTANY

Name of Faculty: PAYEL CHATTERJEE (PC), SUDIP KUMAR SINHA (SKS)

Paper Name & Code: PLANT ANATOMY & EMBRYOLOGY (THEORY), BOT-H-CC-4-3-TH

Planned					
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
PLANT ANATOMY (50 marks)					
1. Cell and Tissues: (PC)	1.1. Cell wall: ultrastructure, chemical constituents; thickening of cell wall.	1. Fahn, A. Plant Anatomy (4th ed.), 1990, Wiley Eastern. 2. Roy, P. Plant Anatomy, Latest Ed., New Central Book Agency	04	Powerpoint presentation, Chalk and Talk	
	1.2. Tissues: meristems, simple and complex tissues, cambium- Structure and function.		03		
	1.3. Mechanical tissues and the principles governing their distribution in plants.		02		
	1.4. Stele: stelar types; leaf-trace and leaf-gap.		03		
	1.5. Stomata: origin and types (Metcalfe and Chalk, 1950; Stebbins and Khush, 1961).		02		
2. Primary and secondary growth: (PC)	2.1. Primary structure of stem and root-monocot and dicot. Leaf- dorsiventral and Isobilateral.	1. Pandey, B.P. Plant Anatomy, Latest Ed., S. Chand & Company. 2. Roy, P. Plant Anatomy, Latest Ed., New Central Book Agency. 3. Tayal, M.S. Plant Anatomy, Latest Ed., Rastogi Publications.	03		
	2.2. Secondary growth: normal (intra- & extra-stelar), anomalous (stem of *Bignonia*, *Boerhavia*, *Tecoma*, *Dracaena* and root of *Tinospora*).		05		
3. Developmental and Ecological Anatomy: (PC)	3.1. Organisation of shoot apex (Tunica–Corpus) and root apex (Korper-Kappe), plastochron.	1. Esau, K. Anatomy of Seed Plants (2nd ed.), 1977, John Wiley & Sons.	04		
	3.2. Adaptive anatomical features of hydrophytes, xerophytes, halophytes.		02		
4. Scope of plant anatomy: (PC)	Application in systematics, forensics and pharmacognosy, brief idea on dendrochronology.	1. Roy, P. Plant Anatomy, Latest Ed., New Central Book Agency.	02		

Planned					
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
EMBRYOLOGY (25 marks)					
1. Pre-fertilisation and post- fertilization changes: **(SKS)**	1.1. Microsporogenesis and Microgametogenesis.	1. Bhojwani, S.S. & Bhatnagar, S.D. The Embryology of Angiosperms (4th ed.), 1989, Publishing House. 2. Roy, P. Plant Embryology, 1st Ed., Soudagar.	02	Chalk and talk, PowerPoint presentation, online tests, Class notes.	
	1.2. Megasporogenesis and Megagametogenesis (monosporic, bisporic and tetrasporic).		03		
	1.3. Pollen germination.		01		
	1.4. Pollen tube- growth, entry into ovule and discharge.		02		
	1.5. Double fertilization, post-fertilization changes.		02		
2. Embryo development and apomixis: **(SKS)**	2.1. Embryogenesis in *Capsella.*	1. Maheswari, P. An Introduction to Embryology of Angiosperm, Latest Ed., Tata McGraw Hill. 2. Roy, P. Plant Embryology, 1st Ed., Soudagar.	01		
	2.2. Development of endosperm (3 types).		01		
	2.3. Apomixis- Apospory and Apogamy.		01		
	2.4. Polyembryony- different types.		02		
		TOTAL	45 hr.		

LESSON PLAN

Department Name: BOTANY

Name of Faculty: PAYEL CHATTERJEE (PC)

Paper Name & Code: PLANT ANATOMY & EMBRYOLOGY (PRACTICAL), BOT-H-CC-4-3-P

Planned					
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
1. Microscopic studies on: (PC)	Types of stomata, sclerenchyma and parenchyma cells, sclereids, raphides (*Colocasia*), cystolith (*Ficus* leaf) starch grains, aleurone grains, laticiferous ducts, oil glands.	1. Pandey, B.P. 2017. Modern Practical Botany Vol 1. S Chand & Company Pvt. 2. Maji, S. 2005. Focus on college practical botany. Calcutta Rita Book Agency.	06	Laboratory method. Practical demonstration. Hands on training.	
2. Basic anatomical study: (PC)	Study of anatomical details through permanent slides/ temporary stained mounts- a) Root-Monocot and dicot, b) Stem-Monocot and dicot, c) Leaf- Isobilateral and Dorsiventral, d) Stelar types.		06		
3. Anomalous secondary structure: (PC)	Study of anomalous secondary structure in stem of *Bignonia*, *Boerhaavia*, *Tecoma*, *Dracaena* and root of *Tinospora*		12		
4. Study of adaptive anatomical features: (PC)	Hydrophytes (*Nymphaea* – petiole), Xerophytes (*Nerium* – leaf) and Halophytes (*Aegiceros corniculatum*- salt gland), Epiphytic root (Orchid velamen).		06		
		Total	30 hr.		

LESSON PLAN

Department Name: BOTANY

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

Paper Name & Code: PLANT TISSUE CULTURE AND HORTICULTURE PRACTICES (THEORY), BOT-H-SEC-3-TH

Planned					
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
PLANT TISSUE CULTURE (50 marks)					
1. Plant Tissue Culture: (AH)	1.1. Land mark contributions.	1. Bhojwani, S.S. & Razdan, M.I. Plant Tissue Culture: Theory and Practise, Elsevier.	01	Powerpoint presentation, class notes, e-resources	
	1.2. Importance of plant tissue culture as tools for fundamental and applied plant sciences.		01		
	1.3. Future prospects in improving cash crops, medicinal plants and forest trees.		01		
2. Requisites of Plant Tissue Culture and Plant regeneration: (AH)	2.1. Requirement of plant tissue culture laboratory- Equipment, instruments, glassware and plastic wares.	1. Jha, T.B. & Ghosh, B. Plant Tissue Culture, 2003, Universities Press. 2. Dey, K.K. Plant Tissue Culture, 1992, New Central Book Agency.	01		
	2.2. Aseptic technique- contaminants and sterilization.		01		
	2.3. Plant tissue culture medium: media preparation (basal medium), gelling agents and their uses, Use of plant growth regulators in plant tissue culture.		02		
	2.4. Cellular totipotency.		01		
	2.5. Organogenesis (direct and indirect).		01		
	2.6. Somatic embryogenesis and its significance.		01		
	2.7. Artificial seed (encapsulation and its potential uses).		01		
3. Types of culture techniques: (AH)	3.1. Plant micropropagation**:** Methods and advantages of micropropagation, Steps of general micropropagation, Important considerations and precautions.	1. Bhojwani, S.S. & Razdan, M.I. Plant Tissue Culture: Theory and Practise, Elsevier.	03	Chalk and talk, Powerpoint presentation, class notes, e-resources.	
	3.2. Somaclonal variation: Types, applications of tissue culture-derived variation and crop improvement.		02		

Planned					
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
	3.3. Callus and haploid culture: Callus culture- Induction, maintenance and application, Suspension culture (introductory idea).	2. Jha, T.B. & Ghosh, B. Plant Tissue Culture, 2003, Universities Press. 3. Dey, K.K. Plant Tissue Culture, 1992, New Central Book Agency.	02		
	3.4. Haploid culture- Anther, pollen and ovary culture methods, application and utilization of haploids in agriculture.		02		
	3.5. Protoplast culture- isolation and culture, protoplast fusion (somatic hybridization), cybrid production, application.		02		
	3.6. Embryo and endosperm culture- procedure and application.		02		
4. Production of useful metabolites by tissue culture techniques: **(AH)**	4.1. Secondary metabolites: Techniques of production of secondary metabolites; terpenes, phenolics and alkaloids- definitions and functions.	1. Chawla, H.S. An Introduction to Plant Biotechnology (2nd ed.), 2002, Oxford & IBH.	04		
	4.2. Valuable natural compounds from plant cell and tissue culture and their uses as drugs- brief idea.		02		
HORTICULTURE PRACTICES (25 marks)					
1. Horticulture: **(RY)**	1.1. Scope, importance and branches.	1. Singh, D. & Manivannan, S. 2009. Genetic Resources of Horticultural Crops. Ridhi International, Delhi, India. 2. Swaminathan, M.S. and Kochhar, S.L. 2007. Groves of Beauty and Plenty: An Atlas of Major	01	Chalk and talk.	
	1.2. Role in rural economy and employment generation,		01		
	1.3. Harvesting and handling of fruits, vegetables and cut flower; methods of preservation and processing.		01		
	1.4. Urban horticulture and ecotourism.		01		
	2.1. Application of manures, fertilizers, nutrients and PGRs.		01		

Planned					
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
2. Horticultural techniques: **(RY)**	2.2. Weed controls, biofertilizers, biopesticides, irrigation methods.	Flowering Trees in India. Macmillan Publishers, India.	01		
	2.3. Hydroponics, propagation methods: vegetative (grafting, cutting, layering, budding), sexual (seed production), scope and limitations.		01		
3. Ornamental plants: **(RY)**	3.1. Types, classifications (annuals, perennials, climbers and trees).		01		
	3.2. Identification and salient features of: 3.2.1. Some ornamental flowers (rose, marigold, gladiolus, carnations, rasna orchid, gerberas, tuberose, birds of paradise, pin cushion cactus and desert rose).		01		
	3.2.2. Ornamental flowering trees (Indian laburnum, gulmohar, jacaranda, jarul, fishtail palm, simul, coral tree).		01		
	3.2.3. Bonsai and their commercial use.		01		
	3.2.4. Importance of flower shows and exhibitions.		01		
4. Fruit and vegetable crops: **(RY)**	4.1. Some common fruits and vegetables- description of plants and their economically important parts (orange, banana, mango, papaya, guava, litchi, bael, potato, cauliflower, carrot, onion, peas, brinjal, ridged gourd).	1. NIIR Board 2005. Cultivation of Fruits, Vegetables and Floriculture. National Institute of Industrial Research Board, Delhi.	02		
	4.2. Fruit processing- scope and benefit.		01		
		TOTAL	45 hr.		

LESSON PLAN

Department Name: BOTANY

Name of Faculty: RAJENDRA YONZONE (RY)

Paper Name & Code: PLANT TISSUE CULTURE AND HORTICULTURE PRACTICES (PRACTICAL), BOT-H-SEC-3-P

Planned					
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
1. Horticultural field visit: (RY)	Field trip (any two with report submission) - Visit to plant tissue culture laboratory, gardens, standing crop sites, nurseries, vegetable plantations, horticultural fields at IARI/AHSI and cold storage.	-----	06	Laboratory method. Practical demonstration. Hans on training.	
2. Plant Tissue culture: (RY)	Media preparation, sterilization and aseptic inoculation of explant for seed culture.		03		
3. Plant Propagation: (RY)	Propagation of two horticulturally important plants (each student needs to propagate plants following two separate vegetative methods; records and photographs to be authenticated by respective teacher and presented in a form of field diary during examination)		15		
4. Identification: (RY)	Identification of ornamental flowers as per theoretical syllabus.		06		
		Total	30 hr. including field trip		

LESSON PLAN

Department Name: BOTANY

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

Paper Name & Code: CELL AND MOLECULAR BIOLOGY (THEORY), BOT-H-CC-5-11-Th

Planned					
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
CELL BIOLOGY					
1. Origin and Evolution of Cells: (PC)	1.1. Evolution of nucleic acid (from RNA to DNA), Concept of RNA world, Ribozymes, First cell.	1. Tamarin, Robert H. Principles of Genetics.7th ed., 2002, Tata McGraw Hill.	02	PowerPoint presentation, Class notes, chalk and talk.	
	1.2. Origin of eukaryotic cell (endosymbiotic theory).		01		
	1.3. Small RNA- riboswitch, RNA interference, si RNA, mi RNA- brief idea.		02		
	1.4. Organellar DNA (cp- and mt- DNA).		01		
2. Nucleus and Chromosome: (PC)	2.1. Nuclear envelope, nuclear lamina and nuclear pore complex.	1. Cooper, G.M. The Cell, A molecular approach. (2nd ed.), 2000, ASM Press.	02		
	2.2. Nucleolus-ultrastructure and ribosome biogenesis.		01		
	2.3. Chromatin ultrastructure and DNA packaging in eukaryotic chromosome.		02		
	2.4. Centromere: types, structure and function.		01		
3. Cell cycle and its regulation: (PC)	3.1. Kinetochore and spindle apparatus-structural organization and functions.	1. Cooper, G.M. The Cell, A molecular approach (2nd ed.), 2000, ASM Press. 2. Alberts, B., Johnson, A., Lewis, J., Raff, M., Roberts, K. & Walter, P. Molecular Biology of the Cell, 2002 (4th ed.), Garland Sciences.	02		
	3.2. Microtubules- structure, organization and function.		01		
	3.3. Mechanism of cell cycle control in Yeast (checkpoints and role of MPF), Apoptosis (Brief idea).		03		
MOLECULAR BIOLOGY					
	1.1. Central Dogma.		01		

Planned					
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
1. DNA Replication, Transcription and Translation (Prokaryotes & Eukaryotes): **(AH)**	1.2. Semiconservative DNA replication – mechanism, enzymes involved in DNA replication- DNA polymerase, DNA gyrase, Helicase, Ligase, primase and other accessory proteins.	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.	04	Chalk and talk and PowerPoint presentation.	
	1.3. Eukaryotic replication with special reference to replication licensing factor, assembly of new nucleosome, replication at the end chromosome telomere, telomerase concept.		03		
	1.4. Fidelity of DNA replication- prokaryote: nucleotide selection, proof reading, mismatch repair; eukaryote: through selection of error prone DNA polymerase.		03		
	1.5. Transcription.		03		
	1.6. RNA processing.		02		
	1.7. Aminoacylation of tRNA.		01		
	1.8. Translation.		03		
2. Gene Regulation: **(AH)**	2.1. Concept of Lac-operon.	1. Klug, W.S. & Cummings, M.R. Concepts of Genetics, 2003, Pearson Education. 2. Russel, P.J. Fundamental of Genetics (2nd ed.), 2000, Pearson Education.	02	Blackboard and PowerPoint presentation.	
	2.2. Positive and negative control.		02		
3. Genetic Code: **(AH)**	3.1 Properties-evidences & exceptions.	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.	02	Blackboard and PowerPoint presentation.	
	3.2. Decipherence of codon (Binding technique).		02		

Planned					
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
4. Recombinant DNA Technology: **(AH)**	4.1. Restriction endonuclease, - types and roles.	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.	02	Blackboard and PowerPoint presentation.	
	4.2. Vector (plasmid pBR322).		01		
	4.3. Marker gene.		01		
	4.4. Steps of cloning technique.		02		
	4.5. PCR and its application.		02		
	4.6. Genomic DNA and cDNA library.		02		
5. Cancer and Oncogene: **(AH)**	Development and causes of Cancer (in general and brief), tumor suppressor gene and oncogene.	Russel, P.J. Fundamental of Genetics (2nd ed.), 2000, Pearson Education.	04	Blackboard and PowerPoint presentation.	
		TOTAL	60 hr.		

LESSON PLAN

Department Name: BOTANY

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

Paper Name & Code: CELL AND MOLECULAR BIOLOGY (PRACTICAL), BOT-H-CC-5-11-P

Planned					
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
1. Study of plant cell structure: (PC)	Study of plant cell structure with the help of epidermal peal mount of Onion/*Rhoeo*/*Crinum.*	1. Hofmann, A. and Clokie, S. 2018. Wilson and Walker's Principles and Techniques of Biochemistry and Molecular Biology. Cambridge University Press. 8th Eds.	03	Hands on demonstration.	
2. Micrometry: (PC)	Measurement of cell size by the technique of micrometry.		03	Hands on demonstration.	
3. Cell Counting: (AH)	Counting cells per unit volume with the help of haemocytometer (Yeast/pollen grains).	1. Pandey B.P. Modern Practical Botany, 2011, S. Chand Publication. 2. Kar, D.K. and Halder, S. Cell Biology, Genetics and Molecular Biology 2008, New Central Book Agency.	3X2 = 06	Hands on demonstration.	
4. DNA staining: (PC)	Cytochemical staining of DNA- Pyronine-methyl green staining.	1. Hofmann, A. and Clokie, S. 2018. Wilson and Walker's Principles and Techniques of Biochemistry and Molecular Biology. Cambridge University Press. 8th Eds.	03	Hands on demonstration.	
5. DNA estimation: (AH)	Estimation of DNA content through DPA staining.	1. Pandey B.P. Modern Practical Botany, 2011, S. Chand Publication. 2. Kar, D.K. and Halder, S. Cell Biology, Genetics and Molecular Biology 2008, New Central Book Agency.	03	Hands on demonstration.	
6. RNA estimation: (AH)	Estimation of RNA through orcinol method.		03	Hands on demonstration.	
7. Study of nucleolus: (PC)	Study of nucleolus through hematoxylin/ orcin staining and determination of nucleolar frequency.	1. Hofmann, A. and Clokie, S. 2018. Wilson and Walker's Principles and Techniques of Biochemistry and Molecular Biology. Cambridge University Press. 8th Eds.	03	Hands on demonstration.	
8. Preparation of models/ charts:	Rolling circle, theta replication, semi-discontinuous replication, prokaryotic RNA polymerase and eukaryotic RNA polymerase II, assembly of spliceosome	-----	3X2 = 06	Model/chart preparation	

Planned					
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
(AH)	machinery, splicing mechanism in group I and group II introns, ribozyme and alternative splicing.				
		TOTAL	30 hr.		

LESSON PLAN

Department Name: BOTANY

Name of Faculty: SUDIP KUMAR SINHA (SKS)

Paper Name & Code: BIOCHEMISTRY (THEORY), BOT-A-CC-5-12-TH

Planned					
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
1. Biochemical Foundations: (SKS)	1.1. Covalent and non-covalent bonds; hydrogen bond; Van der Waal's forces.	1. Sackheim, G. Chemistry for Biology Students (5th ed.) 1996, Benjamin/ Cummings. 2. Lehninger Principles of Biochemistry. 6th Edition. 2013. David L. Nelson, Michael M. Cox. Freeman, Macmillan.	02	Chalk and talk, PowerPoint presentation, online tests, Class notes.	
	1.2. Structure and properties of water.		01		
	1.3. pH and buffer (inorganic and organic).		01		
	1.4. Handerson-Hasselbalch equation.		01		
	1.5. Isoelectric point.		01		
2. Molecules of life: (SKS)	2.1. Nucleic Acids – structure of nucleosides and nucleotides; oligo- and poly nucleotides, B & Z form of DNA, RNA- different forms; nucleotide derivatives (ATP, NADP).	1. Lehninger Principles of Biochemistry. 6th Edition. 2013. David L. Nelson, Michael M. Cox. Freeman, Macmillan. 2. Berg, J.M., Tymoczko, J.L., & Stryer, L., Bio-Chemistry, Latest Ed., Freeman Publ.	08		
	2.2. Proteins – structure and classification of amino acids; primary, secondary, tertiary and quaternary structure of proteins.		06		
	2.3. Carbohydrates - structure of mono-, di- and polysaccharide; stereoisomers, enantiomers and epimers.		06		
	2.4. Lipids - structure of simple lipid and compound lipid (phospholipids and glycolipids), fatty acids- saturated and unsaturated.		04		
3. Energy flow and enzymology: (SKS)	3.1. Bioenergetics-Thermodynamic principles; free energy; energy rich bonds- phosphoryl group transfer and ATP; redox potentials and Biological redox reactions.	1. Lehninger Principles of Biochemistry. 6th Edition. 2013. David L. Nelson,	06		

Planned					
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
	3.2. Enzymes – classification and nomenclature (IUBMB); Co-factors and co-enzymes; isozymes.	Michael M. Cox. Freeman, Macmillan. 2. Berg, J.M., Tymoczko, J.L., & Stryer, L., Bio-Chemistry, Latest Ed., Freeman Publ.	04		
	3.3. Mechanism of enzyme action; enzyme inhibition.		04		
	3.4. Enzyme kinetics (Michaelis- Menten equation) and simple problems.		04		
4. Cell membrane: (SKS)	4.1. Membrane chemistry.	1. Lehninger Principles of Biochemistry. 6th Edition. 2013. David L. Nelson, Michael M. Cox. Freeman, Macmillan.	02		
	4.2. Membrane transport (uniport, symport, antiport), mechanism of ion uptake.		04		
5. Phosphorylation: (SKS)	ATP Synthesis- Chemiosmotic model, Oxidative and Photophosphorylation-Mechanism and differences.	1. Lehninger Principles of Biochemistry. 6th Edition. 2013. David L. Nelson, Michael M. Cox. Freeman, Macmillan. 2. Berg, J.M., Tymoczko, J.L., & Stryer, L., Bio-Chemistry, Latest Ed., Freeman Publ.	06		
		TOTAL	60 hr.		

LESSON PLAN

Department Name: BOTANY

Name of Faculty: SUDIP KUMAR SINHA (SKS)

Paper Name & Code: BIOCHEMISTRY (PRACTICAL), BOT-H-CC-5-12-P

Planned					
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
QUALITATIVE: (SKS)	1. Detection of organic acids: citric, tartaric, oxalic and malic from laboratory samples.	------	03	Laboratory method. Practical demonstration. In hand testing. Write up provided in printed form.	
	2. Detection of carbohydrate and protein from plant samples.		03		
	3. Detection of the nature of carbohydrate – glucose, fructose, sucrose and starch from laboratory samples.		03		
	4. Detection of Ca, Mg, Fe, S from plant ash sample.		03		
QUANTITATIVE: (SKS)	1. Preparation of solutions and buffers.	------	03	Laboratory method. Practical demonstration. In hand testing. Write up provided in printed form.	
	2. Estimation of amino-nitrogen by formol titration method (glycine).				
	3. Estimation of glucose by Benedict's quantitative reagent.		03		
	4. Estimation of titratable acidity from lemon.		03		
	5. Estimation of catalase activity in plant samples and effect of substrate, enzyme concentration and pH on enzyme activity.		03		
	6. Estimation of urease activity in plant samples.		03		
	7. Colorimetric estimation of protein by Folin phenol reagent.		03		
		TOTAL	30 hr.		

LESSON PLAN

Department Name: BOTANY

Name of Faculty: SHARMISTHA BASU (SB)

Paper Name & Code: INDUSTRIAL AND ENVIRONMENTAL MICROBIOLOGY (THEORY), BOT-A-DSE-A-5-2-TH

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Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
Industrial and Environmental Microbiology: **(SB)**	1. Scope of microbes in industry and environment.	1. Agarwal, A.K. & Parihar, P. Industrial Microbiology, 2005, Agrobios (India). 2. Power, C.B. & Dagimawata, H.F. General Microbiology, Vol. I&II, Himalaya Publishing House. 3. Mitchel, R. Environmental Microbiology, Latest Ed. Wiley, N.Y. 4. Sale, A.J. Fundamental Principles of Microbiology, Latest Ed., Tata McGraw Hill. 5. Banerjee, A.K. & Banerjee, N. Microbiology & Immunology, 2006, new Central Book Agency. 6. Prescott & Dunn. Industrial Microbiology. 7. Principles Of Fermentation Technology" by P F Stanbury and A Whitaker.	04	Face to face teaching, Chalk and talk method, content delivery through PPT, students' discussion in the classroom and posting of educational videos, instructional materials and practice questions in google	
	2. Bioreactors/ Fermenters and fermentation process: solid-state and liquid-state (stationary and submerged) fermentations; batch and continuous fermentations. Components of a typical bioreactors, types of bioreactors- laboratory, pilot scale and production fermenters. Constantly stirred fermenter, tower fermenter, fixed bed and fluidized bed bioreactors and air-lift Fermenter.		12		
	3. Microbial production of industrial products: microorganisms involved, media, fermentation conditions, down-stream processing and uses; filtration, centrifugation, cell disruption, solvent extraction, precipitation and ultrafiltration, lyophilization, spray drying, hands on microbial fermentations for the production and estimation of enzymes amylase or lipase activity, organic acids (citric or glutamic acid), alcohol (ethanol) and antibiotic (Penicillin).		12		

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Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
	4. Microbial enzymes of industrial interest and enzyme immobilization: microorganisms for industrial applications. Methods of immobilization, advantages and applications of immobilization, large scale application of immobilized enzymes (glucose isomerase and penicillin acylase).		08	classroom for self-pace learning.	
	5. Microbes and quality of environment: distribution of microbes in air, isolation of microorganisms from soil, air and water.		08		
	6. Microbial flora of water: water pollution, role of microbes in sewage and domestic waste water treatment systems. Determination of BOD, COD of water samples. Microorganisms as indicators of water quality, check coliform and faecal coliform in water samples.		08		
	7. Microbes in agriculture and remediation of contaminated soils: biological fixation, mycorrhizae, bioremediation of contaminated soils, isolation of root nodulating bacteria, arbuscular mycorrhizal colonization in plant roots.		08		
		TOTAL	60 hr.		

LESSON PLAN

Department Name: BOTANY

Name of Faculty: SHARMISTHA BASU (SB)

Paper Name & Code: INDUSTRIAL AND ENVIRONMENTAL MICROBIOLOGY (PRACTICAL), BOT-A-DSE-A-5-2-P

Planned					
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
Industrial and Environmental Microbiology: (SB)	**1.** Principals and functioning of instruments in microbiology laboratory.	1. Chatterjee, T., Santra, S.C. and Das, A. Practical College Botany, New Central Book Agency. 2. R. C. Dubey and D. K. Maheshwari. Practical Microbiology, by S Chand.	09	Laboratory method and demonstration of various sterilisation techniques in microbiology laboratory and demonstration of preparation of culture media. Hands on training in media preparation, sterilisation and preparation of slant, stabs and pouring of plates.	
	2. Hands on sterilization techniques and preparation of culture media.		09		
	3. Preparation of slant, stab and pouring Petri plate.		06		
	4. A visit to any educational institute/ industry to see an industrial fermenter, and other downstream processing operations.		3x2 = 6	Industrial visit to an Institute or a fermentation unit to understand and study the working of a typical industrial fermenter and to understand the downstream processing system. Students will be explained about the working principle and functions of various parts of the Fermenter by the expert faculty or the technician at the institute or the fermentation unit. Students will have a concrete and clear understanding on various aspects of the Fermenter and the Fermentation unit.	
		TOTAL	30 hr.		

LESSON PLAN

Department Name: BOTANY

Name of Faculty: RAJENDRA YONZONE (RY)

Paper Name & Code: HORTICULTURAL PRACTICES AND POST-HARVEST TECHNOLOGY (THEORY), (BOT-A-DSE-B-5-2-TH)

Planned					
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
1. Horticulture: (RY)	Scope, importance and branches. Role in rural economy and employment generation; importance in food and nutritional security; urban horticulture and ecotourism.	1. Christopher, E.P. Introductory Horticulture. 2009. Biotech Books. 2. Adams, C.R. and Early, C.R. 2004. Principles of Horticulture. 4th Eds. Elsevier publications. 3. Acquaah, G. Horticulture Principles and Practices. 4th Eds. Pearson Education Ltd.	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. Ornamental plants: (RY)	Types, classifications (annuals, perennials, climbers and trees), identification and salient features of some ornamental plants (rose, marigold, gladiolus, carnations, orchids, poppies, gerberas, tuberose, sages, cacti and succulents). Ornamental flowering trees (Indian laburnum, gulmohor, jacaranda, Lagerstroemia, fishtail and Erica palms, simul, coral tree).		04		
3. Fruit and vegetable crops: (RY)	Production, origin and distribution; description of plants and their economic products; management and marketing of vegetables and fruit crops; identification of some fruits and some vegetables varieties (citrus, banana, mango, chillis and cucurbits).		04		
4. Horticultural techniques: (RY)	Application manures, fertilizers, nutrients and PGRs; weed controls, biofertilizers, biopesticides, irrigation methods. Hydroponics, propagation methods; vegetative (grafting, cutting, layering, budding), sexual (seed production), scope and limitations.		08		

Planned					
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
5. Landscaping and garden designing: **(RY)**	Planning and lay out (parks and gardens).	1. Brown, L. Applied Principles of Horticultural Science. 3rd Eds. Butterworth-Heinemann.	06		
6. Floriculture: **(RY)**	Cut flowers, bonsai, commerce (market demand and supply), importance of flower shows and exhibitions.		06		
7. Post harvest technology: **(RY)**	Importance of post-harvest technology in horticultural crops, evaluation of quality, traits; harvesting and handling of fruits, vegetables, cut flower; principles, methods of preservation and processing, methods of minimizing losses during storage and transportation; food irradiation-advantages and disadvantages; food safety.	1. Simson, S.P. and Straus, M.C. Post-harvest Technology of Horticultural Crops. 2010. Oxford Book Company.	10		
8. Disease control and management: **(RY)**	Field and post-harvest diseases, identification of deficiency symptoms, remedial measures and nutritional management practices; crop sanitation; IPM strategies (genetic, biological and chemical methods for pest control); quarantine practices; identification of common diseases and pest of ornamental fruits and vegetable crops.	1. Brown, L. Applied Principles of Horticultural Science. 3rd Eds. Butterworth-Heinemann.	08		
9. Horticultural crops: **(RY)**	Conservation and management: documentation and conservation of germplasm. Role of micropropagation and tissue culture techniques; varieties and cultivars of various horticultural crops; IPR issues, national international and professional societies and sources of information on horticulture.		10		
		TOTAL	60 hr.		

LESSON PLAN

Department Name: BOTANY

Name of Faculty: RAJENDRA YONZONE (RY)

Paper Name & Code: HORTICULTURAL PRACTICES AND POST-HARVEST TECHNOLOGY (PRACTICAL), (BOT-A-DSE-B-5-2-P)

Planned					
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
1. Field visits: (RY)	Field visits to gardens, standing crop sites, nurseries, vegetable gardens, horticultural fields at IARI/AHSI or other suitable locations and if possible, to cold storage.	--------	10x3=30	Field activity and field demonstration	
		TOTAL	30 hr.		

LESSON PLAN

Department Name: BOTANY

Name of Faculty: ANJAN HAZRA (AH), ADITI DEY (AD), SUDIP KUMAR SINHA (SKS) & PAYEL CHATTERJEE (PC)

Paper Name & Code: PLANT DIVERSITY (THEORY), BOT-MD-CC1-1-Th

Planned					
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
1. Introduction to plant kingdom: (AH)	1.1. Origin of life and evolution of plant cells.	1. Ganguli, H.C., Das, K.S.K. & Dutta, C.T. College Botany, Vol. I, latest Ed., New Central Book Agency. 2. Ganguli, H.C. and Kar, A.K. College Botany, Vol. II, latest Ed., New Central Book Agency. 3. Mukherjee, S. College Botany, Vol. III, latest Ed., New Central Book Agency. 4. Hait, G., Ghosh, A. and Bhattacharya, K. A Text Book of Botany (Vols. I & II), 2007, New Central Book Agency. 5. Mitra, D., Guha, J. &Chowdhuri, S.K. Studies in Botany (Vols. I & II), Latest Ed., Das Printers.	01	Chalk and talk method.	
	1.2. Importance of plants as source of food, fuel and their role in ecosystem services (as carbon sink, sequestering etc.).		02		
2. Algae: (AD)	2.1. Salient features of Cyanophyceae, Chlorophyceae, Charophyceae, Phaeophyceae, Rhodophyceae and Bacillariophyceae.		02	Chalk and talk.	
	2.2. Criteria and system of classification (Fritsch, 1935).		02		
	2.3. Economic importance of algae in environment, agriculture, biotechnology and industry.		02		
3. Fungi: (AD)	3.1. Salient features of Myxomycota, Mastigomycotina, Zygomycotina, Ascomycotina, Basidiomycotina, Deuteromycotina.		02		
	3.2. System of classification up to Sub-division (Ainsworth, 1973).		01		
	3.3. Economic importance of fungi (food, medicine and agriculture).		02		
	3.4. Fungal symbioses: Mycorrhiza, Lichen and their importance.		01		
4. Bryophytes: (SKS)	4.1. Salient features of Hepaticopsida, Anthocerotopsida and Bryopsida.	1. Mitra, D., Guha, J. &Chowdhuri, S.K. Studies in Botany (Vols. I & II), Latest Ed., Das Printers.	03	Chalk and talk.	

Planned					
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
	4.2. System of classification up to Class (Proskauer 1957).		01		
	4.3. Amphibian nature of bryophytes.		01		
	4.4. Economic and ecological importance.		02		
5. Pteridophytes: **(AH)**	5.1. Salient features of Psilophyta, Lycophyta, Sphenophyta and Filicophyta.		02		
	5.2. System of classification up to Division (Gifford & Foster 1989).		02	Chalk and talk.	
	5.3. Economic importance (food, medicine & agriculture).		01		
6. Gymnosperms: **(PC)**	6.1. Salient features of Cycadophyta, Coniferophyta and Gnetophyta.		02		
	6.2. Outline classification up to Division: Progymnospermophyta to Gnetophyta (Gifford & Foster 1989).	1. Mitra, D., Guha, J. & Chowdhuri, S.K. Studies in Botany (Vols. I & II), Latest Ed., Das Printers	02	Chalk and talk.	
	6.3. Economic importance (wood, resin, essential oil & drugs).		02		
7. Angiosperms: **(PC)**	7.1. Types and morphology of leaf, stem and root.		03		
	7.2. Inflorescence types with examples.		03		
	7.3. Flower: Different parts and forms of calyx, corolla, androecium and gynoecium; aestivation and placentation.		04	Chalk and talk.	
	7.4. Types with examples-fruits and seeds.		02		
		TOTAL	45 hr.		

LESSON PLAN

Department Name: BOTANY

Name of Faculty: ADITI DEY (AD)

Paper Name & Code: PLANT DIVERSITY (PRACTICAL), BOT-MD-CC1-1-P

Planned					
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
1. Flower- dissection, drawing and study: (AD)	a) Different parts, b) Adhesion and cohesion, c) Placentation, d) Aestivation.	1. Chatterjee, T., Santra, S.C. and Das, A. Practical College Botany, New Central Book Agency. 2. Focus on college practical Botany by Prof. P. Maji. Rita Book Agency.	2x6=12	Laboratory method. Demonstration using different flower specimens. Hands on activities.	
2. Study of ovules: (AD)	Types (Fresh specimens/ permanent slides/ photographs).	1. Chatterjee, T., Santra, S.C. and Das, A. Practical College Botany, New Central Book Agency. 2. Mitra, D., Guha, J. & Chowdhuri, S.K. Studies in Botany (Vols. I & II), Latest Ed., Das Printers. 3. Focus on college practical Botany by Prof. P. Maji. Rita Book Agency.	2	Laboratory method. Demonstration using permanent slides and photographs.	
3. Fruits: (AD)	Different types- study from fresh/ preserved specimens.		2	Laboratory method. Demonstration using fresh specimens, preserved specimens, charts and photographs. Hands on activities.	
4. Inflorescence types: (AD)	Study from fresh/ preserved specimens.		2	Laboratory method. Demonstration using fresh specimens, preserved specimens, charts and photographs. Hands on activities.	
5. Identification on the basis of reproductive and structural features from preserved specimens/ permanent slides: (AD)	Algae (*Nostoc*, *Oedogonium* and *Ectocarpus*), Fungi (*Rhizopus*, *Ascobolus* and *Agaricus*), Bryophytes (*Marchantia*, *Anthoceros* and *Funaria*), Pteridophytes (*Selaginella*, *Equisetum* and *Pteris*),		5x2=10	Laboratory method. Demonstration using preserved specimens and permanent slides. Hands on activities.	

Planned					
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
	Gymnosperms (male cone and female cone/ megasporophyll of *Cycas, Pinus* and *Gnetum*).				
3. Field work: **(AD)**	A field notebook supported with photographs taken during field study to be submitted giving comprehensive idea about different types of inflorescences, flowers and fruits.	------	One day local excursion to study plants in their natural habitat. 2hr	Experiential learning through field visits. immersive field trips, hands on activities.	
		TOTAL	30 hr.		

LESSON PLAN

Department Name: BOTANY

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

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: (AH)	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.	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.	05	Chalk and talk, Power-Point Presentation, class notes, e-resources	
	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		
	4.1. Mushroom diseases and management strategies.	1. Acharya, K., Roy, A. & Sarkar, J. Mushroom Cultivation	03	Chalk and talk	

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.	Technology, 2020, Techno World, Kolkata. 2. Tewari, P. & Kapoor, S.C. Mushroom Cultivation, 1988, Mittal Publications, Delhi.	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 (*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: (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 *Pleurotus*/*Calocybe.*		4x2 = 8	Hands on experiment.	
		TOTAL	30 hr.		

LESSON PLAN

Department Name: BOTANY

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

Paper Name & Code: ECONOMIC BOTANY (THEORY), BOT-MD-CC-3-3-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. Importance of germplasm diversity.	1. Mukherjee, S. College Botany, Vol. III, latest Ed., New Central Book Agency 2. Mitra, D., Guha, J., Chowdhuri, S.K. Studies in Botany, Vol. II, latest Ed. D.N. Moulik for Moulik Library. 3. Kochhar, S.L. 2012. Economic Botany in Tropics, MacMillan & Co. New Delhi, India.	04	Chalk and Talk.	
2. Cereals, pulses and oils: (RY)	2.1. Cereals: Rice, cultivation, processing and uses, Millets as future cereals.		04		
	2.2. Pulses and Legumes: Cultivation and uses of Gram and Mung Bean. Importance to man and environment.		03		
	2.3. Oil and fats: General description, Classification, Extraction, uses and health implications of Mustard and Coconut (Botanical name, family and uses). Essential oils- general account, extraction methods and their uses.		05		
3. Sugar, starch, spices and beverages: (AH)	3.1. Processing of sugarcane to products and byproducts. Extraction/ processing from Potato and Sugar beet.	1. Kochhar, S.L. 2012. Economic Botany in Tropics, MacMillan & Co. New Delhi, India. 2.Pandey, B.P. 1978. Economic botany for degree honours and postgraduate students.	02	Chalk and Talk, PowerPoint presentation, Demonstrative Videos, Google Classroom.	
	3.2. Spices and condiments: Scientific names, family, economically important parts and uses of Ajwain, Cumin, Black Cumin, Mustard, Fenugreek, Coriander, Chillies, Bay leaf, Black Pepper, Cardamom (small and big), Clove, Cinnamon, Onion, Garlic and Ginger.		05		
	3.3. Beverages: Tea and coffee (plant habit, processing and uses).		02		
4. Narcotics, timbers and fibres: (AH)	4.1. Habit forming drugs with special reference to Cannabis and Tobacco (processing, uses and health hazards).		04		

Planned					
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
	4.2. Timber: General account with special reference to Sal and Teak.		04		
	4.3. Fibers: Cotton and Jute (extraction and uses).		04		
5. Vegetables and fruits: (RY)	5.1. Vegetables: Scientific names, family and edible parts- Potato, Pointed gourd, Brinjal, Tomato, Cauliflower, Cabbage, Lady´s finger, Ridge gourd, Cucumber, Spinach, Carrot, Pea, Beans, Drumstick, Radish and Sweet potato.	1. Kochhar, S.L. 2012. Economic Botany in Tropics, MacMillan & Co. New Delhi, India.	04	Chalk and Talk.	
	5.2. Fruits: Scientific names, family, types of fruits and edible parts: Mango, Papaya, Custard apple, Pineapple, Tamarind, Jackfruit, Banana, Guava, Pomegranate, Apple, Strawberry, Wood apple, Litchi and Grapes.		04		
		Total	45 hr.		

LESSON PLAN

Department Name: BOTANY

Name of Faculty: RAJENDRA YONZONE (RY)

Paper Name & Code: ECONOMIC BOTANY (PRACTICAL), BOT-MD-CC-3-3-P

Planned					
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
1. Identification: (RY)	Identification of economically important plants (as listed below) from fresh/ herbarium sheets/ preserved specimens: Cereals: Rice and Wheat.	1. Pandey, B.P. 2017. Modern Practical Botany Vol 1. S Chand & Company Pvt.	03	Laboratory method. Practical demonstration.	
	Legume: Gram, Mung bean and Soybean (habit, fruit and seed structure).		03		
	Spices and condiments: Coriander, Cumin, Bay leaf, Black pepper, Cinnamon.		03		
	Tea and coffee (plant habit and parts used).		03		
	Common vegetables: Potato, Cucumber, Brinjal, Lady´s finger, Carrot, Sweet potato.		03		
	Fruits (only identify the type of fruit) as listed in theoretical syllabus (Mango, Papaya, Custard apple, Pineapple, Tamarind, Jackfruit, Banana, Guava, Pomegranate, Apple, Strawberry, Wood apple, Litchi and Grapes).		06		
	Fibres: jute and cotton (plant and parts used).		03		
2. Field visit: (RY)	One field visit to give an idea about cultivation of Rice/Jute/Tea/Potato.		06	One day local excursion.	
		Total	30 hr. including field work		

LESSON PLAN

Department Name: BOTANY

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

Paper Name & Code: MUSHROOM CULTIVATION TECHNOLOGY (THEORY), BOT-MD-SEC-3-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: (AH)	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.	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.	05	Chalk and talk, Power-Point Presentation, class notes, e-resources	
	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		
	4.1. Mushroom diseases and management strategies.	1. Acharya, K., Roy, A. & Sarkar, J. Mushroom Cultivation	03	Chalk and talk	

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.	Technology, 2020, Techno World, Kolkata. 2. Tewari, P. & Kapoor, S.C. Mushroom Cultivation, 1988, Mittal Publications, Delhi.	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-3-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 (*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: (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 *Pleurotus*/*Calocybe.*		4x2 = 8	Hands on experiment.	
		TOTAL	30 hr.		

LESSON PLAN

Department Name: BOTANY

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

Paper Name & Code: PLANT DIVERSITY (THEORY), BOT-MD-CC1-3-Th (Minor+MDC100)

Planned					
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
1. Introduction to plant kingdom. (AH)	1.1. Origin of life and evolution of plant cells.	1. Ganguli, H.C., Das, K.S.K. & Dutta, C.T. College Botany, Vol. I, latest Ed., New Central Book Agency. 2. Ganguli, H.C. and Kar, A.K. College Botany, Vol. II, latest Ed., New Central Book Agency. 3. Mukherjee, S. College Botany, Vol. III, latest Ed., New Central Book Agency. 4. Hait, G., Ghosh, A. and Bhattacharya, K. A Text Book of Botany (Vols. I & II), 2007, New Central Book Agency. 5. Mitra, D., Guha, J. &Chowdhuri, S.K. Studies in Botany (Vols. I & II), Latest Ed., Das Printers.	01	Chalk and talk method.	
	1.2. Importance of plants as source of food, fuel and their role in ecosystem services (as carbon sink, sequestering etc.).		02		
2. Algae. (PC)	2.1. Salient features of Cyanophyceae, Chlorophyceae, Charophyceae, Phaeophyceae, Rhodophyceae and Bacillariophyceae.		02	Chalk and talk.	
	2.2. Criteria and system of classification (Fritsch, 1935).		02		
	2.3. Economic importance of algae in environment, agriculture, biotechnology and industry.		02		
3. Fungi. (PC)	3.1. Salient features of Myxomycota, Mastigomycotina, Zygomycotina, Ascomycotina, Basidiomycotina, Deuteromycotina.		02		
	3.2. System of classification up to Sub-division (Ainsworth, 1973),		01		
	3.3. Economic importance of fungi (food, medicine and agriculture).		02		
	3.4. Fungal symbioses: Mycorrhiza, Lichen and their importance.		01		
4. Bryophytes.			03	Chalk and talk.	

Planned					
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
(AH)	4.1. Salient features of Hepaticopsida, Anthocerotopsida and Bryopsida,	1. Mitra, D., Guha, J. &Chowdhuri, S.K. Studies in Botany (Vols. I & II), Latest Ed., Das Printers.			
	4.2. System of classification up to Class (Proskauer 1957).		01		
	4.3. Amphibian nature of bryophytes.		01		
	4.4. Economic and ecological importance.		02		
5. Pteridophytes. **(AH)**	5.1. Salient features of Psilophyta, Lycophyta, Sphenophyta and Filicophyta.		02	Chalk and talk.	
	5.2. System of classification up to Division (Gifford & Foster 1989).		02		
	5.3. Economic importance (food, medicine & agriculture).		01		
6. Gymnosperms. **(PC)**	6.1. Salient features of Cycadophyta, Coniferophyta and Gnetophyta.	1. Mitra, D., Guha, J. & Chowdhuri, S.K. Studies in Botany (Vols. I & II), Latest Ed., Das Printers.	02	Chalk and talk.	
	6.2. Outline classification up to Division: Progymnospermophyta to Gnetophyta (Gifford & Foster 1989).		02		
	6.3. Economic importance (wood, resin, essential oil & drugs).		02		
7. Angiosperms. **(PC)**	7.1. Types and morphology of leaf, stem and root.		03	Chalk and talk.	
	7.2. Inflorescence types with examples		03		
	7.3. Flower: Different parts and forms of calyx, corolla, androecium and gynoecium; aestivation and placentation.		04		
	7.4. Types with examples-fruits and seeds.		02		
		TOTAL	45 hr.		

LESSON PLAN

Department Name: BOTANY

Name of Faculty: ADITI DEY (AD)

Paper Name & Code: PLANT DIVERSITY (PRACTICAL), BOT-MD-CC1-3-P (Minor+MDC100)

Planned					
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
1. Flower- dissection, drawing and study (AD)	a) Different parts, b) Adhesion and cohesion, c) Placentation, d) Aestivation.	1. Chatterjee, T., Santra, S.C. and Das, A. Practical College Botany, New Central Book Agency. 2. Focus on college practical Botany by Prof. P. Maji. Rita Book Agency.	12	Laboratory method. Demonstration using different flower specimens. Hands on activities.	
2. Study of ovules (AD)	Types (Fresh specimens/ permanent slides/ photographs).	1. Chatterjee, T., Santra, S.C. and Das, A. Practical College Botany, New Central Book Agency. 2. Mitra, D., Guha, J. & Chowdhuri, S.K. Studies in Botany (Vols. I & II), Latest Ed., Das Printers. 3. Focus on college practical Botany by Prof. P. Maji. Rita Book Agency.	2	Laboratory method. Demonstration using fresh specimens, permanent slides and photographs.	
3. Fruits (AD)	Different types- study from fresh/ preserved specimens.		2	Laboratory method. Demonstration using fresh specimens, preserved specimens, charts and photographs. Hands on activities.	
4. Inflorescence types (AD)	Study from fresh/ preserved specimens.		2	Laboratory method. Demonstration using fresh specimens, preserved specimens, charts and photographs. Hands on activities.	
5. Identification on the basis of reproductive and structural features from preserved specimens/ permanent slides (AD)	Algae (*Nostoc*, *Oedogonium* and *Ectocarpus*), Fungi (*Rhizopus*, *Ascobolus* and *Agaricus*), Bryophytes (*Marchantia*, *Anthoceros* and *Funaria*), Pteridophytes (*Selaginella*, *Equisetum* and *Pteris*),		9	Laboratory method. Demonstration using preserved specimens and permanent slides. Hands on activities.	

Planned					
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
	Gymnosperms (male cone and female cone/ megasporophyll of *Cycas, Pinus* and *Gnetum*).				
3. Field work (AD)	A field notebook supported with photographs taken during field study to be submitted giving comprehensive idea about different types of inflorescences, flowers and fruits.	------	One day local excursion to study plants in their natural habitat. 3hr	Experiential learning through field visits. immersive field trips, hands on activities.	
		TOTAL	30 hr.		

LESSON PLAN

Department Name: BOTANY

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

Paper Name & Code: PHYTOCHEMISTRY AND MEDICINAL BOTANY (THEORY) (BOT-G-DSE-A-5-1-TH)

Planned					
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 plants, a broef idea about indigenous medicinal sciences- Ayurbeda, Siddha and Unani. Polyherbal formulations.	1. S.K. Jain, Manual of Ethnobotany, Scientific Publishers, Jodhpur 1995.	14	Chalk and talk,	
2. Pharmacognosy: (SB)	2.1. Scope and its importance.		03		
	2.2. Primary metabolites.		03		
	2.3. Secondary metabolites- alkaloids, terpenoids, phenolics and their functions.		04		
3. Organoleptic: (SKS)	Organoleptic evaluation of crude drugs.	1. Trivedi P.C. 2006. Medicinal Plants: Ethnobotanical approach, Agrobios India. 2. S.K. Jain, Manual of Ethnobotany, Scientific Publishers, Jodhpur 1995.	06	Chalk and talk.	
4. Pharmacologically active constituents: (SKS)	Source plants (one example), parts used and uses of: 4.1. Steroids (Diosgenin, Digitoxin).		03		
	4.2. Tannin (Catechin).		02		
	4.3. Resins (Gingerol, Curcumnoids).		02		
	4.4. Alkaloids (Strychnine, Reserpine, Vinblastine).		03		
5. Ethnobotany and folk medicine: (SKS)	5.1. Brief idea.		05		
	5.2. Applications of ethnobotany.		05		
	5.3. Application of natural product to certain diseases- Jaundice, Cardiac and Diabetics.		10		
		TOTAL	60 hr.		

LESSON PLAN

Department Name: BOTANY

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

Paper Name & Code: PHYTOCHEMISTRY AND MEDICINAL BOTANY (PRACTICAL) (BOT-G-DSE-A-5-1-P)

Planned					
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
1. Preparations of solution and buffers: (AH)	Preparations of solution and buffers.	----------	03	Laboratory method. Practical demonstration. Write up provided in printed form.	
2. Acquaintance with laboratory instruments: (AH)	Autoclave, Incubator, Clinical centrifuge, Analytical balance, pH meter, Colorimeter, Water bath, Distillation plant, Laminar air flow.		3x3=09		
3. Qualitative test: (SKS)	Qualitative test for proteins and carbohydrates, reducing and non-reducing sugar (glucose, fructose and sucrose).	----------	3x3=09	Laboratory method. Practical demonstration. In hand testing. Write up provided in printed form.	
4. Tannin and Alkaloid: (SKS)	Chemical tests for tannin and alkaloid.		03		
5. Identification of medicinal plants: (SKS)	List of Medicinal Plants: *Terminalia arjuna, Centella asiatica, Saraca asoca, Justicia adhatoda, Andrographis paniculata, Aloe vera, Asteracantha longifolia, Rauvolfia serpentina, Herpestis monnieri, Vitex negundo, Holarrhena antidysenterica, Boerhavia repens, Catharanthus roseus, Ocimum sanctum, Eclipta alba, Datura metel.*		03	Fresh or Herbarium specimens. Write up provided in printed form.	
6. Field study and listing of medicinal plants: (AH)	Local field study and listing of medicinal plants. Records to be substantiated with photographs and description.	----------	03	Field trip in a Medicinal plant garden.	
		TOTAL	30 hr.		

LESSON PLAN

Department Name: BOTANY

Name of Faculty: RAJENDRA YONZONE (RY)

Paper Name & Code: BIOFERTILIZERS (THEORY) (BOT-G-SEC-A-3/5-2)

Planned					
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
1. Biofertilizers: (RY)	General account about microbes used as biofertilisers; *Rhizobium*- identification, mass multiplication. Actinorrhizal symbiosis.	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.	04	Chalk and talk method.	
2. *Azospirillum*: (RY)	Identification, mass multiplication, associative effect of different microorganisms. *Azotobacter* and crop response to *Azotobacter* inoculums.		06		
3. Other sources: (RY)	Cyanobacteria, *Azolla*, *Anabaena* and *Azolla* association, blue green algae and *Azolla* in rice cultivation.		06		
4. Mycorrhizal association: (RY)	4.1. Types of Mycorrhizal association- Brief idea.		03		
	4.2. Its influence on growth and yield of crop plants.		03		
5. Organic farming: (RY)	5.1. Green manuring and organic fertilizers.		02		
	5.2. Bio-compost and vermicompost- making methods and field applications.		03		
	5.3. Recycling of biodegradable municipal, industrial and agricultural wastes.		03		
		TOTAL	30 hr.		

LESSON PLAN

Department Name: BOTANY

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

Paper Name & Code: PLANTS AROUND US (THEORETICAL), IDC in Botany

Planned					
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
1. Introduction: (AD)	1.1. Introduction to plant groups: Algae, Bryophytes, Pteridophytes, Gymnosperms, Angiosperms (Monocot and Dicot).	1. Studies in Botany {vol-l)- J.N, Mitra, D. Mitra & S. Chowdhury (Moulik Library). 2. A Textbook of Botany (vol.l)- G. Hait, K. Bhattacharya & A. K. Ghosh (New Central Book Agency). 3. Udvid Bigyan (Vol-l) (Bengali) S. Chowdhury, N. Datta, D. Mitra & J. Guha (Moulik Library). 4. College Botany (vol ll)-H.C. Gangulee, A.K. Kar, S.C. Santra (New Central Book Agency). 5. Snatak Udvidbidya (Semester l)- J.K. Sikdar, K. Sen, P. Giri. (Santra Publication).	02	Chalk and talk and power point presentation.	
	1.2. Fungi -general characters.		01		
	1.3. Contributions of Theophrastus, Charak, Sushruta, Linnaeus, Mendel and J.C. Bose.		02		
2. Plant body: (AD)	2.1. Plant cell and tissue.		01	Blackboard, class notes, e-resources.	
	2.2. Morphology of root, stem, leaf, flower, fruit and seed.		02		
3. Plants and ecosystem: (SB)	3.1. Phytodiversity and conservation.		01	Chalk and talk and power point presentation.	
	3.2. Biodiversity hotspots of India.		01		
	3.3. Forest types in India.		01		
	3.4. Plant-based adaptations to climate change.		01		
	3.5. Concept of 'Carbon footprint'- role of plants in reducing carbon footprint.		01		
4. Plants and society: (SB)	4.1. Plants in day-to-day life (brief general information including uses)- major cereals (rice, wheat and maize).		01		
	4.2. Pulses (mung and pea).		01		
	4.3. Oil (mustard, coconut).		01		
	4.4 Sugar (sugarcane and beet root).		01		

Planned					
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
	4.5 Vegetables (potato, brinjal, ladies finger and spinach).		01		
	4.6 Fruits (apple, banana, guava, mango and jackfruit).		01		
	4.7. Beverages (tea, coffee, beer and wine).		01		
	4.8. Plants as timber (sal and teak).		01		
	4.9. Non-timber-energy (fossil and non-fossil), resin, honey and essential oil (lavender and citronella oil).		01		
	4.10. Fiber (jute and cotton).		01		
	4.11. Ornamental plants (rose, marigold, tuberose, gulmohar, jarul, kalanchoe).		01		
	4.12. Importance of bacteria (*Lactobacillus*, *E. coli* and *Rhizobium*), and Fungi (*Phytophthora*, *Agaricus* and *Penicillium*).		01		
5. Plants and human health: **(SB)**	5.1. Important medicinal plants and their uses-basak (*Justicia adhatoda*), ghritakumari (*Aloe vera*), cinchona (*Cinchona officinalis*), neem *(Azadirachta indica*), kalmegh (*Andrographis paniculata*), pudina (*Mentha arvensis*), tulsi (*Ocimum sanctum*), sarpagandha (*Rauvolfia serpentina*).		04	Blackboard, class notes, e-resources.	
	5.2. Plant-derived medicinal compounds and uses (Quinine, Reserpine, Vincristine, Curcumin, Gingerol).		01		
		TOTAL	30 hr.		

LESSON PLAN

Department Name: BOTANY

Name of Faculty: SHARMISTHA BASU (SB)

Paper Name & Code: PLANTS AROUND US (PRACTICAL), IDC in Botany

Planned					
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
1. Identification: (SB)	Morphological study plant specimens **Microscopic study** *Nostoc*, *Oedogonium* (with oogonium), *Rhizopus*, *Penicillium* (sporangiophore). **Macroscopic study** *Agaricus* (fruit body), *Marchantia* with gemma cup, antheridiophore/archaegoniophore, Moss sporophyte, *Pteris* (fertile leaf/pinna), *Pinus*-male and female cone. Fruits of tomato, peas, cucumber, citrus, apple & banana.	1. Dr. P. Maji, Focus on College Practical Botany, Rita Book Agency, Latest Edition.	3x7 = 21	Identification from permanent slides and preserved specimens.	
2. Work out of flower: (SB)	Floral parts of *Hibiscus rosa-sinensis*, *Clitoria ternatea* & *Datura metel*.		3x3 = 09	Work out of fresh Specimens.	
		TOTAL	30 hr.		